

PROCESSORS & GROWERS RESEARCH ORGANISATION

**1990
GREEN BEAN TRIALS**

**1990
BROAD BEAN TRIAL**

**1990
FIELD BEAN TRIALS**

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CONTENTS

	<u>PAGE</u>
<i>The Season</i>	1
<i>Meteorological Data</i>	1
<i>GREEN BEANS</i>	
<i>Summary - Main Trial Varieties Tested 1988 - 90</i>	2
<i>Trials in 1990</i>	2- 3
<i>Main Trial, Thornhaugh - 1990</i>	3- 4
<i>Preliminary Trial, Thornhaugh - 1990</i>	4- 7
<i>Screening Trial, Thornhaugh - 1990</i>	7
<i>Tables</i>	8-13
<i>Appendix I</i>	14
<i>BROAD BEANS</i>	
<i>Trial, Thornhaugh - 1990</i>	15
<i>Table</i>	16
<i>FIELD BEANS (Vicia Faba)</i>	
<i>White Flowered Beans for the Compounder - Winter Field Beans - 1989/90</i>	17
<i>White Flowered Beans for the Compounder - Spring Field Beans - 1990</i>	17-18
<i>Spring Field Bean Varieties - Recommended List Trial - 1990 (NIAB/PGRO)</i>	18
<i>Spring Field Bean Varieties - Screening Trial - 1990</i>	18-19
<i>Tables</i>	20-23
<i>Appendix II - Key to Source of Varieties</i>	24-26

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THE SEASON

The 1990 season, like 1989 was atypical of weather conditions usually experienced in the pea and bean growing areas. The winter was again very mild with few frosts, leaving autumn ploughed soil unweathered and seedbeds were cloddy after pre-drilling cultivations. Some soils suffered from a moisture deficit from 1989 and there was only about a third of the long term average rainfall in March. The temperature in April was about two degrees warmer than usual and the amount of rainfall was average for this month. In May maximum temperatures were about five degrees above average and there was only 10 mm of rain, this was the beginning of the long hot dry spell. Green beans were sown into very dry seedbeds.

Although there was rain in June and July the amounts were below average and bean vegetative growth was poor. Following a cooler period during the second week of June daily temperatures were regularly above 20°C, increasing to around 30°C by the end of July, drying out the soil very quickly after any rain. Most crops suffered from drought stress during flowering and the flowering period was very short for field beans.

Fungal diseases caused few problems this season, although some field bean crops suffered with late infections of bean rust. Aphids were a problem in field beans and transmitted viruses.

Field, broad and green beans were again very early. Field beans matured at the end of July and after the dry weather the plants were short and easy to harvest.

METEOROLOGICAL DATA

Month	1990 Average Temperature		Long Term Average Temperature	
	Maximum °C	Minimum °C	Maximum °C	Minimum °C
February	11.5	4.1	6.1	0.9
March	13.4	3.8	9.0	1.9
April	14.2	2.0	11.9	4.0
May	19.5	5.2	15.7	6.5
June	19.6	8.8	19.1	9.5
July	24.0	9.6	20.6	11.1
August	26.3	12.6	20.4	11.4
September	19.4	8.2	18.1	9.7

Month	1990 Monthly Rainfall (mm)	Long Term Average Rainfall (mm)
February	72.6	39.2
March	13.6	44.1
April	37.5	42.3
May	9.5	46.2
June	41.0	49.7
July	28.7	52.5
August	15.3	63.5
September	19.5	46.2

Source = Marholm, Peterborough

GREEN BEANS

SUMMARY - MAIN TRIAL VARIETIES TESTED 1988 - 90

Weather conditions were very different over the three year period, and yields were variable. In 1988 rainfall in July was well above average and yields were high; in 1989 the weather after sowing was dry, sunny and warm but drought stress was prevented by occasional rain storms; during 1990, apart from a cooler period during the second week in June and the first week of July, the temperatures were very high and the weather was exceptionally dry and consequently yields were poor. The yield standard Groffy did not perform well under drought conditions, and was outyielded by Nerina in 1989, and yields were similar in 1990. Nerina seemed more tolerant of drought stress.

Arena was disappointing under drought conditions. Pods in all years were wider than standards Gitana and Lasso. Pods appeared to suffer more harvesting machine damage than slimmer more flexible podded varieties. Plants were shorter than varieties with more pods touching the ground.

Masai yielded well in all years for a variety of this pod type. Plant habit and harvesting characteristics were good with a low percentage of "T" stalks in the harvested sample. Size grading would be required to obtain the most attractive product. Masai appears to be the best variety for UK conditions tested so far.

Swing did not yield as well as Nerina in trials, but pods were straighter and slimmer. Harvesting characteristics were also better since pods were not clustered together in the middle of the plant and the percentage of "T" stalks in the harvested sample was low.

Optimus a long podded variety suitable for chopping or slicing, outyielded Groffy but yield increases were not quite significant. The pods were very straight for variety of this type, colour was medium (darker than Groffy). Seeds were small and did not develop rapidly even under hot conditions. Machine harvesting characteristics were not as good as Groffy, and Optimus gave a higher percentage of "T" stalks in the machine harvested sample in 1989 and 90.

TRIALS IN 1990

Bean types are changing and there are now six groups of beans in trials, classified according to pod length and width:-

	<u>Pod length</u> cm	<u>Pod width</u> mm	<u>Processed</u>	<u>Standard</u>
a. Short	<10	fine <9	whole	Lasso
b. Intermediate	<13	extra fine (5-6.5) very fine (6.5-8)	whole/cut whole/cut	
c. Intermediate	<13	fine <9	whole/cut	Nerina
d. Intermediate	<13	>9	cut/slice	Groffy
e. Long	>13	>9	cut/slice	
f. Flat podded	-	-	diamond cut/slice	(Kingreen)

Lasso which is successful commercially, replaces the old trial standard Gitana. Nerina is widely grown and mainly used for freezing whole. Kingreen was tested in trials a few years ago and a commercial product was later under development. In all trials yield and maturity are relative to Groffy.

A key to variety source is given in Appendix II.

The number of extra fine beans entered in trials increased and there were also some interesting intermediate and long podded varieties suitable for cutting and slicing.

An insecticidal/fungicidal seed treatment was applied to all seed to control bean seed fly and fungal "damping-off" diseases.

The Screening Trial was sown first, on 11th May, then the Main Trial on 17th May, and moisture was just adequate for good emergence. The Preliminary Trial was sown into a very dry seedbed on 29th May, and emergence was slow and uneven and this resulted in variable yield data. Rainfall during the season was about half the long term average and May, June, July and most of August were very dry. The second week in June and the first week in July were cool and wetter and bean growth was poor during this period. However, throughout most of the season temperatures were higher than average reaching 30°C at times in July. This excessively dry hot weather resulted in an early condensed harvest which began on 29th July and finished on 15th August.

Botrytis was not a problem this year, and in the absence of strong winds until the 16th August, there was no wind scar damage. Pods were more curly this season when plants were short. Pod quality however, was affected by early seed development, and many varieties suffered from string and parchment in pods to some extent. Often plants had one or two pods which matured early before the rest could contribute to yield - so there was a yield penalty where good quality was achieved.

The Main and Preliminary Trials were harvested with the Ploeger transverse (80 cm picking width) machine plot harvester. Results for the percentage of T stalks, a varietal characteristic are presented here in Appendix I. Assessments show that percentage of damaged and broken beans are dependent on machine operation.

MAIN TRIAL, THORNHAUGH - 1990

Yields were low this year, and the coefficient of variation was high, yield differences should therefore be treated with caution. Swing, Masai, Arena and Optimus were in their final year of evaluation.

Arena matured early and pods were short, suitable for processing whole. Pods were wider than Lasso and not as straight, and medium/pale in colour. Plants were shorter than other varieties and several pods touched the ground so harvesting was difficult this season. There was a high proportion of pods with "T" stalks in the sample and the pods suffered more machine damage than finer beans. Yields were similar to Lasso.

Flevoro a very fine (< 8 mm pod width) whole bean had a good erect plant habit. Pods were straight and medium colour. There were few damaged or broken beans but the machine harvested sample had a high percentage of "T" stalks. Yields were similar to Lasso. Flevoro has performed slightly better elsewhere compared with the similar variety Thialf (which is to be withdrawn).

Thialf was very similar to Flevoro, but plants were slightly shorter, maturity earlier and yields not quite as good.

Lasso the new standard short podded bean gave a sample of fine whole beans of medium colour. Maturity was a little uneven. Yields of Lasso, like the other varieties in this group, were significantly lower than the intermediate podded standard Groffy.

Masai is an extra fine/very fine podded variety. A size grading system is needed to achieve a high quality product, and in France a premium is paid for "extra fine" beans 5 - 6.5 mm pod width. In this trial Masai was graded by hand.

	% Pod Width mm	
	5.0 - 6.5 (extra fine)	6.5 - 8.0 (very fine)
Masai (1st harvest)	45	55
Masai (2nd harvest)	30	70

Masai had medium coloured, straight pods. Plant habit was vigorous and erect. Harvesting characteristics were excellent with a low percentage of "T" stalks, not significantly different from Groffy and there were few broken or damaged beans. Masai gave high yields for a variety of this pod type and produce had a most attractive appearance.

Nerina the intermediate fine podded standard performed well in trials (and commercially) this year, and appeared to withstand drought stress more than many varieties. Pod maturity was even, and yields were good. Nerina had a good plant habit, but beans tended to be close together in the middle of the plant and this resulted in a high percentage of beans with "T" stalks in the machine harvested sample.

Swing a fine intermediate type, gave pods which were slimmer, straighter and shorter than Nerina. It matured three days later than Nerina. Plant habit was good and there were fewer beans with "T" stalks in the machine harvested sample than Nerina. Yields were not significantly better than Nerina. This variety is sensitive to Basagran herbicide which was not applied to the trial this year.

Groffy the intermediate podded standard for cutting and slicing suffered from uneven maturity under the hot dry conditions, and the quick-frozen sample was not as good as in previous years. Pods were straight and pale in colour. Harvesting characteristics were excellent, still the best in the trials.

Maxima (RO34) - this variety had intermediate length pods which were not as wide as Groffy and were more suitable for cutting than slicing. If harvested early it could possibly be frozen as a whole bean. Pods were straight and of medium colour. Pods were well distributed on the plant and there were few "T" stalks in machine harvested produce. Yields were good but not significantly better than Groffy.

Novores was late maturing. Pods were dark, not as wide as Groffy and the quick-frozen sample had an attractive appearance. Harvesting characteristics were good but yields were disappointing, significantly lower than Groffy.

Optimus was the only long podded variety evaluated. Pods were not as wide as Groffy medium colour and very straight for a bean of this type. Although the tall plants had a second flush of flowers above the leaf canopy, pod maturity was even and the chopped sample was good. The percentage of pods with "T" stalks was high. Optimus performed better than Groffy, but yield differences did not quite reach significance.

PRELIMINARY TRIAL, THORNHAUGH - 1990

Varieties entered in Preliminary Trial are on, or entered for National List in an EEC Member country. The seedbed was drier for this later sown trial and emergence was uneven, thus yield variability is high, differences

should be treated with caution and few were statistically significant. Yields of Groffy the standard were poor, particularly at freezing stage.

Two new flat podded varieties were entered in trial and compared with Kingreen. All three gave most attractive samples of "diamond" cut produce with good flavour, but all had some degree of parchment in pods. Produce was also suitable for slicing. Seeds developed quickly.

Simpson was an early maturing flat podded variety. Pods were of medium colour, better than the other two varieties, and also shorter so there was more waste when processed. Seed development was particularly rapid. Plants were shorter than Kingreen and several pods touched the ground, but the percentage of "T" stalks was less. Yields were significantly lower than Kingreen.

Nassau pods were longer but not as wide as Kingreen, of medium/pale colour. Pod maturity was a little uneven. Yields were good but not as high as Kingreen.

Kingreen was evaluated in previous trials. Pods were pale and wide. Yields were the highest in trial, significantly better than Simpson or Nassau. Plants were tall and most pods were held off the ground but the percentage of machine harvested pods with "T" stalks was high.

Two new short podded fine beans for processing whole were compared with Lasso:-

Lasso is the standard short, fine podded bean for processing whole. Maturity was a little uneven.

HMX 7955 matured early. Pods were short, a little wider than Lasso, not as straight and of medium colour. Plant habit was poor with pods held low on the plant so several touched the soil. Yields were low and no better than Lasso.

NUN 7480 was a late maturing short podded variety. Pods were straight and medium/dark colour but showed premature seed development under the hot conditions. Plant habit was excellent, few pods touched the soil. Yields were no better than Lasso and at Aylsham pod set was poor.

Beans with finer pods than varieties in the previous group were evaluated, and were extra fine (5.0 - 6.5 mm)/very fine (6.5 - 8.0 mm) similar to Masai:-

WAV 715 yielded extra fine/very fine pods of rather mixed maturity and seeds developed rapidly. Some pods were rather curly. Pod colour was medium/dark. Plant habit was good with pods held off the ground. As maturity advanced, the percentage of pods with "T" stalks in the sample increased. Yields were a little better than WAV 717 (the reverse was true in last years trial).

WAV 717 matured later than 715 and pods were slightly wider, mainly in the very fine grade. Pods were dark but not very straight. Plants were tall, so no beans touched the ground but percentage of "T" stalks on pods was high at both canning and freezing stage.

Larissa an extra fine podded type was harvested early when a high proportion of pods were less than 6.5 mm wide, but even so yields were good. Pods were medium dark and straight. Harvesting characteristics were similar to WAV 715.

Allure a very fine podded bean was a little longer and wider than Larissa. Pods were even size, dark coloured and straight, and frozen samples were attractive. Harvesting characteristics were poor compared with last year, and the number of pods with "T" stalks was high. Yields were good.

None of these varieties performed better than Masai (in Main Trial).

There were two varieties of Nerina type in trial:-

Nerina the standard intermediate podded variety can be quick-frozen as a whole bean, or cut. This variety seemed less affected by drought than others, maturity was even and the processed samples were good. Machine harvestability was poor with the highest number of pods with "T" stalks in trial.

RS 1367 was similar to Nerina, maturing one day later. Pods were a similar colour and length but wider and not as even in maturity. Plant habit was better with pods well spaced on the plant, thus harvestability was improved and was much better than Nerina. Yields were higher at freezing stage but not significantly so.

Narbonne pods were similar in size and colour to Nerina, and straighter than others in the group. Plants were tall and erect and pods were well distributed. Machine harvesting characteristics were good with a low percentage of pods with "T" stalks in the sample.

Four intermediate podded beans for cutting/slicing were compared with Groffy which suffered from poor yields particularly at freezing stage because a few pods matured before the main crop.

Florence matured very early. The medium coloured pods were longer but not as wide as Groffy and seeds developed quickly in the hot weather. Pods were also curly. Plants were short and many pods trailed on the ground. Harvestability was poor and yields were no better than Groffy.

HS 204 matured a day before Groffy. Pods were a similar size but curly and of medium colour. Pods were held low on the large leaved plant and several touched the soil, but the variety had the lowest percentage of pods with "T" stalks in the machine harvested produce.

Romil matured one day before Groffy. Pods were rather short and not much darker than Groffy and maturity was uneven. In spite of the drought, plants were tall with pods well spread on the plant and none touched the soil. Harvestability was as good as Groffy. Yields were similar at canning stage and improvements were almost significant at freezing stage.

Varlon pods were narrower than Groffy, medium coloured but curly. Plant habit was excellent and harvesting characteristics good but yields no better than Groffy.

Two very similar long podded varieties were evaluated:-

Modus (7318) a long podded variety matured one day later than Groffy. Pods were long, not as wide as Groffy and more suitable for cutting than slicing. Pods were medium/dark in colour. There were significantly more pods with "T" stalks in the machine harvested sample than Groffy. Yields of Modus were very good, and performance in the dry season may have been slightly better than NUN 7324.

NUN 7324 the other long podded variety was very similar to Modus. Pods were slightly wider than Modus. At Aylsham plants were taller and maturity a little later than Modus.

The most promising varieties in trial were Nassau, Narbonne, Modus and NUN 7324.

SCREENING TRIAL, THORNHAUGH - 1990

Varieties are classed in the table according to information on pod length from the breeder, since pods were much shorter than usual this season.

There were two extra fine beans with pod widths less than 8 mm. The proportion of pods less than 6.5 mm was very high for Tavera, but yields were very low and seeds became large rapidly. Label was promising, with a tall erect plant habit and an attractive sample of produce and good yields.

Varieties of slim intermediate type were compared with Nerina, but none performed better than Nerina in terms of yield or pod appearance. Although Blakeney had an erect plant habit, pod position on the plant was low and many touched the soil. Pods were short and wide and were more suitable for cutting than processing whole.

Castel and NIZ 029 plants were very short and most pods of the latter touched the soil. NIZ 029 pods were finer than Nerina, and maturity was uneven. Scipion had good plant habit and pods were slimmer and shorter than Nerina, suitable for freezing whole but maturity was very uneven. Talion pods were wider than Scipion, and maturity was less uneven but yields were low.

Two promising intermediate varieties (for cutting) 200 and PV 496, yielded better than Groffy, which under very hot conditions did not perform as well as usual. 200 was early maturing, beans were well distributed on the plant. Pods of 200 were darker than Groffy. PV 496 also had good plant habit; pods were a little shorter but darker than Groffy.

NIZ 02-8 plants were very short and several pods touched the soil. WAV 875 matured unevenly and yields were low. Pods of WAV 875 and 877 were slim but large seeds developed quickly.

Long podded WAV 920 was the highest yielding variety in trial, but pods trailed on the ground, and were curly and pale. WAV 772 had long dark pods, but seeds developed rapidly.

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Main Variety Trial - 1990
 Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 17th May
 Results are means of three replicates. Target population 45 plants per m². Row width 30 cm

Variety	Source	Seeds /kg	At Practical		Maturity (± days) relative to Groffy	Yield % of Groffy	Plant habit 1=lax 5=erect	No. pods touching soil 1=most 5=none	External colour raw	Pod Characteristics									
			Freezing Stage							Canning Stage		Average length cm	Section 1=flat 5=round	Pod width mm					
			Maturity (± days) relative to Groffy	Yield % of Groffy						Maturity (± days) relative to Groffy	Yield % of Groffy				1=very curved 5=straight	F	C	F	C
<u>Short</u>																			
Arena	Nun	6172	- 2	60	- 3	56	3	3	M/P	3.9	9.3	9.5	4.1	8.3	8.8				
Thialf	PV	5845	- 2	46	- 3	53	5	4	M	4.3	8.6	9.3	3.8	7.9	8.1				
Flevoro	PV	5807	- 1	63	- 2	52	5	4	M	4.3	9.3	9.9	3.9	7.6	8.0				
<u>Lasso</u>	<u>PV</u>	6347	0	<u>71</u>	- 2	<u>53</u>	<u>5</u>	<u>4</u>	<u>M</u>	<u>4.1</u>	<u>8.9</u>	<u>9.1</u>	<u>3.8</u>	<u>7.9</u>	<u>8.3</u>				
<u>Intermediate (extra fine/very fine)</u>																			
Masai	S&G	6151	0	82	- 1	68	5	4.5	M	4.5	9.6	10.1	3.5	7.2	7.4				
<u>Intermediate (whole)</u>																			
<u>Nerina</u>	<u>RS</u>	5225	0	99	- 1	90	<u>5</u>	<u>4.5</u>	<u>M</u>	<u>4.0</u>	<u>10.9</u>	<u>11.7</u>	<u>4.5</u>	<u>8.3</u>	<u>8.9</u>				
Swing	PV	5712	+ 3	83	+ 3	110	5	4.5	M	4.3	9.2	9.7	4.1	8.2	8.4				
<u>Intermediate</u>																			
<u>Groffy</u>	<u>Nun</u>	4070	0(2/8)	100	0(5/8)	100	<u>5</u>	<u>4</u>	<u>P</u>	<u>4.2</u>	<u>11.6</u>	<u>11.9</u>	<u>4.6</u>	<u>10.4</u>	<u>11.1</u>				
				(4.2t/ha)		(5.9t/ha)													
Maxima (RO 34)	S&G	4570	+ 2	112	+ 1	102	5	4	M	4.3	13.0	13.8	4.9	9.8	10.1				
Novores	PV	4519	+ 4	60	+ 4	49	4	4	M/D	3.8	10.7	10.9	4.1	9.8	10.1				
<u>Long</u>																			
Optimus	vW	3446	+ 2	128	+ 2	105	5	5	M	4.2	13.1	13.9	4.7	10.5	10.9				
Significance @ P = 0.05				SD		SD					SD	SD		SD	SD				
LSD @ P = 0.05				32.7		31.0					0.88	0.99		0.51	0.48				
CV %				23.2		23.8					4.9	5.3		3.4	3.1				

P = Pale; M = Medium; D = Dark. Significantly less than Groffy
 Short pods (10 cm or less) suitable for freezing or canning whole; freezing stage SL (seed length) 80; canning SL 90
 Intermediate extra fine pods (10 - 13 cm length; 6.5 - 8 mm width). Maturity judged by pod width, NOT by seed length
 Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110
 Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110
 Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Preliminary Variety Trial - 1990
 Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 29th May
 Results are means of two replicates. Target population 45 plants per m². Row width 30 cm

Variety	Source	Seeds /kg	At Practical		At Practical		Plant habit	No. pods touching soil	External colour	Shape	Pod Characteristics				
			Freezing Stage	Maturity	Canning Stage	Average length					Section	Pod width			
			(± days) relative to Groffy	(± days) relative to Groffy	(± days) relative to Groffy	cm					1=flat 5=round	mm			
<u>Flat podded</u>															
Simpson	Ni/Zw	3189	- 3	108	- 3	106	4	2	M	5.0	12.1	12.4	1.0	15.8	18.0
Nassau	HS	2488	- 2	171	- 2	114	5	3	M/P	5.0	14.0	15.3	1.0	14.6	16.1
Kingreen	Rog	2280	- 1	251 ⁺	- 1	163 ⁺	5	4	P	5.0	13.1	13.4	1.0	17.4	18.6
<u>Short</u>															
HMX 7955	HM	5123	- 2	74	- 3	63	3	2	M	3.8	8.5	9.2	3.3	7.6	8.2
Lasso	PV	6347	- 1	108	- 2	59	4	4	M	4.5	8.8	9.2	3.5	7.8	7.2
NUN 7480	Nun	5861	+ 4	84	+ 2	49	5	4.5	M/D	4.5	9.0	9.2	3.9	7.4	7.8
<u>Intermediate (extra fine/very fine)</u>															
Larissa	PV	8395	- 2	128	- 2	84	5	4.5	M/D	4.3	10.2	10.7	2.8	6.7	7.2
Allure	PV	6956	+ 1	147	- 4	81	5	4	D	4.2	10.5	10.6	3.4	7.1	7.8
WAV 715	vW	5968	+ 1	149	0	82	5	4.5	M/D	4.0	10.1	10.4	3.3	7.0	7.2
WAV 717	vW	5424	+ 3	65	+ 2	47	5	5	D	3.8	10.6	10.8	3.2	7.4	7.6
<u>Intermediate (whole/cut)</u>															
Nerina	RS	8054	0	104	- 3	104	4.5	4	M/D	4.1	9.4	10.6	4.6	8.0	8.6
Narbonne	RS	3082	+ 1	117	0	93	5	4	M/D	4.5	10.1	10.9	3.9	8.6	8.4
RS 1367	RS	3790	+ 1	158	0	103	5	4.5	M/D	4.1	10.4	10.6	4.0	8.9	9.0
<u>Intermediate (cut/slice)</u>															
Florence	RS	3331	- 3	152	- 3	90	3	2	M	3.5	11.8	12.8	3.8	8.9	9.4
HS 204	HS	3484	- 1	69	0	98	3	3	M	3.5	10.7	11.2	4.0	9.5	10.0
Romil	Nun	3095	- 1	189	- 1	104	5	5	M/P	4.4	9.7	10.8	4.1	8.9	9.8
Groffy	Nun	4070	0	100	0	100	5	5	P/M	4.2	9.8	10.4	4.0	10.2	10.0
			(10/8)	(1.18t/ha)	(10/8)	(2.35t/ha)									
Varlon	Nun	3646	0	87	0	107	5	5	M	3.9	10.8	11.8	3.7	8.4	9.0

continued/.... 10/1990

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Preliminary Variety Trial - 1990
 Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 29th May
 Results are means of two replicates. Target population 45 plants per m². Row width 30 cm

Variety	Source	At Practical Freezing Stage		At Practical Canning Stage		Plant habit 1=lax 5=erect	No. pods touching soil 1=most 5=none	Pod Characteristics		Pod width mm		
		Maturity (± days) relative to Groffy	Yield % of Groffy	Maturity (± days) relative to Groffy	Yield % of Groffy			External colour P=pale M=medium D=dark	Average length cm		Shape 1=very curved 5=straight	Section 1=flat 5=round
<u>Long</u>												
Modus	Nun	+ 1	191	+ 1	157 [†]	4.5	3.5	3.6	12.6	13.2	4.5	9.2
NUN 7324	Nun	+ 1	182	+ 1	101	5	3.5	3.9	12.7	13.5	4.5	9.8
			SD		SD				SD	SD		SD
Significance @ P = 0.05			96.9		52.4				0.96	1.12		1.04
LSD @ P = 0.05			34.9		26.9				4.3	4.7		5.3
CV %												4.3

Coefficients of Variation (CV%) are very high at freezing stage, and yield differences should be treated with caution

[†] Significantly greater than Groffy

P = Pale; M = Medium; D = Dark

Flat pods suitable for freezing or canning before seeds become obvious externally

Short pods (10 cm or less) suitable for freezing or canning; freezing stage SL (seed length) 80; canning SL 90

Intermediate extra-fine pods (10 - 13 cm length; 6.5 - 8 mm width). Maturity judged by pod width, NOT by seed length

Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110

Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110

Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Screening Variety Trial - 1990
 Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 11th May
 Results are means of two replicates. Target population 45 plants per m². Row width 30 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage		At Practical Canning Stage		Plant habit 1=lax 5=erect	No. pods touching soil 1=most 5=none	External colour raw	External Shape 1=very curved 5=straight	Pod Characteristics				
			Maturity (± days) relative to Groffy	Yield % of Groffy	Maturity (± days) relative to Groffy	Yield % of Groffy					Average length cm	Section 1=flat 5=round	Pod width mm		
			F	C	F	C					F	C	F	C	
<u>Short Lasso</u>	<u>PV</u>	6347	- 1	80	- 2	90	5	4	M	4.5	9.0	9.4	4.4	8.0	8.4
<u>Intermediate (extra fine/very fine)</u>															
Label	Vil	6617	+ 1	90	0	86	5	5	M	4.0	10.5	10.9	4.0	6.8	7.0
Tavera	RS	5225	+ 2	62	0	71	5	4	M/P	3.9	9.1	9.7	3.1	6.2	6.6
<u>Intermediate (whole)</u>															
Nerina	RS	8054	0	96	0	99	5	4	M	4.5	11.0	12.2	4.4	9.2	9.4
Talion	Gr	4209	0	66	0	93	5	5	M	4.5	8.8	9.6	3.5	7.8	8.4
NIZ 029	Ni/Zw	5137	+ 1	83	+ 1	93	4	1	M/D	4.7	9.7	10.6	4.6	8.2	8.4
Scipion	Gr	6811	+ 1	78	0	101	5	4	M	4.3	9.0	9.4	4.1	7.8	8.0
Castel	Vil	5221	+ 2	55	+ 1	98	4	3	M/P	4.0	10.2	10.3	4.5	9.0	9.4
Blakeney	Bk	4724	+ 2	78	+ 2	87	5	3	M	4.3	8.8	9.3	4.0	9.2	9.6
<u>Intermediate</u>															
200	HS	2905	- 2	118	- 2	122	5	4	M	4.2	12.6	12.7	5.0	10.7	10.9
NIZ 2-8	Ni/Zw	5103	0	86	0	88	4	2	M	4.4	10.5	10.7	4.5	9.8	10.2
Groffy	Nun	4070	0	100	0	100	5	4.5	M/P	4.1	11.3	11.8	4.5	10.3	11.1
			(31/7)	(5.7t/ha)	(3/8)	(6.1t/ha)									
WAV 875	vW	4797	+ 1	62	+ 1	83	5	5	M	4.4	11.0	11.8	3.4	7.6	8.0
WAV 877	vW	4627	+ 2	84	+ 2	148	5	3	M/P	4.1	11.0	11.3	4.6	8.0	8.1
PV 496	PV	4277	+ 3	132	+ 3	149	5	4.5	M/D	3.9	10.9	11.3	4.5	10.2	10.8

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Screening Variety Trial - 1990
 Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 11th May
 Results are means of two replicates. Target population 45 per m². Row width 30 cm

Variety	Source	At Practical Freezing Stage		At Practical Freezing Stage		Yield § of Groffy	Plant habit 1=lax 5=erect	No. pods touching soil 1=most 5=none	External colour raw	External Shape 1=very curved 5=straight	Pod Characteristics				
		Maturity (± days) relative to Groffy	Yield % of Groffy	Maturity (± days) relative to Groffy	Yield % of Groffy						Average length cm	Section 1=flat 5=round	Pod width mm		
WAV 920	vW	0	141 ⁺	0	140	4	4	2	P	3.8	13.4	14.3	4.8	10.0	10.6
WAV 772	vW	+ 3	90	+ 3	113	5	5	4	D	3.7	12.0	12.4	4.1	8.4	8.6
Significance @ P = 0.05			SD		NSD						SD	SD		SD	SD
LSD @ P = 0.05			31.2		-						1.04	1.00		0.44	0.54
CV %			16.7		31.1						4.7	4.3		2.4	2.8

§ Yields at canning stage high CV%, are less reliable than yields at freezing stage

+ Significantly greater than Groffy; - Significantly less than Groffy

P = Pale; M = Medium; D = Dark

Intermediate extra fine pods (10 - 13 cm length; 6.5 - 8 mm width). Maturity judged by pod width, NOT by seed length

Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110

Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110

Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

APPENDIX I
 GREEN BEAN VARIETY STUDIES. Summary of machine harvesting data - Main and Preliminary Trial - 1990
 Percentage by weight of beans with "T" stalks

Main Trial Variety	% T Stalks		Preliminary Trial Variety	% T Stalks	
	F	C		F	C
<u>Short</u>			<u>Short</u>		
Thialf	35 ⁺	25 ⁺	Simpson	9	12
Arena	24 ⁺	24 ⁺	Nassau	7.5	25 ⁺
Flevoro	28 ⁺	30 ⁺	Kingreen	24 ⁺	24 ⁺
Lasso	19 ⁺	19 ⁺			
<u>Intermediate extra/very fine</u>			<u>Short</u>		
Masai	14	12	HMX 7955	5	21 ⁺
			Lasso	11	24 ⁺
			NUN 7480	16.8	24 ⁺
<u>Intermediate (whole)</u>			<u>Intermediate (extra/very fine)</u>		
Nerina	34 ⁺	25 ⁺	Larissa	17	27 ⁺
RO 34	13	12	Allure	30.5 ⁺	28 ⁺
Swing	17	12	WAV 715	14	30 ⁺
			WAV 717	24 ⁺	24 ⁺
<u>Intermediate</u>			<u>Intermediate (whole/cut)</u>		
Groffy	10	8	Nerina	35.5 ⁺	42 ⁺
Novores	15	9	Narbonne	15.5	18
			RS 1367	19.5 ⁺	16
<u>Long</u>			<u>Intermediate cut/slice)</u>		
Optimus	29 ⁺	23 ⁺	Florence	24 ⁺	24.5 ⁺
			HS 204	4.5	6
			Romil	12.5	10
			Groffy	10.5	13
			Varlon	16	15
			<u>Long</u>		
			Modus	21 ⁺	22
			NUN 7324	19 ⁺	20
Significance @ P = 0.05	SD	SD	Significance @ P = 0.05	SD	SD
LSD @ P = 0.05	7.0	7.9	LSD @ P = 0.05	8.1	10.5
CV %	18.4	25.6	CV %	22.8	23.6

⁺ Significantly higher percentage than Groffy
 % broken & % damaged beans very few significant differences between varieties
 % broken & % damaged beans, no significant differences between varieties

BROAD BEANS

Two new varieties of broad beans were entered for trial this year, one standard seed size and the other small seeded. Yields were compared with Medes, and Talia was included for comparison with the small seeded variety.

BROAD BEAN TRIAL, THORNHAUGH - 1990

Seed of all varieties was treated with fungicide to control damping off diseases. The trial was sown into a rather dry seedbed on 11th April and emergence was uneven. The season was much drier and warmer than for some years. Consequently plants were shorter than usual with Talia significantly shorter than the other varieties, and no varieties suffered from lodging. There was little infection with diseases except for a slight, late attack of bean rust.

Harvesting began early on the 18th July with Medes the earliest maturing variety. NIZ 0785 matured late and seed maturity was uneven. Talia matured very rapidly in the hot weather. Medes was the highest yielding variety; No. 24 yielded a little lower than Medes but not significantly so at freezing and canning stage. NIZ 0785 yielded significantly less than Medes and Talia at freezing and canning stage. Produce from No. 24 was slightly smaller seeded and less uniform in size than Medes. Beans of NIZ 0785 were very uneven in size and of mixed maturity.

BROAD BEAN VARIETY STUDIES. Summary of agronomic data - Variety Trial - 1990
 Varieties placed in order of maturity. Standard variety underlined. All varieties sown on 11th April
 Results are means of four replicates. Target population 18 plants/m². Row width 30 cm.

Variety	Source	Seeds /kg	At Practical Freezing Stage			At Practical Canning Stage			Mean length 10 beans mm	Plant height cm
			Maturity (± days) relative to Medes \$	Yield as % of Medes	Mean length 10 beans mm	Maturity (± days) relative to Medes \$	Yield as % of Medes			
<u>Medes</u>	<u>Ni/Zw</u>	924	0(18/77)	100 (5.1t/ha)	206	0(22/77)	100 (6.3t/ha)	217	72	
Talia	Nun	1655	+ 1	72	171	0	72	178	52	
No. 24	HS	1203	+ 2	93	204	+ 1	95	208	77	
NIZ 0785	Ni/Zw	1879	+ 5	38	173	+ 4	43	192	75	
				SD	SD		SD	SD	SD	
				10.56	5.80		21.46	18.2	5.26	
				8.7	1.9		17.3	5.7	4.8	

Significance @ P = 0.05
 LSD @ P = 0.05
 CV %

\$ Maturity of Medes is normally 1 day earlier than Threefold White
 * Significantly less than Medes

Practical Freezing Stage - TR 110 - 140 for a 140 g sample
 Practical Canning Stage - TR 115 - 140 for a 56 g sample

FIELD BEANS (*Vicia Faba*)

The trials programme included a Recommended List spring field bean trial at Thornhaugh as part of the National NIAB/PGRO series funded by PGRO Pulse Levy. Evaluation of white flowered spring bean varieties for the compounder continued and there was further work on other aspects including herbicide tolerance and seed treatment. There were enough new varieties of white flowered winter beans to conduct a trial. There was also a Screening Trial of new material from breeders. Yields, particularly of spring beans suffered from the hot, dry conditions this season. Many were affected by a late attack of bean rust (*Uromyces fabae*), but there was little chocolate spot (*Botrytis fabae*) even on winter beans.

WHITE FLOWERED BEANS FOR THE COMPOUNDER - WINTER FIELD BEANS - 1989/90

The winter was very mild and there were few plant losses from frost. There was a little pheasant and rabbit damage and final populations achieved were a little lower than target, and Glacier (IB 38) and Conf 1 also had a germination problem.

Initial growth in early spring was good, but dry conditions resulted in short plants and only Banner suffered slight lodging. There was little chocolate spot (*Botrytis fabae*) or downy mildew (*Peronospora viciae*) disease.

79001 matured very early indeed on 24th July, the latest maturing variety was Glacier.

79001 and Conf 1 were very low yielding, and Glacier did not perform as well as the control varieties Bourdon, Banner and Punch. It is possible that low populations of IB 38 and Conf 1 affected their yield potential.

WHITE FLOWERED BEANS FOR THE COMPOUNDER - SPRING FIELD BEANS - 1990

The aim of the trial series (begun in 1986) is to assess varieties of white flowered tannin-free field beans for yield, maturity, harvestability and other agronomic characters and also to provide Compounders with samples of produce from the trial so that quality of produce for animal feed could be determined by analysis and feeding studies.

Seventeen varieties of white flowered spring beans, including breeders coded material, were evaluated at Thornhaugh on a light soil and compared with coloured flowered control varieties Troy, Alfred and Corton.

Drought stress had considerable effect on field bean growth. Flowering was early, beginning on 11th May with Pluto, followed by Blandine, Albatross, Cresta (702 PC/LN) and 6-9005. The latest variety to flower was Octopus. The flowering period was short. Pluto had the shortest straw lengths and this variety was difficult to harvest because pods were very close to the ground. Toret, 88903 and 6-9005 were also short strawed. No variety lodged except for Corton and Conf 1 where lodging was slight.

The earliest variety to mature was Pluto which suffered from combining losses. Other very early varieties were Troy, 6-9005 and 88903.

Pluto, a very large flat seeded broad bean would have been very difficult to drill with a conventional cereal drill. 6-9022 and Cresta are also large seeded.

Many varieties gave significantly lower yields than mean of the coloured flowered control varieties Troy, Alfred and Corton, including Toret and Blandine and the performance of Albatross was very poor this year.

The highest yielding white flowered variety in trial was Cresta, followed by Conf 1 and 6-9008 and 906, whilst 3/88, Caspar, 907 and 6-9022 gave similar yields to Troy. However no variety outyielded the mean of the control varieties.

The EC minimum price differential (September 1990) between peas (white flowered and tannin-free (@ £154/t)) and field beans (@ £139/t) is nearly £15/tonne. If a price premium were offered for white flowered beans and was equal to peas, a variety yielding 90% of the standards or more could compete with coloured flowered varieties.

At the time of writing only one compounder offers the higher "pea" price for white flowered tannin-free beans.

SPRING FIELD BEAN VARIETIES - RECOMMENDED LIST TRIAL - 1990 (NIAB/PGRO)

Varieties of spring sown beans at Recommended List Stage of testing were evaluated at Thornhaugh on a fine sandy loam soil as part of the National RL series. Eleven varieties including determinate variety Tina, and white flowered Albatross and Toret were compared with standard varieties Alfred, Corton, Troy and Victor. Toret, Pistache and Tina were all short strawed and sown in blocks separated by discard areas from taller varieties. Tina was sown at a higher population (target 65 plants/m²), for other varieties the target population was 35 plants/m².

Throughout most of the season rainfall was lower and temperatures higher than average and the field beans suffered from drought stress. Plants were very short and lodging was negligible. There was an attack of bean rust, which affected all varieties, but it appeared too late to warrant spraying.

Pistache, Toret and Tina were the shortest strawed varieties.

Troy was the earliest variety to mature, Frinebo and Minden were the latest to mature and Gobo and Corton were also late maturing.

The highest yielding varieties were Corton, Frinebo and Gobo and these performed significantly better than the mean of the controls. Tina the determinate variety also performed well. Several varieties gave similar yields to the mean of the controls including new varieties in trial Leopard and Hedin. Late maturing "Special Use" varieties Minden and Maris Bead (pigeon feed) performed well this year.

Varieties which yielded significantly less than the mean of the controls included the control Troy, Pistache and the "Special Use" varieties Albatross and Toret (both white flowered) and Barker (pigeon feed). In this trial Albatross yielded significantly better than Toret. Toret appears to form several productive tillers under fertile wet conditions, but it seems less suited to a light drought prone soil.

It appeared that on the whole the tall vigorous late maturing bean varieties withstood drought far better than some of the short early varieties.

SPRING FIELD BEAN VARIETIES - SCREENING TRIAL - 1990

Sixteen varieties of field beans were compared with controls of Troy and Alfred in terms of yield and field characteristics. Emergence was good, but in a season which was much drier than average, growth was poor and the beans suffered from drought stress. All varieties were coloured flowered. Flowering was early and of short duration, and harvest began very early on 28th July. A slight infection of bean rust appeared late in the season after pod fill stage.

Bean plants were shorter than usual with Troy the shortest and 4471, BW 211 and 5053 the tallest varieties. No variety lodged and all varieties were easily harvested. Troy was the earliest variety to mature, and 4471 the latest. The early maturing control varieties Troy and Alfred appeared less able to withstand drought than later varieties and yields were lower than usual. Two varieties BW 211 and 6-9011 yielded significantly higher than the mean of the control varieties, and 5053 and 4471 also yielded well. BW 215 gave similar yields to Troy. Only one variety, 6-9006 yielded significantly lower than the control varieties.

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - White Flowered Beans for the Compounder - Winter Field Bean Trial 1989/90
 All varieties sown on 24th October 1989 at a final target population of 18 plants/m². Results are means of 4 replicates
 Yields (@ 15% moisture content) are given as a % of control varieties Banner, Bourdon and Punch

Variety	Source	Plants/m ² final	Seeds/ kg	Maturity (± days) relative to Banner	Yield % of controls @ 15% MC	Lodging 9=erect 1=lodged	Ease of harvest 9=easy 1=diffi- cult	Thousand seed weight (g)
<u>Bourdon</u>	PBI	16	1583	- 1	101.5	9	9	558
<u>Punch</u>	PBI	16	1456	- 1	99.6	9	8	580
<u>Banner</u>	PBI	16	1671	0(5/8)	98.9	8	7	563
Glacier (IB 38)#	PBI	10	1489	+ 5	82.6-	9	8	576
7-9001#	Mar	18	1385	-12	45.4-	9	8	552
Conf 1#	Conf	11	1656	+ 1	41.9-	9	8	505

Mean yield of control varieties Banner, Bourdon and Punch t/ha 4.36 t/ha

Significance @ P = 0.05

LSD @ P = 0.05

CV %

SD
10.52
8.9

= white flowered
 - Significantly lower than the mean yield of control varieties

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - White Flowered Beans for the Compounder - Spring Field Bean Trial - 1990
 Control varieties underlined. All varieties sown on 23rd February at a target population of 40 plants/m²
 Results are means of three replicates. Yields are given as a % of control varieties Troy, Alfred and Corton

Variety	Source Breeder (UK Agent)	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length (cm)	Lodging 9=erect 1=lodged	Ease of harvest 9=easy 1=diffi- cult	Thousand seed weight (g)
<u>Corton</u>	<u>Sem</u>	<u>2096</u>	<u>+11</u>	<u>108.2</u>	<u>112</u>	<u>8</u>	<u>9</u>	<u>439</u>
Cresta (702 PC/LN)w	PBI	1605	+11	108.1	74	9	9	554
Conf 1 w	Conf	1984	+16	100.0	93	8	9	503
6-9008 w	Mar (Mar)	2358	+11	98.23	83	9	9	359
<u>Alfred</u> 906 w	<u>Geb (SI)</u> Conf	<u>1661</u> 1429	+ 6 + 7	<u>97.7</u> 96.82	<u>81</u> 81	<u>9</u> 9	<u>9</u> 9	<u>465</u> 504
<u>Troy</u> 3/88 w	<u>Lem (Wh)</u> Prd (Bk)	<u>2066</u> 1842	0(28/7) + 5	<u>94.1</u> 93.99	<u>76</u> 77	<u>9</u> 9	<u>9</u> 9	<u>441</u> 467
Caspar 907 w	Ceb (SI) Conf	1563 1786	+ 5 + 4	93.88 93.18	67 68	9 9	9 9	452 427
6-9022 w	Mar (Mar)	1339	+ 6	91.23	68	9	9	587
Octopus 904 w	Joo (ICI) Conf	1678 1613	+ 5 + 6	86.2 78.6	66 75	9 9	9 9	485 453
Toret w	Ni/Zw (Ni)	1664	+11	77.3	60	9	9	496
Blandine 6-9021 w	INRA (Mar/D) Mar (Mar)	1548 1938	+ 8 +10	76.3 74.8	77 71	9 9	9 9	517 440
Conf 2 w	Conf	2128	+ 8	73.2	71	9	9	473
NIZ 07-23 w	Ni/Zw (Ni)	1414	+11	72.3	63	9	9	543
6-9005 w	Mar (Mar)	1927	0	64.8	54	9	9	460
88903 w	Ceb (SI)	1502	0	64.6	56	9	9	466
Albatross (Pluto) w	Lem (Twy) R.Zw (SI)	1634 1279	+ 9 - 2	60.7 (15.1)	83 44	9 9	9 3	504 636

Mean yield controls 4.62 t/ha
 SD 10.31
 Significance @ P = 0.05 7.6
 LSD @ P = 0.05
 CV %

- Significantly lower than the mean yield of control varieties
 (Pluto harvest losses were high because it was very short strawed)

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - Spring Field Bean Recommended List Trial - 1990
 All varieties sown on 22nd February at a target population of 35 plants/m², except for Tina 65 plants/m².
 Results are means of 3 replicates. Yields (@ 15% MC) are given as % of control varieties Alfred, Corton, Troy and Victor.

Variety	Source	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length (cm)	Lodging 9=erect 1=lodged	Ease of harvest 9=easy 1=diffi- cult	Thousand seed weight (g)
Corton	<u>Sem</u>	<u>2188</u>	<u>+15</u>	<u>123⁺</u>	<u>111</u>	<u>9</u>	<u>9</u>	<u>456</u>
Frinebo	Bk	1890	+20	121 ⁺	107	9	9	497
Gobo	Bk	1927	+17	120 ⁺	108	9	9	434
Tina	Bk	1934	+17	107	71	9	9	434
Victor	<u>SI</u>	<u>1678</u>	<u>+ 6</u>	<u>102</u>	<u>75</u>	<u>9</u>	<u>9</u>	<u>470</u>
Leopard	PBI	1767	+ 6	98	83	9	9	444
Minden	Ni	2075	+23	95	100	9	9	384
Alfred	<u>SI</u>	<u>1727</u>	<u>+ 8</u>	<u>93</u>	<u>87</u>	<u>9</u>	<u>9</u>	<u>447</u>
Maris Bead	PBI	2639	+13	93	98	9	9	345
Hedin	PBI	2105	+13	92	91	9	9	384
Pistache	ICI	1484	+10	84 ⁻	60	9	9	591
Troy	<u>TwY</u>	<u>2119</u>	<u>0(26/77)</u>	<u>82⁻</u>	<u>69</u>	<u>9</u>	<u>9</u>	<u>442</u>
Albatross w	TwY	1704	+13	78 ⁻	90	9	9	527
Barker	Bk	2500	+10	71 ⁻	90	9	9	336
Toret	Ni	1658	+14	66 ⁻	59	9	9	503

Mean yield of controls 4.48 t/ha

Significance @ P = 0.05

LSD @ P = 0.05

CV %

SD

10.8

6.2

⁺ Significantly higher than the mean yield of control varieties; ⁻ Significantly lower than the mean yield of control varieties

w = White flowered

ti = determinate type

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - Spring Field Bean Screening Trial - 1990
Control varieties underlined. All varieties sown on 5th March at a target population of 40 plants/m² in ten 12 cm rows
Results are means of 4 replicates. Yields are given as % of control varieties Troy and Alfred

Variety	Source Breeder (UK Agent)	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length cm	Lodging 9=erect 1=lodged	Ease of harvest 9=easy 1=difficult	Thousand seed weight g
BW 211	Conf	1478	+ 7	120.8 [†]	94	9	9	502
6-9011	Mar (Mar)	1727	+ 8	119.1 ⁺	86	9	9	442
5053 (Conf 2)	Conf	2200	+12	112.6	94	9	9	423
<u>Alfred</u>	<u>Ceb (SI)</u>	1662	+ 7	108.4	83	9	9	434
4471 (Conf 1)	Conf	2120	+14	107.6	95	9	9	408
<u>Troy</u>	<u>Lem (Wh)</u>	2065	0(28/7)	91.6	72	9	9	424
BW 215	Conf	1408	+11	88.4	88	9	9	491
6-9006	Mar (Mar)	1730	+ 5	72.8 ⁻	84	9	9	414

Mean yield of controls

3.89 t/ha

Significance @ P=0.05

SD

LSD @ P=0.05

13.06

CV %

8.7

[†] Significantly higher than the mean yield of control varieties; ⁻ Significantly lower than the mean yield of control varieties

APPENDIX II

KEY TO SOURCE OF VARIETIES

CODE	NAME & ADDRESS	COUNTRY
Bk	Booker Seeds Limited Boston Road Sleaford Lincolnshire NG34 7HA	UK
Ceb	Cebeco Zaden BV 31 Blaak Postbus 182 3000 AD Rotterdam	Holland
Conf	Confidential	
D	Dalgety Agriculture Limited Dalgety House, Works Lane Setchey Kings Lynn Norfolk PE33 0AU	UK
Gr	AGRI International Dept. Griffaton Production Le Ridereau BP No. 1 49800 Andard	France
HM	Harris Moran International BV P.O. Box 272 1600 AG Enkhuizen	Holland
HS	Holland Select BV P.O. Box 27 1619 ZG Andyk	Holland
ICI	ICI Seeds UK Limited Marsh Lane Boston Lincolnshire PE21 7RR	UK
INRA	INRA BV. 1540 21034 Dijon Cedex	France
Joo	J. Joordens Zaadhandel BV Schijfweg Noord 5 Postbus 7823 5995 ZG Kessel (LB)	Holland
Lem	Hans-Georg Lembke KG Norddeutsche Pflanzenzucht D-2331 Hohenlieth Post Holtsee U Eckernforde	W. Germany
Mar	Maribo (UK) Ltd. Potterhanworth Lincoln LN4 2DY	UK

Ni	Nickerson Seeds Limited Rothwell Lincoln LN7 6DT	UK
Ni/Zw	Nickerson/Zwaan BV Rothwell Lincoln LN7 6DT	UK
Nun	Nunhems Zaden BV Postbus 4005 6080 AA Haelen	Holland
PBI	Plant Breeding International Cambridge Maris Lane Trumpington Cambridge CB2 2LQ	UK
Prd	Prodana Seeds A/S Faborgvej 248 Postbos 94	Denmark
PV	Pop Vriend BV P.O. Box 5 1619 ZG Andijk	Holland
Rog	Rogers Brothers Seed Co. International Group P.O. Box 4727 Boise ID 83711-0727	USA
RS	Royal Sluis Postbus 22 1600 AA Enkhuizen	Holland
RZw	Rijk Zwaan UK Limited Pocklington Industrial Estate Pocklington York YO4 2NR	UK
Sem	Semundo Limited Unit 55 Clifton Road Cambridge CB1 4FR	UK
S&G	Sluis & Groot BV P.O. Box 13 Enkhuizen	Holland
SI	Seed Innovations Limited 1 Paradise Road Downham Market Norfolk PE38 9HS	UK
Twy	Twyford Seeds Limited Scotts Farm Kings Sutton Banbury Oxfordshire OX17 3QW	UK

26/1990

VEB	VEB Saat-Und Pflanzgut Noosdorfstrasse 7-9 1193 Berlin-Treptow	E. Germany
Vil	Vilmorin SA La Menitre 49250 Beaufort-en-Vallee	France
vW	van Waveren Pflanzenzucht GmbH D-3405 Rosdorf Uber Gottingen	W. Germany
Wh	Wherry & Sons Limited South Street Bourne Lincolnshire PE10 9LU	UK