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Effects of crop husbandry on yield of hybrid winter barley grown in first and second cereal situations

by

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Contents

Abstract

The first hybrid barley variety, Colossus (NFC200-57), was added to the HGCA Winter Barley Recommended List in 2004. This six-row feed variety with high yield potential was claimed to out-yield second wheat and therefore could potentially replace it in the rotation. The project set out to examine the potential of hybrid winter barley by exploring agronomic issues – seed rate and nitrogen management as well as performance – in a second cereal situation, particularly regarding take-all.

The experiments ran for three consecutive harvest years - 2003 to 2005 - at sites in the south and west (Andover and Cirencester) and north (Yorkshire and Scottish Borders). Experiments on seed rate and nitrogen dose and timing were done in a first cereal situation; seed rate in comparison with a conventional variety (Siberia) and nitrogen dose and timing with and without a take-all seed dressing (Latitude) in a second or subsequent cereal situation.

A reduction in the conventional seed rate of 30% was acceptable for hybrid barley; however it was also acceptable in most cases for a conventional variety. There was no response to increasing the seed rate above the base level of 250 seeds/m² in a first cereal situation in ten out of twelve site years. In the second cereal situation there was no response to increasing the seed rate above the base 250 seeds/m².

Colossus out-yielded Siberia by an average (nine site years) of 0.54 t/ha; the largest difference recorded was 1.6 t/ha. Take-all indices at the sites were low to moderate and yield responses to Latitude seed dressing averaged only 0.06 t/ha. The response was slightly larger in Colossus (0.1t/ha) than Siberia (0.03 t/ha).

Colossus responded to nitrogen dose in a similar way to conventional barley. In the first cereal situation there was little benefit from delivering more nitrogen early; there were several sites years when delaying 30% of the nitrogen to GS 49 reduced yield, however, particularly at the more northerly sites this timing gave greater yields. Conversely, additional N early was beneficial at the southern sites in three out of four site years.

Specific changes are not required to agronomy for hybrid barley compared with conventional varieties. The main driver required to make a convincing argument for a change from growing winter wheat to winter barley in a second cereal situation is still the relative yield and the relative price obtainable for each crop.

Summary

Yield responses in their first year of National List testing (2002) put hybrid winter barley varieties more than 20% above control varieties. In 2000 they out-yielded controls by 19% and in 1999 showed a 12% increase when compared to conventional six-row controls in the breeder's trials. This high yield potential coupled with early vigour was presented as an opportunity to revolutionise winter barley production and potentially provide an alternative to second wheat. The hybrid lines had been grown under standard husbandry guidelines for conventional winter barley.

Many growers automatically choose wheat in the 1st cereal part of a rotation as it has the highest yield potential. This may not be the case in the future as on some soil types it is possible that hybrid winter barley will consistently out yield winter wheat. There are also advantages from the earlier harvest of barley over wheat. It will be important to compare hybrid winter barley with 1st wheats, with the barley subjected to a range of agronomic inputs. Firstly, input levels should be increased to explore the possibility that the heterosis that has already been demonstrated can be enhanced. Secondly, there is evidence from other hybrid crops that the vigour of hybrids can naturally reduce their overall N requirements by making them more N-efficient. This would entail growing hybrid barley with slightly lower N inputs, thereby again assisting in the objective of reducing the cost per tonne of production.

The 2nd cereal slot is usually a more problematical decision on many farms, particularly with the potential threat of take-all. Hybrid winter barley could improve the yield potential of this slot in the rotation. In view of their yield potential and vigour this project set out to answer the following questions:

- Can further yield improvements be achieved by more dedicated agronomic packages?
- Is the optimum timing of nitrogen affected by hybrid vigour?
- What effect can these yield improvements have on the cost per tonne of production?
- Will winter barley become a more realistic candidate for 2nd cereal positions?

Direct comparisons with winter wheat were not done within this project.

Table 1. *Summary of experiment 1. Seed rate comparison for Colossus grown as a first cereal at twelve sites, 2003-2005.*

Seed rate (seeds/m²)	Yield t/ha
250 seeds/m²	9.03
300 seeds/m²	9.14
350 seeds/m²	9.16

A small increase in yield was observed with increasing seed rate but this numerical increase was not statistically significant, with only two of the twelve sites recording real (P=0.05) responses to more than 250 seeds/m² both in 2003. Lodging and brackling did not always increase with plant population; in fact in

several cases it was worse at the lowest seed rate. Higher seed rates were associated with lower specific weight and thousand seed weights always a weakness with six-row barley.

Table 2. *Overall summary of Experiment 2. The effect of seed rate and seed treatment on the yield of Colossus and Siberia grown as a second cereal at four sites 2003-2005.*

Seed dressing	Seed rate (seeds/m²)	Colossus	Siberia	Mean	Response to Latitude
Standard	250	8.99	8.48	8.74	
Standard	350	9.02	8.62	8.82	
+ Latitude	250	9.03	8.52	8.77	+ 0.03
+ Latitude	350	9.23	8.72	8.98	+ 0.16
Mean		9.07	8.58		

Increasing the seed rate in a second cereal situation had a similarly small effect to that in a first cereal situation; a mean response of 0.12 t/ha was recorded. The response to Latitude was 0.03 t/ha at the lower seed rate and 0.16 t/ha at the higher seer rate. Colossus out yielded Siberia by 0.49 t/ha.

Table 3. *Overall summary of Experiment 3. Effect of nitrogen dose and timing on the yield of Colossus winter barley grown in a first cereal situation at four sites, 2003-2005.*

	Nitrogen dose (kg/ha N)			
Nitrogen timing % applied at each timing	150	180	210	Mean
Early (60/40/0)	8.62	8.88	8.95	8.82
Standard (30/70/0)	8.45	8.96	9.00	8.80
Late (30/40/30)	8.46	8.66	8.98	8.70
Mean	8.99	9.32	9.40	

The standard approach to the timing of nitrogen was the most reliable method of achieving the highest yield. The exception to this rule was at the lowest does of nitrogen (sub optimal for yield) when increasing the proportion applied at the early timing gave the highest yield. Barley is particularly sensitive to dry springs and delaying a proportion to early May reduced yield except at the highest dose when the timing appeared to make less difference. However, this treatment had effectively received 147 kg/ha by mid April. Whilst there were benefits in terms of grain quality (and occasionally in yield) from the delayed dose the difficulty of predicting satisfactory rainfall to ensure uptake in dry springs make this method difficult to manage.

Table 4. *Overall summary of Experiment 4. Effect of nitrogen dose and timing and take-all seed treatment on the yield of Colossus grown in a second cereal situation at four sites, 2003- 2005.*

Seed treatment	Nitrogen timing	Nitrogen dose (kg/ha N)			Mean
		180	210	240	N timing
Standard	Early (60/40/0)	8.34	8.58	8.81	8.58
	Standard (30/70/0)	8.46	8.54	8.70	8.57
	Late (30/40/30)	8.52	8.28	8.70	8.50
Mean N dose		8.44	8.47	8.74	
+ Latitude	Early (60/40/0)	8.54	8.70	8.98	8.74
	Standard (30/70/0)	8.58	8.61	8.82	8.67
	Late (30/40/30)	8.43	8.62	8.73	8.59
Mean N dose		8.52	8.65	8.84	
Mean overall N dose		8.48	8.56	8.79	
Response to Latitude		+0.08	+0.18	+0.11	+0.12

In a second cereal situation, the argument for a greater proportion of the total N dose being applied early to counter the effects of take-all have been established in winter wheat. Over all this also appeared to be true for winter barley and it was more pronounced when Latitude was used. Whilst the yield response to Latitude was not great (and generally there was only low to moderate take-all observed in the trials) it did improve grain quality.

Within the lifetime of the project the second and third generation of hybrid barley varieties have appeared from the same breeding programme as Colossus. Boost and now Bronx have demonstrated higher yields than Colossus in trials along with some agronomic improvements in disease resistance and straw strength/resistance to lodging. However, breeders of conventional six-row barley have kept pace with the hybrid programme and as at harvest 2006 there is little evidence of the hybrids eclipsing conventional varieties but both have demonstrated improvements in yield.

Table 5. *HGCA Recommended List agronomic data for hybrid barley*

Variety	Resistance to lodging	Straw height (cm)	Mildew	Yellow rust	Brown rust	Rhyncho sporium	Net Blotch	BaYMV
Colossus	6	122	4	3	3	8	7	-
Boost	7	113	7	7	4	8	8	R
Bronx	(7)	126	8	6	5	8	8	R

The hypothesis that hybrid barley might have a need for different nitrogen requirements was not supported by these experiments; it appeared to behave similarly to a conventional six-row. The experiments examining

the timing of nitrogen for barley suggested that in the north, with higher May rainfall delaying nitrogen could be beneficial – there was no yield penalty and in some cases lodging was reduced. In the drier south on shallower soils this delay reduced yields.

Whilst there were no direct comparisons with winter wheat in the experiments by comparison with average wheat yields at each site it is possible to quantify the relative margins of wheat and barley in first and second cereal situations. Table 6 shows typical yields of cereals over the lifetime of the project.

Table 6. *Typical yields from trial sites* in the locality of the experiments (t/ha)*

Site	Typical first wheat yield			Typical second wheat yield			Hybrid winter barley yield		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Andover	9.1	11.6	10.7	-	8.8	10.6	7.7	9.5	10.01
Bainton	9.8	10.7	11.6	7.6	6.5	8.6	8.2	8.0	9.0
Cirencester	8.2	8.5	9.9	9.6	8.2	-	7.4	8.0	9.8
Coldstream	11.3	10.1	12.2	7.8	9.1	9.9	10.2	10.9	10.2
Mean	9.60	10.23	11.10	8.33	8.15	9.70	8.38	9.10	9.75
Gross output	710.4	756.6	821.4	616.67	603.10	717.80	527.6	573.3	614.4
Margin	426.3	472.5	537.3	332.55	318.98	433.68	271.9	317.6	358.7

* Data from TAG and HGCA variety trials.

Based on these data the gross outputs are £763, £646 and £572 for first wheat, second wheat and feed hybrid barley respectively. Using typical variable costs it is clear that whilst winter barley may compete favourably with second winter wheat if the former reliably yields 10.00 t/ha and the latter fails to yield more than 7.5 t/ha, in the situations shown in the table, second wheat is still more profitable than winter barley in the same situation. This does not however take in to account the slightly more intangible benefits of growing barley in the second cereal situation such as the early entry for oilseed rape.

Methods

Four separate experiments were done over a three year period (2003 – 2005 harvest years) at four sites.

Table 1. *Experiment sites 2003-2005*

	Experiment	Andover, Hampshire	Bainton, Driffield, North Yorkshire	Cirencester, Gloucestershire	Coldstream, Scottish Borders
1	Seed rate x variety (1st cereal)	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005
2	Seed rate x seed dressing (2nd cereal)	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005
3	Nitrogen dose and timing (1st cereal)	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005
4	N dose and timing ± seed dressing (2nd cereal)	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005	2003, 2004, 2005

Table 2. *Soil series at each site*

Andover, Hampshire	Bainton, Driffield, North Yorkshire	Cirencester, Gloucestershire	Coldstream, Scottish Borders
Andover	Panholes	Elmton	Salop

Experiment 1. Seed rate in a first cereal situation

To test the hypothesis that with hybrid vigour a seed rate 70% that of conventional barley was satisfactory. Colossus was sown at 250, 300 and 350 seeds/m²; plant establishment and ear numbers were recorded together with any related effects of these on the crop e.g. lodging or brackling as well as grain yield and grain quality (specific weight and thousand seed weight).

Experiment 2. Seed rate in a second cereal situation with or without a take-all seed dressing

To test the hypothesis that a hybrid barley out yields a conventional variety even when sown at a lower seed rate. To measure the response to a take-all seed dressing to compare the response of a hybrid with that of conventional barley. Colossus was compared with the conventional six-row variety Siberia at 350 and 250 seeds/m² with or without Latitude seed dressing (in addition to Raxil S as a standard).

Experiment 3. Nitrogen dose and timing in a first cereal situation

To test the hypothesis that because of its different growth habit, hybrid barley responds differently to nitrogen than conventional barley. Nitrogen doses of 150, 180 and 210 kg/ha N (as ammonium nitrate) were applied to Colossus in one of two two-way split treatments or a three-way split treatment. The two-way splits were either proportioned so that 60% of the total dose was applied in early March followed by the remaining 40% in early April (60/40/0) or a 30% in early March followed by 70% in early April (30/70/0). The three-way split was proportioned so that 30% of the total dose was delayed until GS 39-45 (30/40/30) in early May.

Treatment timing	Treatment name
Split 60% in early March; 40% in early April	Early (60/40/0)
Split 30% in early March; 70% early April	Standard (30/70/0).
Split 30% in early March; 40% in early April; 30% in early May	Late (30/40/30)

Experiment 4. Nitrogen dose and timing with and without a take-all seed dressing

As Experiment 3 but in a second cereal situation with the addition of Latitude seed dressing. The doses of nitrogen were also increased to 180, 210 and 240 kg/ha N.

Results

Year 1 – 2003

Experiment 1 – First cereal

Table 3. *Effect of seed rate on plant population, plant establishment, lodging, ear number, yield, specific weight and TGW of the hybrid winter barley cv .Colossus at Bainton, 2003.*

	Plant estab./m² 17 October	Plant estab. % 17 October	Lodging % on 26 June	Ears /m² on 26 June	Brackling % at harvest	Yield t/ha at 85% dm on 15 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	171	69.9	73.3	222	86.7	9.94	63.2	46
300 seeds/m²	199	66.7	60.0	214	76.7	9.96	62.5	44
350 seeds/m²	225	64.4	46.7	223	73.3	10.29	63.8	43
LSD (P=0.05)	21.56	8.26	9.25	28.35	7.56	0.345	.	.
CV						1.51	.	.
Prob. (F)	0.0058	NS	0.0035	NS	0.0178	NS		

The crop was sown on 26 September. The three seed rates produced different plant populations with plant establishment being similar in the autumn but ear numbers were similar by June. However lodging and brackling were worst at the lowest seed rate, sometimes seen with winter barley and in contrast to winter wheat. At harvest there was no significant differences between treatments although the highest seed rate tended to have the highest yield (NS) and the lowest TGW.

Table 4. *Effect of seed rate on plant population, plant establishment, brackling, yield, specific weight and TGW of the hybrid winter barley cv .Colossus at Coldstream, 2003.*

	Plant popn./m² 10 October	Plant estab. % 10 October	Brackling at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	138	56.3	5	10.23	60.8	48.7
300 seeds/m²	156	52.3	5.7	10.01	61.7	48.7
350 seeds/m²	176	50.3	1.7	10.01	60.3	47.7
LSD (P=.05)	27.68	9.67	41.1	0.654	2.2	2.23
CV				3.32		
Prob. (F)	0.059	NS	NS	0.036	0.02	0.03

The crop was sown on 16 September. Three distinct populations were established but plant establishment was only between 50 and 56%. There was little brackling and no lodging recorded. Yields were similar (P=0.05) with the lowest seed rate tending to have slightly greater yield although specific weight and TGW were similar.

Table 5. *Effect of seed rate on plant population, plant establishment, ear number, yield, specific weight and TGW of the hybrid winter barley cv .Colossus at Cirencester, 2003.*

	Plant popn. /m² on 27 November	Plant estab. % on 27 November	Ear count/m² on 26 June	Yield t/ha at 85% dm 24 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	201	82.1	385.3	8.88	60.0	42.2
300 seeds/m²	234	78.5	446.7	9.69	59.5	40.8
350 seeds/m²	260	74.1	438.7	9.96	59.4	42.0
LSD (P=.05)	60.3	20.26	113.25	1.200	1.36	2.36
CV				5.57		
Prob. (F)	NS	NS	NS	NS	NS	NS

The crop was sown on 24 September. Plant populations were similar from all three seed rates with establishment % declining from 82% to 74% as the seed rate increased. Ear numbers were not significantly different although the lowest seed rate produced fewest ears (NS). Yield differences were not statistically different as there was considerable variation between plots. Specific weight and TGW were poor on this light land site.

Table 6. *Effect of seed rate on plant population, ear number, brackling, yield, specific weight and TGW of the hybrid winter barley cv .Colossus at Andover, 2003.*

	Plant popn. /m² on 24 October	Ear count/m² on 18 June	Brackling at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	89	370.7	92	7.60	61.0	45.6
300 seeds/m²	83	345.3	90	7.70	60.8	45.8
350 seeds/m²	106	379.3	83	7.72	60.8	45.1
LSD (P=.05)	24.3	78.44	12.2	0.39	1.05	1.64
CV				2.23		
Prob. (F)	NS	NS	NS	NS	NS	NS

The crop was sown on 4 October. Lower seed rates were used at this site; plant establishment was 44, 33 and 35% respectively resulting in similar ear numbers in June. There was severe brackling at harvest but although yield differences were not significantly different and specific weight poor, TGW was good. There were no significant differences between treatments.

Experiment 2 – Second cereal

Table 7. *The effect of seed rate and seed treatment on the population, establishment, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Bainton, 2003*

		Plant popn. /m² on 16 October	Estab. % on 16 October	Take-all plant score 1-100 on 27 June	Brackling % at harvest	Yield t/ha at 85% dm 15 July	TGW g
350 seeds	Colossus + Latitude	205.3	58.7	1.3	40	9.51	43
	Colossus + standard	236.7	67.6	4.3	47	9.41	42
	Siberia + Latitude	242.7	69.3	3.7	27	8.70	43
	Siberia + standard	259.3	73.9	4.0	20	8.29	42
250 seeds	Colossus + Latitude	165.3	67.5	3.7	57	9.10	43
	Colossus + standard	166.7	68.0	6.7	50	9.23	40
	Siberia + Latitude	186.0	75.9	6.3	20	8.45	44
	Siberia + standard	194.7	79.5	11.3	17	8.64	44
	LSD (P=.05)	30.57	9.43	7.42	15.1	0.716	.
	CV					4.58	.
	Prob. (F)		0.01	NS		0.0165	

The crop was sown on 18 September. The Latitude dressing appeared to reduce establishment of Colossus at the higher seed rate. Take-all infection was low but Latitude seed dressing reduced the disease consistently although not significantly (P=0.05). Yield was improved with Latitude seed dressing and Colossus consistently out yielded Siberia but these differences were not statistically significant. Overall, Colossus yielded 0.79 t/ha higher than Siberia; Latitude seed dressing produced a small response of 0.02 t/ha and 0.12 t/ha for Colossus and Siberia respectively.

Table 8. *The effect of seed rate and seed treatment on the population, establishment, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Coldstream, 2003*

		Plant popn./m² on 10 October	Estab. % on 10 October	Take-all plant score 1-100 18 July	Brackling % at harvest	Ear Count /m² on 23 June	Yield at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	188.0	54	8.0	47	225	10.14	56.9	49.0
	Colossus + standard	182.0	52	3.7	48	248	9.49	55.6	45.0
	Siberia + Latitude	199.3	57	6.3	0	245	9.24	55.4	50.0
	Siberia + standard	222.7	64	8.3	0	223	7.79	54.5	49.3
250 seeds	Colossus + Latitude	138.7	57	9.0	50	193	9.39	56.2	48.0
	Colossus + standard	141.3	58	10.3	51.7	226	9.20	55.7	49.0
	Siberia + Latitude	168.7	69	10.0	0	246	9.27	54.0	49.3
	Siberia + standard	152.7	62	10.7	0	253	8.41	53.1	49.0
LSD (P=.05)		34.37	11.7	5.83	5.92	37.5	0.58	1.47	3.3
CV							3.71		
Prob. (F)		0.001	0.05	NS	NS	0.045	0.0001	0	0.07

The crop was sown on 16 September. Within each seed rate there were no significant differences in plant population, between seed rates distinctions were evident. Percentage establishment was similar within and between seed rates. Take-all was slight and not significantly different between treatments. There was moderate brackling at harvest in all Colossus treatments but this was not affected by seed rate or seed dressing. Ear numbers tended to be higher where only Raxil S seed dressing was used but these differences were not statistically significant. Colossus out yielded Siberia by 0.87 t/ha: the response to Latitude seed dressing was 0.42t/ha in the case of Colossus and 1.15 t/ha for Siberia. This was the largest response recorded in the whole trial series. It was also the earliest drilled trial in a second cereal situation.

Table 9. *The effect of seed rate and seed treatment on the population, take-all, brackling, ear count, yield, specific weight and TGW of Colossus and Siberia winter barley grown as a second cereal, Cirencester, 2003*

		Plant count/m² on 2 December	Take-all Index on 9 July	Brackling % at harvest	Lodging % at harvest	Ear count/ m² 9 July	Yield t/ha at 85% dm 28 July	Specific wt. kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	206.7	12.7	33.33	66.67	460.7	9.07	59.8	44.0
	Colossus + standard	187.6	14.7	21.67	78.33	432.7	9.64	60.2	42.5
	Siberia + Latitude	200.4	10.7	0	0	614.7	10.02	57.6	46.0
	Siberia + standard	197.3	14.0	0	0	550.7	9.16	56.6	44.0
250 seeds	Colossus + Latitude	142.2	8.7	10	90	424.0	8.95	59.3	43.0
	Colossus + standard	130.2	14.7	20	80	473.3	9.24	60.7	45.5
	Siberia + Latitude	160.0	9.7	0	0	521.3	9.17	57.2	47.5
	Siberia + standard	156.9	20.0	0	0	570.7	9.00	55.7	44.0
LSD (P=.05)		35.76	6.859	26.8	26.8	126.412	1.06		
CV							6.52		
Prob. (F)		0.0021	0.0653	0.0001	0.105	0.0508	NS		

The crop was sown on 24 September. Within seed rates there were no differences in plant population. Populations at the lower seed rate were not always significantly different from those at the higher rate. There were differences in take-all infection at the lower seed rate where Latitude reduced severity of the disease; however this difference was not statistically significant. Colossus lodged and brackled severely. Siberia produced more ears than Colossus. There was considerable variation in yield between plots resulting in no statistically significant treatment differences. Specific weight was poor.

Table 10. *The effect of seed rate and seed treatment on the population, take-all, brackling, ear count, yield, specific weight and TGW of Colossus and Siberia winter barley grown as a second cereal, Andover, 2003*

		Plant count/m² on 28 October	Take-all Index on 17 June	Ear count/ m² 14 July	Yield t/ha at 85% dm 19 July	Specific wt. kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	182	13.0	403	7.34	56.7	42.8
	Colossus + standard	179	14.4	433	6.98	57.9	43.2
	Siberia + Latitude	195	16.9	567	7.29	54.9	45.4
	Siberia + standard	134	20.6	515	6.75	56.7	45.3
250 seeds	Colossus + Latitude	141	13.0	364	7.18	57.0	43.7
	Colossus + standard	124	11.1	360	6.91	57.4	42.7
	Siberia + Latitude	134	11.8	501	7.41	54.3	46.1
	Siberia + standard	154	16.1	459	7.02	57.0	46.1
LSD (P=.05)		31.4	NS	96.8	0.63	1.84	0.81
CV					5.02		
Prob. (F)		0.0008		0.0036	NS	0.0012	0.0018

The trial was drilled on 27 September. Different plant populations were established from the two seed rates. Colossus produced fewer ears/m² than Siberia but yields were similar and not statistically different.

Experiment 3 – First cereal

Table 11. *The effect of nitrogen dose and timing on ear number, brackling, take-all, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Coldstream, 2003.*

Treatment	Ears/m² on 23 June	Brackling % at harvest	Take-all index on 18 July	Yield t/ha at 85% dm on 21 July	Specific weight kg/hl	TGW g
150 split 60/40/0	233.3	20	0	8.90	62.1	49.7
150 split 30/70/0	214.0	17	0	8.86	61.0	48.0
150 split 30/40/30	234.7	15	0	8.34	60.7	48.7
180 split 60/40/0	244.7	7	1	9.66	61.4	48.3
180 split 30/70/0	222.0	15	1	10.03	60.9	48.0
180 split 30/40/30	229.3	13	1	8.86	59.7	49.0
210 split 60/40/0	218.7	5	0	10.11	61.4	48.3
210 split 30/70/0	240.0	10	0	10.13	60.9	47.7
210 split 30/40/30	256.7	12	0	10.43	60.6	49.0
LSD (P=.05)	39.33	22.5	.	0.675	1.49	2.61
CV			.	4.11		
Prob. (F)	NS	NS		0.0001	NS	NS

The total nitrogen dose was applied in up to three splits on 10 March, 4 April and 13 May as ammonium nitrate. There was no effect on ear numbers (P=0.05) although there was a tendency for greater numbers where N dose was increased. There was no lodging recorded at this site. Brackling scores were not statistically different although they tended to be lower when the two higher N doses were applied as a 60/40 split. Take-all was recorded at very low levels in this first cereal situation, differences were small and not significant (P=0.05). Yield differences were observed (P=0.05) with the greatest yield recorded at the highest N dose. Effects at the lowest dose suggested that a three-way split reduced yield. Responses at the 180 N dose were similar suggesting that the latest dose was not used efficiently – this was also reflected by the specific weight for this treatment.

Table 12. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Andover, 2003.*

Treatment	Ears/m² on 21 July	Brackling % at harvest	Yield t/ha at 85% dm on 21 July	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	382.0	80	6.67	61.1	44.9
150 split 30/70/0	417.3	83	6.98	61.5	45.2
150 split 30/40/30	341.3	53	6.63	62.3	45.0
180 split 60/40/0	422.7	70	7.02	61.3	45.6
180 split 30/70/0	376.7	62	7.62	61.2	44.8
180 split 30/40/30	396.7	67	7.12	62.0	46.0
210 split 60/40/0	380.7	67	7.28	60.2	43.8
210 split 30/70/0	403.3	93	7.60	61.2	46.0
210 split 30/40/30	379.3	67	7.19	62.3	46.8
LSD (P=.05)	67.37	42.5	0.508	1.20	1.87
CV			4.71		
Prob. (F)	NS	NS	NS	NS	NS

The total nitrogen dose was applied in up to three splits on 6 March (GS 25-26), 31 March (GS 29) and 15 May (GS 39-49) as ammonium nitrate. There was no effect on ear numbers (P=0.05). There was no lodging recorded at this site. Yield differences were observed (P=0.05). Effects at all doses suggested that the standard 30/70/0 split produced the higher yields although a three-way split tended to result in higher specific weights and TGWs.

Table 13. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Bainton, 2003.*

Treatment	Ears/m² on 4 June	Lodging % at harvest	Yield t/ha at 85% dm on 21 July	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	235.3	23.3	9.47	64.7	40.3
150 split 30/70/0	251.3	23.3	9.54	63.9	40.3
150 split 30/40/30	232.7	3.3	9.75	63.0	42.0
180 split 60/40/0	250.0	61.7	10.62	62.0	42.0
180 split 30/70/0	246.7	51.7	10.27	62.6	40.7
180 split 30/40/30	275.3	36.7	9.97	63.3	42.3
210 split 60/40/0	266.7	81.7	10.56	61.1	37.7
210 split 30/70/0	264.0	75.0	9.92	60.8	39.3
210 split 30/40/30	254.0	70.0	10.25	60.5	43.3
LSD (P=.05)	31.7	33.4	0.833	1.87	5.76
CV			4.8		
Prob. (F)	NS	0.0001	0.0824	0.0001	NS

Ear numbers were not significantly different. Lodging was less where a proportion of the N was applied later. Yields were not statistically different although at the higher two levels applying a grater proportion early appeared to be beneficial although this method reduced the TGW at the highest dose.

Table 14. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Cirencester, 2003.*

Treatment	Ear count /m² on 26 June	Brackling % at harvest	Yield t/ha at 85% dm on 4 August	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	320.7	89	7.89	58.5	41.0
150 split 30/70/0	361.3	90	8.07	59.9	39.2
150 split 30/40/30	338.7	90	7.24	58.5	38.0
180 split 60/40/0	384.0	87	7.96	59.0	37.3
180 split 30/70/0	408.0	87	7.64	58.8	36.8
180 split 30/40/30	374.0	90	7.40	58.0	37.2
210 split 60/40/0	371.3	90	8.61	58.7	36.3
210 split 30/70/0	390.0	88	7.41	58.0	36.5
210 split 30/40/30	364.0	90	7.57	58.4	37.5
LSD (P=.05)	4.45	65.8	0.97	1.36	3.53
CV			7.24		
Prob. (F)	NS	NS	NS	NS	NS

The total nitrogen dose was applied in up to three splits on 28 February (GS 25-26), 16 April (GS 32-33) and 2 May (GS 45-49) as ammonium nitrate. There were no significant differences between treatments; brackling was severe when the crop was harvested late on 4 August. Yield and quality were poorer than the northern sites.

Experiment 4 – Second cereal

Table 15. *Effect of nitrogen dose and timing of application on brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Bainton, 2003*

N dose, timing and seed dressing	Brackling at harvest	Yield t/ha at 85% dm 5 July 2003	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing				
180 60/40/0	50	7.65	62.7	40.3
180 30/70/0	40	8.48	61.9	40.7
180 30/40/30	57	8.24	61.5	40.0
210 60/40/0	53	8.23	62.1	40.0
210 30/70/0	50	8.00	60.9	39.7
210 30/40/30	53	7.82	61.2	39.7
240 60/40/30	53	8.43	62.0	40.0
240 30/70/0	37	7.94	62.0	41.0
240 30/40/30	40	8.48	61.3	40.0
Standard plus Latitude dressing				
180 60/40/0	53	8.43	62.3	42.0
180 30/70/0	37	8.28	62.1	41.7
180 30/40/30	57	7.77	62.0	40.7
210 60/40/0	53	8.98	63.1	41.7
210 30/70/0	47	8.24	61.6	42.0
210 30/40/30	43	7.65	62.8	43.3
240 60/40/0	47	8.85	62.3	40.0
240 30/70/0	53	8.61	62.7	39.3
240 30/40/30	30	8.12	62.0	40.7
LSD (P=.05)	23.26	0.802		4.19
CV	29.43	5.84		6.18
Prob. (F)	NS	0.0579		NS

The trial was drilled on 18 September; nitrogen was applied on 10 April, 4 May and 13 May as ammonium nitrate. Overall there was a response of 0.18 t/ha to the use of Latitude seed dressing. Take all levels were very low and there were no differences observed between treatments. Delaying 30% of the N dose until GS 37-49 resulted in a yield reduction except at the highest N dose applied. Where Latitude was used the early nitrogen timing tended to produce higher yields.

Table 16. *Effect of nitrogen dose and timing of application on take-all, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Coldstream, 2003*

	Take-all index on 18 July	Brackling % at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing					
180 60/40/0	10.7	42	8.48	57.4	46.7
180 30/70/0	12.3	30	7.74	57.4	45.7
180 30/40/30	11.7	22	7.45	57.6	48.0
210 60/40/0	11.7	27	8.14	58.1	48.0
210 30/70/0	13.7	33	7.60	57.6	46.0
210 30/40/30	7.3	32	7.41	57.7	45.3
240 30/70/0	10.7	37	8.61	57.4	47.3
240 30/40/30	10.7	28	8.41	58.0	46.7
240 30/40/30	13.3	30	8.20	58.1	44.7
Standard plus Latitude					
180 60/40/0	5.7	17	8.67	57.9	49.0
180 30/70/0	12.0	30	7.91	58.8	46.3
180 30/40/30	9.4	25	7.75	56.6	48.7
210 60/40/0	11.3	20	8.35	58.6	48.3
210 30/70/0	14.3	28	8.28	57.4	47.0
210 30/40/30	8.0	37	7.97	58.8	47.7
240 60/40/0	6.3	33	8.79	58.8	48.0
240 30/70/0	6.3	25	8.51	58.1	46.0
240 30/40/30	9.7	30	8.77	58.7	47.7
LSD (P=.05)	6.52	12.3	0.572	1.85	2.38
CV	38.03	25.48	4.2	1.91	3.03
Prob.(F)	NS	0.0303	0.0001	0.5256	NS

The crop was sown on 16 September; nitrogen was applied on 10 April, 4 May and 13 May. Overall the yield response to Latitude seed dressing was 0.31 t/ha. Yield tended to decline if nitrogen was delayed. Take-all levels were slight but tended to be lower where Latitude was applied as a seed dressing. Specific weight was poor.

Table 17. *Effect of nitrogen dose and timing of application on take-all, lodging, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Cirencester, 2003*

	Take-all Index on 9 July	Lodging % at harvest	Brackling % at harvest	Yield t/ha at 85% dm 28 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing						
180 60/40/0	10.7	16.7	83	8.26	60.1	49.0
180 30/70/0	17.3	13.3	87	8.01	60.0	49.0
180 30/40/30	11.7	5.0	95	9.08	60.4	49.5
210 60/40/0	13.7	20.0	80	8.92	60.5	49.0
210 30/70/0	12.3	0.0	100	8.30	59.7	44.5
210 30/40/30	14.7	41.7	58	7.96	62.0	49.5
240 60/40/0	17.3	23.3	77	8.50	60.2	47.5
240 30/40/30	12.3	53.3	47	7.83	59.4	44.5
240 30/70/0	15.0	5.0	95	7.97	60.8	48.5
Standard plus Latitude						
180 60/40/0	7.8	33.3	67	8.76	59.5	46.5
180 30/70/0	9.3	26.7	73	8.37	60.0	44.5
180 30/40/30	15.3	13.3	87	7.99	61.0	43.0
210 60/40/0	11.7	13.3	87	7.99	60.6	47.0
210 30/70/0	10.0	31.7	68	8.41	60.3	45.0
210 30/40/30	10.7	28.3	72	8.57	59.9	42.0
240 60/40/0	10.7	31.7	68	8.87	60.3	45.0
240 30/70/0	10.7	10.0	87	8.61	59.4	46.0
240 30/40/30	12.7	3.3	97	8.19	59.4	42.0
LSD (P=0.05)	8.04	44.822	44.9	1.172		
CV	38.81	130.78	33.98	8.41		
Prob (F)	NS	NS	NS	NS		

The crop was sown on 24 September; nitrogen was applied as ammonium nitrate on 7 March, 3 April and 1 May. Overall there was a 0.11 t/ha response to Latitude. There was no overall response to more than 180 kg/ha N and the crop responded best to the higher dose at the early timing of nitrogen. However, there were no statistically significant differences.

Table 18. *Effect of nitrogen dose and timing of application on take-all, lodging, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Andover, 2003*

	Take-all Index on 17 June	Ears/m² on 14 July	Yield t/ha at 85% dm 28 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing					
180 60/40/0	15.7	371	5.61	51.0	39.9
180 30/70/0	10.6	357	6.07	54.3	42.1
180 30/40/30	24.3	359	5.86	53.9	41.6
210 60/40/0	14.1	401	5.96	53.9	40.8
210 30/70/0	17.5	413	6.67	54.3	42.1
210 30/40/30	19.5	353	5.75	54.3	41.4
240 60/40/0	17.7	371	7.05	55.3	42.0
240 30/70/0	16.2	369	6.43	54.3	45.6
240 30/40/30	22.1	339	6.46	53.4	40.8
Standard plus Latitude					
180 60/40/0	23.3	376	6.05	51.7	41.2
180 30/70/0	17.4	349	6.60	54.9	42.7
180 30/40/30	14.4	331	6.28	55.6	42.0
210 60/40/0	17.6	336	6.06	53.5	40.9
210 30/70/0	10.2	345	6.75	54.7	41.6
210 30/40/30	14.8	349	6.68	55.2	43.4
240 60/40/0	12.5	386	6.52	53.4	41.3
240 30/70/0	17.3	313	6.61	53.8	41.5
240 30/40/30	14.9	376	6.31	54.6	44.7
LSD (P=0.05)		96.7	0.535	1.84	1.81
CV			5.08		
Prob (F)		0.0036	0.0002	0.0012	0.0018

The trial was sown on 27 September. Nitrogen was applied on 12 March, 31 March and 15 May. Take-all levels were moderate; in the absence of Latitude seed treatment the take-all index tended to rise when 30% of the nitrogen was held back until May. This effect was not apparent where Latitude was used. Yield was generally highest when the standard nitrogen timing was applied.

Results

Year 2 – 2004

Experiment 1 - First cereal

Table 19. *Effect of seed rate on plant population, ear number, lodging, brackling and yield of the hybrid winter barley cv .Colossus in a first cereal situation at Bainton, 2004.*

	Plant estab./m² on 26 October	Ears /m² on 7 June	Lodging % at harvest	Brackling % at harvest	Yield t/ha at 85% dm 15 July
250 seeds/m²	216.7	428.7	53.3	20	10.03
300 seeds/m²	263.3	438.7	58.3	7	10.26
350 seeds/m²	270.0	460.0	58.3	17	10.00
LSD (P=.05)	23.48	70.49	11.33	27.2	1.668
CV					7.29
Prob. (F)	0.0061	NS	NS	NS	NS

Different plant populations were established but ear numbers in June were similar and resultant yields were the same.

Table 20. *Effect of seed rate on plant population, ear number, brackling, yield, specific weight and TGW of the hybrid winter barley cv .Colossus in a first cereal situation at Coldstream, 2004.*

	Plant popn./m² on 10 October	Ears/m2 on 2 June	Brackling at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	203.3	444.7	17	9.70	59.6	47.7
300 seeds/m²	219.3	480.7	20	8.56	59.1	45.0
350 seeds/m²	233.3	478.0	22	9.69	59.4	46.9
LSD (P=.05)	27.32	28.95	20	0.68	1.46	3.31
CV				2.81		
Prob. (F)	NS	0.0453	NS	0.0199	NS	NS

Similar populations were established, ear numbers were greater at the two higher seed rates. Yield and TGW was lowest at the 300 seeds treatment but similar at the lowest and highest seed rates.

Table 21. *Effect of seed rate on plant population, ear number, yield, specific weight and TGW of the hybrid winter barley cv .Colossus grown as a first cereal at Cirencester, 2004.*

	Plant popn. /m² 11 November	Ear count/m² on 26 June	Yield t/ha at 85% dm 24 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	129.3	342.0	5.36	61.6	45.7
300 seeds/m²	148.7	338.0	5.35	60.6	44.3
350 seeds/m²	168.7	372.7	5.66	60.6	44.7
LSD (P=.05)	59.91	54.54	0.84	2.65	2.95
CV			6.8		
Prob. (F)	NS	NS	NS	NS	NS

Yield was low and there were no significant differences between treatments.

Table 22. *Effect of seed rate on plant population, ear number, lodging, yield, specific weight and TGW of the winter barley cv .Colossus and Siberia grown as a first cereal at Andover, 2004.*

	Plant popn. /m² 24 October	Ear count/m² on 2 June	Lodging at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
Colossus 200 seeds/m²	139.3	580.0	8.3	7.03	63.9	48.6
Siberia 200 seeds/m²	158.0	522.7	83.3	7.40	63.8	52.0
Colossus 300 seeds/m²	169.3	702.0	22.7	7.36	63.5	46.7
Siberia 300 seeds/m²	171.3	605.3	83.3	7.60	63.6	50.5
LSD (P=.05)	102.05	220.63	18.5	0.92	2.36	4.77
CV				6.29		
Prob. (F)	NS	NS	0	NS	NS	NS

This trail compared Siberia and Colossus at two seed rates in contrast to the other sites. Siberia had a slightly improved plant population but produced fewer ears (NS). Yield and TGW were higher than Colossus despite severe lodging. This suggested that Colossus was unable to fulfil the earlier potential due to poor grain fill. Statistically (P=0.05), there were no differences in the performance of the two varieties.

Experiment 2 – Second cereal

Table 23. *The effect of seed rate and seed treatment(Raxil S ± Latitude) on the population, establishment, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a third cereal, Andover 2004*

		Plant popn. /m² on 16 October	Ear number /m2 on June	Yield t/ha at 85% dm 15 July	Specific weight kg/hl	TGW g
350 seeds	Colossus + Latitude	235	413	10.60	61.4	49.0
	Colossus standard	164	394	9.42	63.2	48.2
	Siberia + Latitude	213	379	9.54	61.7	48.0
	Siberia standard	213	442	9.34	63.5	47.0
250 seeds	Colossus + Latitude	161	399	10.90	61.6	48.3
	Colossus standard	134	432	9.36	63.2	47.5
	Siberia + Latitude	136	433	8.75	61.6	48.6
	Siberia standard	141	399	8.97	62.8	47.2
	LSD (P=.05)	43.2	84.1	1.221	5.13	4.68
	CV			7.41		
	Prob. (F)	0.0001	NS	NS	NS	NS

Overall, Colossus yielded better than Siberia by 0.7 t/ha (NS). Latitude improved yield by 0.46 t/ha (NS) and there was no benefit from increasing the seed rate above 200 seeds/m². Colossus appeared to respond to Latitude at both seed rates but this was not statistically significant.

Table 24. *The effect of seed rate and seed treatment(Raxil S ± Latitude) on the population, establishment, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Bainton, 2004*

		Plant popn. /m² on 16 October	Ear number /m2 on June	Lodging % at harvest	Yield t/ha at 85% dm 15 July	TGW g
350 seeds	Colossus + Latitude	276.0	371.3	53	9.80	46.0
	Colossus standard	246.7	392.0	47	9.07	45.3
	Siberia + Latitude	229.3	368.7	0	8.90	48.7
	Siberia standard	230.7	359.3	0	9.09	49.6
250 seeds	Colossus + Latitude	202.7	354.7	57	9.64	47.1
	Colossus standard	197.3	355.3	70	9.04	45.5
	Siberia + Latitude	177.3	359.3	0	8.52	49.0
	Siberia standard	173.3	352.0	0	8.78	47.6
	LSD (P=.05)	37.54	40.5	16	0.643	3.37
	CV				4.03	
	Prob. (F)	0.0005	NS	0	0.013	NS

Discreet populations were established from the two seed rates although Colossus' establishment at 250 seeds was almost as good as Siberia's at 350 seeds. Ear numbers were similar at either seed rate. Lodging was confined to Colossus. Colossus out yielded Siberia by 0.57 t/ha; the response to Latitude seed dressing was 0.22 t/ha.

Table 25. *The effect of seed rate and seed treatment on the population, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Coldstream, 2004*

		Plant popn./m² on 22 October	Take-all root score 1-100 6 July	Brackling % at harvest	Ear Count /m² on 23 June	Yield at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	187.3	8.7	45	430.7	9.33	53.0	42.5
	Colossus standard	180.7	7.7	55	399.3	9.26	53.7	42.8
	Siberia + Latitude	218.7	7.3	15	466.7	8.65	53.0	42.9
	Siberia standard	210.0	5.7	32	455.3	8.40	52.2	44.8
250 seeds	Colossus + Latitude	154.7	8.3	37	418.0	8.79	53.6	42.5
	Colossus standard	158.7	7.0	53	401.3	9.13	53.7	44.4
	Siberia + Latitude	164.0	8.0	22	426.0	8.70	53.2	43.8
	Siberia standard	156.7	7.0	17	387.3	8.25	53.1	42.8
LSD (P=.05)		20.72	2.44	15.2	59.06	0.47	1.22	1.93
CV						3.04		
Prob. (F)		0.0001	NS	0.0002	NS	0.0014	NS	NS

Two distinct populations were established from the two seed rates, Siberia tended to have a higher population than Colossus, particularly at the higher seed rate. Take-all was present at a low level but there were no effects from the seed dressing. Brackling was worst with Colossus. By June ear numbers were similar. Overall, Colossus out yielded Siberia, particularly at the higher seed rate by 0.62 t/ha. The response to Latitude was 0.11 t/ha.

Table 26. *The effect of seed rate and seed treatment on the population, brackling, ear count, yield, specific weight and TGW of Colossus and Siberia winter barley grown as a second cereal, Cirencester, 2004*

		Plant count/m² on 3 November	Brackling % at harvest	Ear count / m² 9 July	Yield t/ha at 85% dm 28 July	Specific wt. kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	243.3	97.7	502.7	8.52	63.7	41.7
	Colossus standard	254.7	98.3	462.0	7.99	62.6	41.7
	Siberia + Latitude	225.3	98.0	489.3	7.48	58.8	37.7
	Siberia standard	236.7	97.3	480.7	7.70	60.5	40.0
250 seeds	Colossus + Latitude	190.7	97.0	434.0	8.24	64.0	44.3
	Colossus standard	186.7	97.3	414.0	8.07	63.1	42.5
	Siberia + Latitude	178.0	96.7	448.7	7.46	60.5	43.8
	Siberia standard	160.0	97.0	443.3	6.88	60.6	41.0
LSD (P=.05)		31.09	2.57	79.5	1.067	2.04	4.72
CV					7.78		
Prob. (F)		0.0001	NS	NS	NS	0.0008	NS

The trial was drilled on 24 September. Discreet populations were established from the two seed rates with Colossus tending to produce higher plant populations than Siberia. Ear numbers appeared to be enhanced where Latitude was used in the case of Colossus but not significantly (P=0.05). Colossus out yielded Siberia and Latitude tended to increase yield exce3pt with Siberia at the higher seed rate.

Experiment 3 – First cereal

Table 27 *The effect of nitrogen dose and timing on ear number, brackling, lodging and yield of Colossus hybrid winter barley grown as a first cereal at Bainton, 2004.*

Treatment	Ears/m² on 7 June	Brackling % at harvest	Lodging % at harvest	Yield t/ha at 85% dm on 27 July
150 split 60/40/0	422.7	33	47	9.33
150 split 30/70/0	398.7	23	55	9.66
150 split 30/40/30	392.0	57	17	9.35
180 split 60/40/0	412.7	30	60	10.05
180 split 30/70/0	410.7	28	62	10.24
180 split 30/40/30	372.0	27	57	10.41
210 split 60/40/0	376.0	15	75	9.92
210 split 30/70/0	404.0	8	88	9.85
210 split 30/40/30	434.0	23	70	9.86
LSD (P=.05)	34.42	44.3	59.2	0.829
CV				4.83
Prob. (F)	0.024	NS	NS	NS

The trial was drilled on 23 September. The total nitrogen dose was applied in up to three splits on 26 March, 20 April and 14 May as ammonium nitrate. Despite differences in ear number recorded on 7 June there were no statistically significant differences in yield.

Table 28. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Coldstream, 2004.*

Treatment	Ears/m² on 21 July	Brackling % at harvest	Yield t/ha at 85% dm on 21 July	TGW g
150 split 60/40/0	469.3	18	9.74	45.1
150 split 30/70/0	444.7	37	10.00	45.7
150 split 30/40/30	423.3	13	9.51	46.6
180 split 60/40/0	459.3	20	10.56	45.0
180 split 30/70/0	456.0	20	10.24	44.6
180 split 30/40/30	443.3	15	10.06	47.1
210 split 60/40/0	445.3	17	10.42	46.1
210 split 30/70/0	460.0	17	10.02	45.6
210 split 30/40/30	445.3	17	10.20	46.6
LSD (P=.05)	60.42	19.3	0.794	1.53
CV			4.55	
Prob. (F)	NS	NS	NS	0.039

The total nitrogen dose was applied in up to three splits on 6 March (GS 25-26), 31 March (GS 29) and 15 May (GS 39-49) as ammonium nitrate. There were no statistically significant differences although at the two

higher N doses the 60/40/0 split tended to produce higher yields. The later nitrogen tended to produce higher thousand grain weights.

Table 29. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Cirencester, 2004.*

	Ear count /m² on 26 June	Yield t/ha at 85% dm on 4 August	TGW g
150 split 60/40/0	304.7	5.61	45.8
150 split 30/70/0	362.0	5.73	44.8
150 split 30/40/30	364.7	5.79	44.2
180 split 60/40/0	322.0	5.84	46.7
180 split 30/70/0	400.0	6.19	46.2
180 split 30/40/30	353.3	5.62	44.3
210 split 60/40/0	355.3	6.01	45.5
210 split 30/70/0	363.3	5.72	45.3
210 split 30/40/30	334.0	5.68	43.5
LSD (P=.05)	81.79	0.67	1.985
CV		6.7	
Prob. (F)	NS	NS	NS

The total nitrogen dose was applied in up to three splits on 1 March (GS 25-26), 14 April (GS 29) and 12 May (GS 39-49) as ammonium nitrate. There were no statistically significant differences at this low yielding site.

Table 30. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Andover, 2004.*

	Ear count /m² on 26 June	Yield t/ha at 85% dm on 4 August	TGW g
180 split 60/40/0	428	7.18	46.9
180 split 30/70/0	390	7.18	46.6
180 split 30/40/30	414	7.10	45.2
210 split 60/40/0	380	7.21	47.1
210 split 30/70/0	466	7.59	46.6
210 split 30/40/30	410	7.31	45.2
240 split 60/40/0	367	7.73	47.9
240 split 30/70/0	425	7.63	47.0
240 split 30/40/30	434	7.72	46.6
LSD (P=.05)		0.34	
CV		4.57	
Prob. (F)		NS	

The total nitrogen dose was applied in up to three splits on 3 March (GS 25-26), 14 April (GS 29) and 6 May (GS 39-49) as ammonium nitrate. There were no statistically significant differences at this site.

Experiment 4 – Second cereal

Table 31. *Effect of nitrogen dose and timing of application on brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Bainton, 2004*

N dose, timing and seed dressing	Take-all index on 6 July	Brackling % at harvest	Yield t/ha at 85% dm 27 July 2003	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing					
180 60/40/0	7.0	70	8.61	61.3	46.9
180 30/70/0	7.7	63	8.88	60.7	44.1
180 30/40/30	7.3	40	8.83	60.2	44.9
210 60/40/0	7.0	77	9.12	60.0	44.3
210 30/70/0	7.7	72	9.14	61.7	45.9
210 30/40/30	6.7	60	8.33	61.0	45.5
240 60/40/0	8.3	68	8.99	60.7	44.9
240 30/70/0	6.7	52	9.27	60.9	44.5
240 30/40/30	6.3	47	9.36	60.7	43.4
Standard plus Latitude dressing					
180 60/40/0	7.7	60	8.88	61.0	46.5
180 30/70/0	6.3	48	9.02	60.3	46.1
180 30/40/30	7.3	53	8.47	60.3	44.3
210 60/40/0	8.0	68	9.14	60.5	44.9
210 30/70/0	7.7	73	8.58	60.5	38.2
210 30/40/30	8.3	43	8.87	60.5	44.3
240 60/40/0	9.0	82	9.58	59.0	45.9
240 30/70/0	7.3	55	8.99	59.9	46.3
240 30/40/30	7.3	58	9.16	61.4	46.3
LSD (P=.05)	1.88		0.516	0.98	3.62
CV			3.46		
Prob. (F)	NS		0.02	0.0015	0.0146

Overall there was a response of 0.02 t/ha to the use of Latitude seed dressing. Take all levels were low and there were no differences observed between treatments. The standard nitrogen timing tended to produce the higher yields, the exceptions being at the highest dose of N where the pattern was not distinct suggesting above optimum nitrogen supply.

Table 32. *Effect of nitrogen dose and timing of application on take-all, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Coldstream, 2004*

	Take-all score 1-100 on 18 July	Brackling % at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing					
180 60/40/0	7.7	37	9.24	54.9	43.9
180 30/70/0	5.3	33	9.29	54.4	43.1
180 30/40/30	7.7	42	9.27	55.8	44.6
210 60/40/0	7.3	43	9.18	55.0	43.7
210 30/70/0	7.7	18	9.07	54.4	44.9
210 30/40/30	7.0	17	8.85	55.9	44.9
240 60/40/0	6.0	35	9.44	55.1	44.1
240 30/70/0	6.7	38	9.51	54.7	42.1
240 30/40/30	8.7	50	9.28	55.5	43.3
Standard plus Latitude					
180 60/40/0	6.7	43	9.15	54.5	43.8
180 30/70/0	6.7	27	9.24	53.9	43.0
180 30/40/30	7.3	37	9.33	56.3	44.9
210 60/40/0	6.7	53	9.69	54.8	43.9
210 30/70/0	4.7	50	9.55	53.6	43.9
210 30/40/30	7.7	52	9.18	57.2	44.4
240 60/40/0	5.0	55	9.60	55.5	43.7
240 30/70/0	6.7	35	9.42	54.8	43.5
240 30/40/30	7.3	32	9.51	56.4	44.7
LSD (P=.05)	2.81	15.9	0.484	1.96	1.74
CV			3.11		
Prob.(F)	NS	0.0002	NS	NS	NS

Take-all levels were low and showed no clear treatment effects. Brackling was present and in some cases appeared to be worse where early N doses had been used. There were no statistically significant differences in yield although early or standard nitrogen timings tended to improve yield over the late timing.

Table 34. *Effect of nitrogen dose and timing of application on take-all, lodging, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Cirencester, 2004*

	Take-all Index 9 July	Ear number /m2 on 9 July	Brackling % at harvest	Yield t/ha at 85% dm 28 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing						
180 60/40/0	7	476.7	51.7	7.25	61.2	42.2
180 30/70/0	5	502.0	82.7	7.51	61.7	41.5
180 30/40/30	3	525.3	90.0	7.36	61.6	42.2
210 60/40/0	1	495.3	84.7	8.32	62.1	41.5
210 30/70/0	2	504.0	87.7	8.19	61.7	41.7
210 30/40/30	3	454.7	83.3	8.39	62.5	43.2
240 60/40/0	5	466.7	63.0	8.49	61.5	41.2
240 30/70/0	4	527.3	87.7	8.54	62.4	42.3
240 30/40/30	3	491.3	60.7	8.18	62.4	42.7
Standard plus Latitude						
180 60/40/0	6	486.0	66.3	7.61	62.9	44.3
180 30/70/0	4	438.0	91.3	7.83	63.0	44.2
180 30/40/30	1	485.3	73.3	8.02	62.9	44.0
210 60/40/0	2	490.7	81.7	8.72	62.2	45.2
210 30/70/0	1	446.0	73.0	8.05	61.8	43.7
210 30/40/30	3	503.3	76.7	8.01	62.2	43.2
240 60/40/0	3	463.3	74.7	8.17	61.5	44.3
240 30/70/0	3	482.7	79.0	8.43	62.0	42.3
240 30/40/30	4	486.0	91.0	8.8	62.4	43.0
LSD (P=0.05)	3.3	84.92	38.79	1.143	1.358	2.898
CV				8.46		
Prob (F)	0	NS	NS	NS	NS	NS

The trial was drilled on 24 September; nitrogen was applied on 1 March, 14 April and 12 May. Take-all levels were low. There were no statistically significant differences and no consistent trends.

Table 35. *Effect of nitrogen dose and timing of application on take-all, lodging, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Andover, 2004*

	Ear number /m2 on 12 July	Yield t/ha at 85% dm 22 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing				
180 60/40/0	319	8.76	64.6	49.2
180 30/70/0	341	8.09	64.5	48.1
180 30/40/30	385	8.84	64.3	49.3
210 60/40/0	307	8.45	64.9	49.6
210 30/70/0	429	9.28	64.8	48.7
210 30/40/30	358	9.04	64.3	49.5
240 60/40/0	323	8.89	64.4	48.9
240 30/70/0	353	9.12	64.3	50.4
240 30/40/30	355	8.92	64.8	49.4
Standard plus Latitude				
180 60/40/0	332	8.67	64.7	49.5
180 30/70/0	357	8.32	64.4	48.6
180 30/40/30	357	8.28	65.0	50.0
210 60/40/0	306	8.63	64.9	49.5
210 30/70/0	375	8.99	64.7	48.7
210 30/40/30	387	8.92	64.7	47.9
240 60/40/0	321	8.80	64.7	48.7
240 30/70/0	388	9.00	65.0	48.8
240 30/40/30	366	8.52	64.3	48.2
LSD (P=0.05)	70.6	0.911	0.76	1.97
CV		6.24		
Prob (F)	NS	NS	NS	NS

The trial was drilled on 25 September in a third cereal position. Nitrogen was applied on 3 March, 13 April and 7 May. There was no overall response to Latitude seed dressing. There was a response to increasing the N dose from 180 to 210 kg/ha N but no further. The standard timing appeared most appropriate; there was no benefit from increasing the proportion of nitrogen applied early or delaying a proportion until later. None of these differences were statistically significant (P=0.05).

Results

Year 3 – 2005

Experiment 1 - First cereal

Table 36. *Effect of seed rate on plant population, ear number, lodging, brackling and yield of the hybrid winter barley cv .Colossus in a first cereal situation at Bainton, 2005.*

	Plant estab./m² on 3 November	Ears /m² on 1 June	Leaning % at harvest	Lodging % at harvest	Yield t/ha at 85% dm 15 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	216.7	412.0	40	92	9.22	56.7	56.1
300 seeds/m²	247.3	430.7	43	88	8.90	58.0	54.7
350 seeds/m²	270.7	428.7	55	87	9.08	57.1	55.3
LSD (P=.05)	63.48	31	24.8	5.97	0.398	1.25	2.47
CV					1.94		
Prob. (F)	NS	NS	NS	NS	NS	NS	NS

Different plant populations were established but ear numbers in June were similar and resultant yields were the same.

Table 37. *Effect of seed rate on plant population, ear number, brackling, yield, specific weight and TGW of the hybrid winter barley cv .Colossus in a first cereal situation at Coldstream, 2005.*

	Plant popn./m² 10 November	Ears/m2 on 28 June	Brackling at harvest	Yield t/ha at 85% dm 21 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	190.0	338.0	6.7	10.03	59.1	44.9
300 seeds/m²	233.0	352.7	6.7	9.91	59.8	43.2
350 seeds/m²	279.0	362.0	5.0	9.99	58.6	41.5
LSD (P=.05)	53.8	39.68	5.97	0.391	1.5	4.26
CV				1.73		
Prob. (F)	0.0257	NS	NS	NS	NS	NS

Statistically similar populations were established from all seed rates although there was a trend towards higher populations with increasing seed rate; ear numbers were greater at the two higher seed rates. Yield was similar at all seed rates but TGW was highest at the lower seed rate.

Table 38. *Effect of seed rate on plant population, ear number, yield, specific weight and TGW of the hybrid winter barley cv .Colossus grown as a first cereal at Cirencester, 2005.*

	Plant popn. /m² on 9 November	Ear count/m² on 4 July	Yield t/ha at 85% dm 20 July	Specific weight kg/hl at 85% dm	TGW g
250 seeds/m²	111.3	522	9.15	60.5	35.7
300 seeds/m²	151.3	623	9.67	61.2	36.8
350 seeds/m²	146.0	577	9.35	60.5	35.5
LSD (P=.05)	32.09	67.1	1.29	2.311	3.46
CV			6.06		
Prob. (F)	0.0487	0.0342	NS	NS	NS

Establishment was poor but the crop compensated and yields were good. However there were no yield differences.

Table 39. *Effect of seed rate on plant population, ear number, yield, specific weight and TGW of the hybrid winter barley cv .Colossus and the conventional cv Siberia grown as a first cereal at Andover, 2005.*

	Plant popn. /m² on 9 November	Ear count/m² on 4 July	Yield t/ha at 85% dm 20 July	Specific weight kg/hl at 85% dm	TGW g
Colossus 200 seeds/m²	157	405	8.95	64.1	43.6
Colossus 300 seeds/m²	221	411	8.61	65.4	46.8
Siberia 200 seeds/m²	179	529	9.34	62.9	47.0
Siberia 300 seeds/m²	224	562	9.60	63.3	47.8
LSD (P=.05)	42.2	72.6	0.959	1.20	6.95
CV			5.88		
Prob. (F)	0.02	0.0036	NS	0.0015	NS

Both varieties compensated by producing more ears when sown at the lower population and this resulted in statistically similar yields although Siberia out yielded Colossus in this trial which was suspected of having barley mosaic virus.

Experiment 2 – Second cereal

Table 40. *The effect of seed rate and seed treatment on the population, establishment, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Bainton, 2005*

		Plant popn. /m² on 16 October	Ear number /m2 on June	Take-all Index on 12 July	Lodging % at harvest	Yield t/ha at 85% dm 15 July	Specific weight kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	220.7	517.3	6.3	70	9.78	57.9	40.4
	Colossus standard	244.7	508.0	7.7	83	10.09	57.7	41.0
	Siberia + Latitude	219.3	558.0	8.0	47	9.52	56.3	40.3
	Siberia standard	216.0	534.7	13.7	10	8.76	54.6	38.5
250 seeds	Colossus + Latitude	235.3	538.7	6.7	67	10.35	56.4	39.2
	Colossus standard	203.3	516.7	8.7	85	10.83	58.0	43.2
	Siberia + Latitude	174.0	542.0	11.0	20	7.85	55.7	39.9
	Siberia standard	198.7	559.3	11.7	28	8.57	54.3	41.6
	LSD (P=.05)	18.66	44.36	6.38	30.4	1.04	1.26	3.11
	CV					5.83		
	Prob. (F)	0.0001	NS	NS	0.0001	0.002		NS

The trial was sown on 18 September. Colossus established better than Siberia at the lower seed rate. Ear numbers indicated that Siberia compensated satisfactorily. Colossus lodged more than Siberia at either seed rate. The highest yield was obtained from Colossus grown without Latitude at 250 seeds/m².

Table 41. *The effect of seed rate and seed treatment on the population, take-all, brackling, yield and TGW of Colossus and Siberia winter barley grown as a second cereal, Coldstream, 2005*

		Plant popn./m² on 10 November	Take-all Index on 14 July	Brackling % at harvest	Ear Count /m² on 28 June	Yield at 85% dm 24 July	Specific weight kg/hl at 85% dm	TGW g
350 seeds	Colossus + Latitude	257	2.7	61.7	373.3	9.57	53.5	38.7
	Colossus standard	297	1.7	60	399.3	9.05	53.8	38.0
	Siberia + Latitude	229	4.3	15	437.3	9.48	54.4	43.1
	Siberia standard	267	3.0	0	430.7	9.64	53.4	42.1
250 seeds	Colossus + Latitude	250	2.3	71.7	389.3	9.31	53.4	37.9
	Colossus standard	195	4.3	36.7	384.7	9.21	53.3	40.4
	Siberia + Latitude	182	2.7	1.7	408.7	9.16	55.1	44.0
	Siberia standard	195	1.3	6.7	423.3	9.82	54.2	43.0
LSD (P=.05)		31.3	2.71	25.88	45.78	0.916	1.46	1.64
CV						5.56		
Prob. (F)		0.0001	NS	0.0001	NS	NS	NS	0.0001

Two distinct populations were established from the two seed rates, Colossus tended to have a higher population than Siberia, particularly at the higher seed rate. Latitude seed dressing tended to reduce plant population. Take-all was present at a low level but there were no effects from the seed dressing. Brackling was worst with Colossus. Siberia had higher ear numbers than Colossus. Overall, Siberia out yielded Colossus, particularly at the higher seed rate. The response to Latitude was negative (- 0.05 t/ha).

Table 42. *The effect of seed rate and seed treatment on the population, brackling, ear count and yield of Colossus and Siberia winter barley grown as a second cereal, Cirencester, 2005*

		Plant count/m² on 12 December	Brackling % at harvest	Ear count / m² 9 July	Yield t/ha at 85% dm 28 July
350 seeds	Colossus + Latitude	158.0	100	654	9.28
	Colossus standard	163.0	100	630	9.24
	Siberia + Latitude	156.0	89	699	9.34
	Siberia standard	167.0	75	703	9.17
250 seeds	Colossus + Latitude	173.0	100	633	9.30
	Colossus standard	146.0	100	628	9.07
	Siberia + Latitude	130.0	65	603	9.25
	Siberia standard	156.0	85	682	9.41
LSD (P=.05)		20.99	24.333	120.849	0.833
CV					5.14
Prob. (F)		0.0008	0.0467	NS	NS

The trial was drilled on 24 September. Establishment was poor but the crop compensated to produce yields over 9 t/ha despite bad brackling. Yield differences were not significantly different (P=0.05).

Table 43. *The effect of seed rate and seed treatment on the population, brackling, ear count and yield of Colossus and Siberia winter barley grown as a second cereal, Andover, 2005*

		Plant count/m² on 21 October	Ear count / m² 9 July	Take-all index 18 July	Yield t/ha at 85% dm 28 July	Specific weight kg/hl	TGW g
350 seeds	Colossus + Latitude	216	445	10.7	9.89	57.6	40.0
	Colossus standard	210	421	8.6	9.87	57.2	40.0
	Siberia + Latitude	231	482	7.0	9.96	57.5	44.4
	Siberia standard	260	443	19.0	9.95	56.3	39.6
250 seeds	Colossus + Latitude	153	397	8.7	9.82	58.1	40.5
	Colossus standard	151	403	9.7	9.79	56.9	40.5
	Siberia + Latitude	171	467	10.3	10.22	57.0	43.5
	Siberia standard	181	493	23.7	10.16	56.6	40.6
LSD (P=.05)		35.1	64.6	8.15	0.455	0.90	1.82
CV					2.59		
Prob. (F)		0.0001	0.0533	0.0069	NS	0.0176	0.0001

The trial was drilled on 27 September. Siberia tended to establish better than Colossus at either seed rate although this was not significant (P=0.05). Ear numbers were similar whatever the seed rate so the lower plant population tillered more. Latitude reduced the take-all index of Siberia but levels were low in Colossus and no effect was observed. Yields were similar at either seed rate and despite the higher take-all index Siberia yielded higher than Colossus. However the effects of take-all were obvious in the specific and thousand seed weights for Siberia

Experiment 3 – First cereal

Table 44. *The effect of nitrogen dose and timing on ear number, leaning, lodging, yield, specific weight and TGW of Colossus hybrid winter barley grown as a first cereal at Bainton, 2005.*

Treatment	Ears/m² on 1 June	Leaning % at harvest	Lodging % at harvest	Yield t/ha at 85% dm on 20 July	Specific weight at 85% dm	TGW g
150 split 60/40/0	471.3	13.3	61.7	9.62	58.8	55.8
150 split 30/70/0	475.3	8.3	78.3	9.90	58.2	56.5
150 split 30/40/30	432.0	8.3	31.7	10.61	58.4	56.4
180 split 60/40/0	454.0	16.7	80.0	9.80	58.0	56.3
180 split 30/70/0	459.3	23.3	83.3	9.50	57.8	56.6
180 split 30/40/30	453.3	25.0	73.3	10.24	58.7	56.0
210 split 60/40/0	431.3	30.0	85.0	9.84	57.6	56.4
210 split 30/70/0	426.7	30.0	78.3	10.19	57.0	56.8
210 split 30/40/30	428.0	28.3	63.3	10.48	57.4	56.7
LSD (P=.05)	43.79	23.25	32.42	0.944	1.06	2.21
CV				5.44		
Prob. (F)	NS	NS	NS	NS	0.0349	NS

The total nitrogen dose was applied in up to three splits on 14 March, 31 March and 14 May as ammonium nitrate. There was a yield response to the late application of nitrogen and in this case the lowest dose appeared sufficient despite the standard timing giving generally higher ear numbers and better tgws.

Table 45 *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Coldstream, 2005.*

Treatment	Ears/m² on 28June	Brackling % at harvest	Yield t/ha at 85% dm on 21 July	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	348.0	3.3	9.90	60.7	41.3
150 split 30/70/0	356.0	15.0	9.73	60.8	41.5
150 split 30/40/30	346.0	6.7	10.11	60.8	41.6
180 split 60/40/0	366.0	21.7	10.31	61.2	42.3
180 split 30/70/0	363.3	15.0	10.04	60.3	41.5
180 split 30/40/30	352.7	13.3	10.24	60.7	41.0
210 split 60/40/0	358.7	10.0	10.24	61.0	42.1
210 split 30/70/0	358.0	20.0	10.49	60.4	41.2
210 split 30/40/30	356.0	21.7	10.51	60.7	42.0
LSD (P=.05)	41.02	21.63	0.333	1.16	1.94
CV			1.89		
Prob. (F)	NS	0.6	0.0019	NS	NS

The total nitrogen dose was applied in up to three splits on 6 March (GS 25-26), 31 March (GS 29) and 15 May (GS 39-49) as ammonium nitrate. There was a yield response to delayed nitrogen but this did not quite reach significance (P=0.05) in most instances.

Table 46. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Cirencester, 2005.*

Treatment	Ear count /m² on 26 June	Brackling % at harvest	Yield t/ha at 85% dm on 4 August	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	504.7	99.0	9.96	60.7	37.2
150 split 30/70/0	526.0	98.6	10.13	62.5	37.2
150 split 30/40/30	499.3	99.7	9.98	62.2	37.5
180 split 60/40/0	550.0	99.0	9.82	61.5	36.2
180 split 30/70/0	517.3	99.0	10.04	62.3	38.5
180 split 30/40/30	546.7	99.0	9.97	61.7	37.2
210 split 60/40/0	567.3	98.7	9.72	60.2	36.2
210 split 30/70/0	482.0	97.7	9.93	61.6	37.3
210 split 30/40/30	526.7	99.0	9.67	60.7	37.2
LSD (P=.05)	80.99	1.58	0.784	2.39	1.76
CV			4.57		
Prob. (F)	NS	NS	NS	NS	NS

Nitrogen was applied on 28 February, 16 April and 2 May. There were no significant yield differences.

Table 47. *The effect of nitrogen dose and timing on ear number, brackling, yield, grain specific weight and thousand grain weight of Colossus hybrid winter barley grown as a first cereal at Andover, 2005.*

Treatment	Ear count /m² on 18 July	Brackling % at harvest	Yield t/ha at 85% dm on 22 July	Specific weight kg/hl at 85% dm	TGW g
150 split 60/40/0	373	86.7	8.13	53.7	42.8
150 split 30/70/0	393	80.0	7.17	61.6	42.3
150 split 30/40/30	345	75.0	7.49	62.6	42.9
180 split 60/40/0	391	63.3	7.59	61.0	40.4
180 split 30/70/0	412	88.3	8.23	62.3	43.3
180 split 30/40/30	397	70.0	7.34	62.5	42.4
210 split 60/40/0	440	86.7	8.36	63.4	42.5
210 split 30/70/0	394	78.3	8.40	60.7	42.4
210 split 30/40/30	402	71.7	8.23	63.3	43.4
LSD (P=.05)	50.03	21.03	0.866	9.90	3.66
CV			6.11		
Prob. (F)	0.0604	NS	0.0502	NS	NS

The trial was drilled on 28 September; nitrogen was applied according to treatment on 8 March, 19 April and 6 May. Delaying 30% of the N until 6 May reduced ear numbers at the lowest N dose of 150 kg/ha. At the highest dose of N a greater proportion applied early tended to increase the ear number. Treatment receiving 30% of the N late tended to brackle less. There was some variation in yield: at the lower N dose there appeared to be a benefit from a greater proportion of early N (although the specific weight was low indicating poor grain fill), however this was not so at the two higher doses where there was no clear pattern.

Experiment 4 – Second cereal

Table 48. *Effect of nitrogen dose and timing of application on brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Bainton, 2005*

N dose, timing and seed dressing	Ear number /m² on 14 June	Take-all index on 7 July	Lodging % at harvest	Yield t/ha at 85% dm 19 July 2003	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing						
180 60/40/0	508.7	6.0	46.7	9.56	59.8	42.3
180 30/70/0	475.3	9.7	50.0	10.96	59.5	39.3
180 30/40/30	456.0	8.7	46.7	10.86	61.5	40.9
210 60/40/0	482.0	7.7	78.3	9.55	58.8	39.5
210 30/70/0	471.3	7.0	73.3	9.58	58.6	39.1
210 30/40/30	476.0	5.3	68.3	9.27	60.3	40.2
240 60/40/0	482.0	7.3	78.3	9.83	59.7	38.9
240 30/70/0	482.7	10.3	83.3	10.14	59.1	42.1
240 30/40/30	480.0	9.3	63.3	9.91	58.7	37.9
Standard plus Latitude						
180 60/40/0	506.0	6.3	73.3	9.45	59.3	38.7
180 30/70/0	495.3	11.0	78.3	10.54	60.0	39.2
180 30/40/30	476.0	5.7	68.3	10.53	60.5	39.5
210 60/40/0	486.7	5.7	83.3	9.56	59.1	38.4
210 30/70/0	484.7	7.0	81.7	9.70	57.2	38.7
210 30/40/30	478.0	5.3	55.0	9.92	60.8	40.7
240 60/40/0	490.7	7.7	68.3	10.33	59.5	40.1
240 30/70/0	516.7	6.7	85.0	10.20	59.4	39.1
240 30/40/30	458.7	6.0	61.7	9.78	60.1	38.5
LSD (P=.05)	52.55	5.13	29.798	1.684	1.38	3.62
CV				10.11		
Prob. (F)	0.7379	0.4976	0.1427	0.7552	0.0003	0.5224

Overall there was a response of 0.04 t/ha to the use of Latitude seed dressing. Take all levels were low and there were no differences observed between treatments.

Table 49. *Effect of nitrogen dose and timing of application on ear number, take-all, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Coldstream, 2005*

	Ear number /m² on 28 June	Take-all score 1-100 on 14 July	Brackling % at harvest	Yield t/ha at 85% dm 24 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing						
180 60/40/0	422.0	3.7	20	8.91	57.2	38.4
180 30/70/0	390.7	3.7	53	8.81	56.5	40.4
180 30/40/30	386.0	3.0	62	9.04	57.1	41.6
210 60/40/0	382.0	4.3	28	9.40	57.9	38.8
210 30/70/0	371.3	4.0	52	9.05	56.4	40.6
210 30/40/30	374.7	5.0	43	9.23	56.8	41.2
240 60/40/0	414.7	3.0	37	9.68	57.2	40.3
240 30/70/0	378.7	3.3	63	9.19	56.4	39.7
240 30/40/30	372.0	3.7	60	9.43	56.7	39.7
Standard plus Latitude						
180 60/40/0	397.3	1.0	47	9.10	56.7	39.5
180 30/70/0	368.0	2.7	50	9.06	57.2	41.0
180 30/40/30	374.0	3.3	43	9.08	57.2	41.6
210 60/40/0	391.3	3.3	38	9.45	56.8	40.0
210 30/70/0	379.3	4.3	50	9.05	56.2	38.9
210 30/40/30	390.0	3.3	58	9.38	56.5	38.6
240 60/40/0	388.7	2.7	52	9.70	56.3	39.4
240 30/70/0	385.3	5.0	72	9.27	56.2	38.8
240 30/40/30	386.0	2.0	65	9.39	56.0	39.3
LSD (P=.05)	6.1	2.88	32.7	0.386	1.33	1.79
CV				2.51		
Prob.(F)	0.7733	0.502	0.213	0.0011	0.3351	0.0061

The overall response to Latitude was 0.07 t/ha. There was a yield response to increasing nitrogen dose, particularly with the early timing and with standard seed dressing.

Table 49. *Effect of nitrogen dose and timing of application on ear number, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Cirencester, 2005*

	Ear number /m² on 6 July	Brackling % at harvest	Yield t/ha at 85% dm 19 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing					
180 60/40/0	614.7	94	9.41	61.2	36.8
180 30/70/0	594.7	98	9.18	62.0	38.0
180 30/40/30	648.7	98	8.86	61.3	36.3
210 60/40/0	661.3	98	9.11	59.6	36.5
210 30/70/0	614.7	88	9.09	59.7	35.3
210 30/40/30	575.3	95	9.07	59.7	36.3
240 60/40/0	591.3	100	9.05	61.8	37.3
240 30/70/0	625.3	96	9.28	62.2	37.2
240 30/40/30	641.3	93	9.50	59.7	35.8
Standard plus Latitude					
180 60/40/0	596.0	93	9.12	61.7	37.5
180 30/70/0	603.3	92	9.26	60.3	37.7
180 30/40/30	556.7	82	9.20	58.2	37.3
210 60/40/0	584.7	97	9.14	58.3	36.5
210 30/70/0	644.7	98	9.16	61.1	36.7
210 30/40/30	587.3	95	9.71	61.6	36.2
240 60/40/0	624.0	91	9.56	61.1	37.7
240 30/70/0	612.0	85	9.41	60.2	36.7
240 30/40/30	614.0	77	9.48	61.0	37.5
LSD (P=0.05)	70.12	14.9	0.446	3.06	2.1
CV			2.89		
Prob (F)	0.2625	0.1722	0.0496	0.2649	0.5107

The trial was drilled on 24 September; nitrogen was applied on 28 February, 16, April and 2 May. The response to Latitude was 0.17 t/ha. There was severe brackling at this site. Yield was reduced when no Latitude was used and the lowest level of N was applied at the late timing. At higher N levels there was adequate N supplied and yield was not penalised. The differences appeared to less marked where Latitude had been used.

Table 50. *Effect of nitrogen dose and timing of application on ear number, brackling, yield, specific weight and TGW of Colossus hybrid winter barley with or without Latitude seed treatment grown in a second cereal situation, Andover, 2005*

	Ear number /m2 on 6 July	Brackling % at harvest	Take-all index	Yield t/ha at 85% dm 19 July	Specific weight kg/hl at 85% dm	TGW g
Standard seed dressing						
180 60/40/0	450	53.3	5.7	7.90	57.1	36.6
180 30/70/0	419	53.3	13.8	7.93	57.2	38.8
180 30/40/30	404	61.7	10.7	8.20	57.3	38.4
210 60/40/0	423	58.3	8.7	8.31	56.3	37.6
210 30/70/0	405	61.7	5.3	8.09	56.9	38.9
210 30/40/30	428	48.3	9.0	8.23	57.2	38.0
240 60/40/0	393	58.3	6.3	8.20	56.9	37.7
240 30/70/0	415	46.7	5.0	8.22	56.8	38.6
240 30/40/30	438	65.0	7.0	7.90	56.9	37.9
Standard plus Latitude						
180 60/40/0	397	61.7	7.7	8.62	58.4	38.7
180 30/70/0	399	71.7	14.7	8.76	58.5	40.1
180 30/40/30	375	63.3	9.3	8.56	59.0	39.5
210 60/40/0	415	58.3	8.3	8.49	57.8	37.8
210 30/70/0	435	66.7	5.0	8.78	57.7	38.8
210 30/40/30	415	51.7	6.0	8.94	58.5	39.8
240 60/40/0	420	65.0	12.7	8.53	57.5	37.8
240 30/70/0	429	73.3	5.3	8.82	57.4	40.1
240 30/40/30	388	46.7	8.6	8.72	58.0	39.3
LSD (P=0.05)	71.6	22.51	6.43	0.804	1.07	2.09
CV						
Prob (F)	NS	NS	0.0655	NS	0.0005	0.0742

The trial was drilled on 27 September and the nitrogen was applied according to treatment on 8 March, 19 April and 6 May. Latitude seed treatment produced small improvements in specific weight and thousand seed weight. It tended to reduce ear numbers and increase brackling. Take-all tended to be worse where Latitude was not used and where N dose was at the lowest level. Yield was 0.58 t/ha higher overall where Latitude had been used.

At the lowest level of N (in the absences of Latitude) ear numbers were greater where a greater proportion of N was applied early.

Discussion

Experiment 1 – seed rate for hybrid barley sown as a first cereal.

Only two of the 12 experiments recorded statistically significant differences in yield (Table 51). Eight experiments showed no yield response to more than the lowest seed rate of 250 seeds/m². In one experiment there was a yield response to increasing the population to 350 seeds (Bainton, 2003) and in one (Cirencester, 2003) there was a response to increasing the seed rate to 250 seeds but no further. A seed rate of 250 seeds/m² was adequate in most situations and so the hypothesis was proved in this situation. Ear number generally increased in line with plant population and where brackling and lodging occurred, these parameters tended to increase in severity as seed number increased but not always. Lower seed numbers proved adequate with this variety and importantly, specific weight and thousand grain weight (TGW) tended to decline as population density increased.

Table 51. *Summary of three years experiments at four sites on the seed rate of Colossus winter barley. Yield (t/ha at 85% dm).*

2003	Bainton	Coldstream	Cirencester	Andover	Mean
250 seeds/m²	9.94	10.23	8.88	9.82	9.72
300 seeds/m²	9.96	10.01	9.69	9.87	9.88
350 seeds/m²	10.29	10.01	9.96	9.9	10.04
2004					
250 seeds/m²	10.03	9.70	5.36	7.03	8.03
300 seeds/m²	10.26	8.56	5.35	n/a	8.06
350 seeds/m²	10.00	9.69	5.66	7.36	8.18
2005					
250 seeds/m²	9.22	10.03	9.15	8.95	9.34
300 seeds/m²	8.90	9.91	9.67	n/a	9.49
350 seeds/m²	9.08	9.99	9.35	8.61	9.26

n/a = not tested

Experiment 2 – seed rate and seed dressing in a second cereal situation compared with a conventional variety.

Siberia was chosen as the conventional six-row variety in this test. Two seed rates were compared each with and without take-all seed dressing (Latitude) in addition to the standard (Raxil S) seed dressing. Twelve experiments were done over the three year period of the project. In the direct comparison of varieties the hybrid Colossus out yielded the conventional Siberia by 0.19 t/ha in 2003; by 0.37 t/ha in 2004; and by 0.13 t/ha in 2005. Overall there was only a +0.23 t/ha yield advantage from growing Colossus over Siberia in a second cereal situation. The response to a take-all seed dressing from Colossus vs. Siberia was 0.16 vs. 0.03. Colossus tended to respond more to a take-all seed dressing but the overall response to treatment across the twelve sites was only 0.06 t/ha; the response was very variable, the mean smoothing values of +1.36/ha to -0.43t/ha. This is typical of the disease. Although 250 seeds/m² was an acceptable seed rate for both Siberia

and Colossus in most instances there was a 0.16 t/ha advantage to the higher seed rate but there were no grounds to suggest that Siberia required the higher seed rate to maintain its yield.

Table 52. *Twelve site summary of yield effects.*

2003		Andover		Bainton		Coldstream		Cirencester	
SD	Seed rate	Colossus	Siberia	Colossus	Siberia	Colossus	Siberia	Colossus	Siberia
Standard	250	6.91	7.02	9.23	8.64	9.20	8.41	9.24	9.00
Standard	350	6.98	6.75	9.41	8.29	9.49	9.24	9.64	9.16
Latitude	250	7.18	7.41	9.10	8.45	9.39	9.27	8.95	9.17
Latitude	350	7.34	7.29	9.51	8.70	10.14	7.79	9.07	10.02
Mean Standard		6.95	6.89	9.32	8.47	9.35	8.83	9.44	9.08
Mean Latitude		7.26	7.35	9.31	8.58	9.77	8.53	9.01	9.60
Mean Variety		7.10	7.12	9.31	8.52	9.56	8.68	9.23	9.34
Response to Latitude		0.32	0.47	-0.02	0.11	0.42	-0.30	-0.43	0.51
Response to hybrid		-0.01		0.79		0.88		-0.11	
2004		Andover		Bainton		Coldstream		Cirencester	
SD		Colossus	Siberia	Colossus	Siberia	Colossus	Siberia	Colossus	Siberia
Standard	250	9.36	8.97	9.04	8.78	9.13	8.25	8.07	6.88
Standard	350	9.42	9.34	9.07	9.09	9.26	8.40	7.99	7.70
Latitude	250	10.90	8.75	9.64	8.52	8.79	8.70	8.24	7.46
Latitude	350	10.60	9.54	9.80	8.90	9.33	8.65	8.52	7.48
Mean Standard		9.39	9.16	9.06	8.94	9.20	8.33	8.03	7.29
Mean Latitude		10.75	9.15	9.72	8.71	9.06	8.68	8.38	7.47
Mean Variety		10.07	9.15	9.39	8.82	9.13	8.50	8.21	7.38
Response to Latitude		1.36	-0.01	0.67	-0.22	-0.14	0.35	0.35	0.18
Response to hybrid		0.92		0.57		0.63		0.83	
2005		Andover		Bainton		Coldstream		Cirencester	
SD		Colossus	Siberia	Colossus	Siberia	Colossus	Siberia	Colossus	Siberia
Standard	250	9.30	9.70	10.83	8.57	9.21	9.82	9.07	9.41
Standard	350	9.40	9.50	10.09	8.76	9.05	9.64	9.24	9.17
Latitude	250	9.40	9.70	10.35	7.85	9.31	9.16	9.30	9.25
Latitude	350	9.40	9.50	9.78	9.52	9.57	9.48	9.28	9.34
Mean Standard		9.35	9.60	10.46	8.67	9.13	9.73	9.16	9.29
Mean Latitude		9.40	9.60	10.07	8.69	9.44	9.32	9.29	9.30
Mean Variety		9.38	9.60	10.26	8.68	9.29	9.53	9.22	9.29
Response to Latitude		0.05	0.00	-0.40	0.02	0.31	-0.41	0.13	0.01
Response to hybrid		-0.23		1.59		-0.24		-0.07	

Experiment 3 – nitrogen dose and timing in a first cereal situation

Colossus was sown at 250 seeds/m² for these experiments and nitrogen applied at the start of spring growth (GS 29) in early March, early April (GS 30) and early May (GS 39-49). Three doses of nitrogen were compared; 180 kg/ha being the usual dose for feed barley, 150 kg/ha to examine whether the hybrid barley would perform at similar levels with less nitrogen i.e. more efficiently scavenge the nutrient and 210 kg/ha to

see if the hybrid responded to higher levels on N. The nitrogen was applied in three splits; the standard 30/70/0 split commonly used for conventional feed barley, a 60/40/0 split to examine the benefit of a higher early dose to see if the hybrid vigour can be exploited early in the season; and a three-way split 30/40/30 to see if there is a response to later applied nitrogen.

A summary of the three years yield data is presented in Table 53. Overall the experiment suggested a small increase in yield of 0.3 t/ha as nitrogen increased from 150 kg/ha to 180 kg/ha N but only an additional 0.1 t/ha from 180 kg/ha to 210 kg/ha. Yield responses to the highest dose tended to occur most consistently at the two northern sites although in 2003 they were observed at Andover and Cirencester. There was a very small benefit (0.04 t/ha) from applying more N at the early timing (60% cf the standard 30%) but generally a yield penalty from delaying 30% until later in the season. The exceptions occurred in 2005 when May rainfall enabled the nitrogen to be utilised.

Table 53. *Three year summary of Experiment 3.*

2003	Bainton				Coldstream				Andover				Cirencester				4 site mean
N dose	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	
N timing																	
Standard	9.47	10.62	10.56	10.22	8.90	9.66	10.11	9.56	6.67	7.02	7.28	6.99	7.89	7.96	8.61	8.15	8.73
Early	9.54	10.27	9.92	9.91	8.86	10.03	10.13	9.67	6.98	7.62	7.60	7.40	8.07	7.64	7.41	7.71	8.67
Late	9.75	9.97	10.25	9.99	8.34	8.86	10.43	9.21	6.63	7.12	7.19	6.98	7.24	7.40	7.57	7.40	8.40
Mean	9.59	10.29	10.24		8.70	9.52	10.22		6.76	7.25	7.36		7.73	7.67	7.86		

2004	Bainton				Coldstream				Andover				Cirencester				
N dose	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	
N timing																	
Standard	9.33	10.05	9.92	9.77	9.74	10.56	10.42	10.24	7.18	7.59	7.63	7.47	5.61	5.84	6.01	5.82	8.32
Early	9.66	10.24	9.85	9.92	10.00	10.24	10.02	10.09	7.18	7.21	7.73	7.37	5.73	6.19	5.72	5.88	8.31
Late	9.35	10.41	9.86	9.87	9.51	10.06	10.20	9.92	7.10	7.31	7.72	7.38	5.79	5.62	5.68	5.70	8.22
Mean	9.45	10.23	9.88		9.75	10.29	10.21		7.15	7.37	7.69		5.71	5.88	5.80		

2005	Bainton				Coldstream				Andover				Cirencester				
N dose	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	150	180	210	Mean	
N timing																	
Standard	9.62	9.80	9.84	9.75	9.90	10.31	10.24	10.15	7.08	8.23	7.62	7.64	9.96	9.82	9.72	9.83	9.35
Early	9.90	9.50	10.19	9.86	9.73	10.04	10.49	10.09	7.70	7.59	8.36	7.88	10.13	10.04	9.93	10.03	9.47
Late	10.61	10.24	10.48	10.44	10.11	10.24	10.51	10.29	7.08	6.76	8.23	7.36	9.98	9.97	9.67	9.87	9.49
Mean	10.04	9.85	10.17		9.91	10.20	10.41		7.29	7.53	8.07		10.02	9.94	9.77		
3 yr mean	9.69	10.12	10.10		9.45	10.00	10.28		7.07	7.38	7.71		7.82	7.83	7.81		

Experiment 4 - nitrogen dose and timing in a second cereal situation

The trial design was similar to Experiment 3 but in a second cereal situation the nitrogen doses and splits were compared with and without Latitude seed dressing to control/reduce the effect from take-all. Nitrogen doses were increased to 180, 210 and 240 kg/ha N.

Overall yield increased by 0.1 and 0.3 t/ha when nitrogen does was increased from 180 to 210 to 240 kg/ha. The response was more defined when Latitude was used. In this second cereal situation applying more N early tended to improve yields but only a small difference of c. 0.1 t/ha between timings was observed. The response to Latitude seed dressing averaged 0.16 t/ha and tended to be greater at the 210 kg/ha dose of N.

Table 54. *Summary of twelve experiments. Yield (t/ha at 85%dm).*

Seed dressing	Nitrogen timing	Nitrogen dose (kg/ha N)			Mean
		180	210	240	
Standard	Early (60/40/0)	8.30	8.56	8.76	8.54
	Standard (30/70/0)	8.41	8.51	8.66	8.52
	Late (30/40/30)	8.49	8.28	8.63	8.47
	Mean	8.40	8.45	8.68	
Latitude	Early (60/40/0)	8.54	8.68	8.94	8.72
	Standard (30/70/0)	8.60	8.63	8.82	8.68
	Late (30/40/30)	8.44	8.65	8.73	8.61
	Mean	8.53	8.65	8.83	
	Overall mean of N dose	8.46	8.55	8.76	
Response to Latitude		0.12	0.21	0.15	0.16

Table 55. *Four site summary of yield.*

	2003	Andover				Bainton				Coldstream				Cirencester			
Seed dressing	N dose	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean
	N timing																
	Early (60/40/0)	5.61	5.96	7.05	6.21	7.65	8.23	8.43	8.10	8.48	8.14	8.61	8.41	8.26	8.92	8.50	8.56
Standard	Standard (30/70/0)	6.07	6.67	6.43	6.39	8.48	8.00	7.94	8.14	7.74	7.60	8.41	7.92	8.01	8.30	7.83	8.05
	Late (30/40/30)	5.86	5.75	6.46	6.02	8.24	7.82	8.48	8.18	7.45	7.41	8.20	7.69	9.08	7.96	7.97	8.34
	Mean	5.85	6.13	6.65		8.12	8.02	8.28		7.89	7.72	8.41		8.45	8.39	8.10	
	Early (60/40/0)	6.05	6.06	6.52	6.21	8.43	8.98	8.85	8.75	8.67	8.35	8.79	8.60	8.76	7.99	8.87	8.54
Latitude	Standard (30/70/0)	6.60	6.75	6.61	6.65	8.28	8.24	8.61	8.38	7.91	8.28	8.51	8.23	8.37	8.41	8.61	8.46
	Late (30/40/30)	6.28	6.68	6.31	6.42	7.77	7.65	8.12	7.85	7.75	7.97	8.77	8.16	7.99	8.57	8.19	8.25
	Mean	6.31	6.50	6.48		8.16	8.29	8.53		8.11	8.20	8.69		8.37	8.32	8.56	

Table 55 continued

	2004	Andover				Bainton				Coldstream				Cirencester			
Seed dressing	N dose	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean
	N timing																
	Early (60/40/0)	8.76	8.45	8.89	8.70	8.61	9.12	8.99	8.91	9.24	9.18	9.44	9.29	7.25	8.32	8.49	8.02
Standard	Standard (30/70/0)	8.09	9.28	9.12	8.83	8.88	9.14	9.27	9.10	9.29	9.07	9.51	9.29	7.51	8.19	8.54	8.08
	Late (30/40/30)	8.84	9.04	8.92	8.93	8.83	8.33	9.36	8.84	9.27	8.85	9.28	9.13	7.36	8.39	8.18	7.98
	Mean	8.56	8.92	8.98		8.77	8.86	9.21		9.27	9.03	9.41		7.37	8.30	8.40	
	Early (60/40/0)	8.67	8.63	8.80	8.70	8.88	9.14	9.58	9.20	9.15	9.69	9.6	9.48	7.61	8.72	8.17	8.17
Latitude	Standard (30/70/0)	8.32	8.99	9.00	8.77	9.02	8.58	8.99	8.86	9.24	9.55	9.42	9.40	7.83	8.05	8.43	8.10
	Late (30/40/30)	8.28	8.92	8.52	8.57	8.47	8.87	9.16	8.83	9.33	9.18	9.51	9.34	8.02	8.01	8.80	8.28
	Mean	8.42	8.85	8.77		8.79	8.86	9.24		9.24	9.47	9.51		7.82	8.26	8.47	

Table 55 continued

	2005	Andover				Bainton				Coldstream				Cirencester			
Seed dressing	N dose	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean	180	210	240	Mean
	N timing																
	Early (60/40/0)	7.90	8.31	8.20		9.56	9.55	9.83	9.65	8.91	9.40	9.68	9.33	9.41	9.11	9.05	9.19
Standard	Standard (30/70/0)	7.93	8.09	8.22		10.96	9.58	10.14	10.23	8.81	9.05	9.19	9.02	9.18	9.09	9.28	9.18
	Late (30/40/30)	8.20	8.23	7.90		10.86	9.27	9.91	10.01	9.04	9.23	9.43	9.23	8.86	9.07	9.50	9.14
	Mean	8.01	8.21	8.11		10.46	9.47	9.96		8.92	9.23	9.43		9.15	9.09	9.28	
	Early (60/40/0)	8.62	8.49	8.53		9.45	9.56	10.33	9.78	9.1	9.45	9.7	9.42	9.12	9.14	9.56	9.27
Latitude	Standard (30/70/0)	8.76	8.78	8.82		10.54	9.70	10.2	10.15	9.06	9.05	9.27	9.13	9.26	9.16	9.41	9.28
	Late (30/40/30)	8.56	8.94	8.72		10.53	9.92	9.78	10.08	9.08	9.38	9.39	9.28	9.2	9.71	9.48	9.46
	Mean	8.65	8.737	8.69		10.17	9.73	10.10		9.08	9.29	9.45		9.19	9.34	9.48	
N dose 3 year mean		7.63	7.89	7.95		9.08	8.87	9.22		8.75	8.82	9.15		8.39	8.62	8.71	

Conclusion

Four experiments were done at four sites over a three year period to examine the agronomy of hybrid winter barley and to assess whether there was a need to provide different husbandry guidelines for this crop. There was no evidence to suggest that hybrid barley should be treated any differently to conventionally bred barley. Hybrid barley's yield potential was compared with that of conventional barley and although overall there was an improvement in yield it was not large. In a second cereal situation the benefit of Latitude seed treatment to reduce the effects of take-all on barley was small and would not be cost effective. Altering the standard timing of nitrogen did not generally improve yield although there were situations when additional early N was beneficial in a second cereal site and in wet summers when delaying a proportion of N was beneficial. On balance the standard timing was the most reliable means of obtaining the highest yield. Hybrid barley therefore appeared similar to conventional barley in its husbandry requirements. The case for growing barley as opposed to wheat in a second cereal position was not tested in this series of experiments. However, using typical yields and gross margins from wheat and barley, the advantage still rests firmly with wheat based on current price differentials.

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Appendix - Site details and application dates of inputs

(NB seed rate and nitrogen inputs as per treatments where relevant otherwise as listed below)

2003

Andover - first cereal

Trial Name	HGCA Hybrid barley		
Crop:	Winter barley		
Location:	Basingstoke, Lower Norton Farm, Sutton Scotney, Andover		
Trial Code:	HA03-151 &152		
Soil Type:	Andover series		
Soil Analysis (ppm):	P- 58, K-265, Mg-85, Mn-317, S-4, pH-7.9,		
Previous Crop:	Set aside		
Drill Date:	04/10/02		
Harvest Date:	19/07/03		
Seed Rate:	350 seeds/m^2		
	Product:	Rate:	Date:
Fertiliser:	Double Top	50 kg/ha N	07/03/03
		22 kg/ha S	
	N34.5	125 kg/ha N	14/04/03
	0:21:32	250 kg/ha	26/02/03
Fungicides:	Acanto	0.25 l/ha	07/04/03
	Opus	0.25 l/ha	07/04/03
	Corbel	0.25 l/ha	07/04/03
	Amistar	0.25 l/ha	08/05/03
	Opus	0.25 l/ha	08/05/03
	Corbel	0.125 l/ha	08/05/03
Growth Regulators:	5C Cycocel	1.25 l/ha	03/04/03
	Terpal	1.0 l/ha	01/05/03
	Agral	80 ml/ha	01/05/03
Herbicides:	Javelin Gold	2.5 l/ha	19/11/02
	IPU	0.5 l/ha	19/11/02
	Ally	20 g/ha	21/03/03
	CMPP	1.5 l/ha	21/03/03
Insecticides:	Hallmark Zeon	50 ml/ha	06/12/02

Andover - second cereal

Trial Name:	HGCA hybrid barley		
Crop:	Winter barley		
Location:	Longmans, Lower Norton Farm, Sutton Scotney, Andover		
Trial Code:	HA03-117 & 118		
Soil Type:	Andover series		
Soil Analysis (ppm):	P- 28, K-213, Mg-65, Mn-416, S-4, pH-8.1,		
Previous Crop:	Spring Barley		
Drill Date:	27/09/02		
Harvest Date:	19/07/03		
Seed Rate:	350 seed/m²		
	Product:	Rate:	Date:
Fertiliser:	Double Top	50 kg/ha N 22 kg/ha S	07/03/03
	N34.5	125 kg/ha N 14/04/03	
	0:21:32	250 kg/ha	26/02/03
Fungicides:	Acanto	0.25 l/ha	07/04/03
	Opus	0.25 l/ha	07/04/03
	Corbel	0.25 l/ha	07/04/03
	Amistar	0.25 l/ha	08/05/03
	Opus	0.25 l/ha	08/05/03
	Corbel	0.125 l/ha	08/05/03
Growth Regulators:	5C Cycocel	1.25 l/ha	03/04/03
	Terpal	1.0 l/ha	01/05/03
	Agral	80 ml/ha	01/05/03
Herbicides:	Javelin Gold	2.5 l/ha	19/11/02
	IPU	0.5 l/ha	19/11/02
	Ally	20 g/ha	21/03/03
	CMPP	1.5 l/ha	21/03/03
Insecticides:	Hallmark Zeon	50 ml/ha	06/12/02

Bainton – first cereal

Site Address:	Field House Farm, Bainton, Driffield, Yorkshire		
Altitude:	50m		
Soil Type:	Panholes		
Previous Crop:	Spring Peas		
Soil Analysis:	(ppm) P- 13, K- 100, Mg- 354, Mn- 258, pH- 7.4, S- 2, OM- 3.2%, B- 1.5, Cu- 5.8		
Sowing Date:	26/09/02		
Harvest Date:	15/07/03		
Fertiliser:	0-20-30	363kg/ha	30/08/02
	34.5% N	50 kg/ha N	10/03/03
	34.5% N	63 kg/ha N	04/04/03
	34.5% N	89 kg/ha N	13/05/03
Fungicides:	Acanto	0.5 l/ha	23/04/03
	Opus	0.3 l/ha	23/04/03
	Corbel	0.25 l/ha	23/04/03
	Twist	0.25 l/ha	15/05/03
	Opus	0.25 l/ha	15/05/03
Growth Regulator:	3C Cycocel	1.25 l/ha	04/04/03
	Moddus	0.1 l/ha	04/04/03
	5C Cycocel	1.0 l/ha	17/04/03
	Moddus	0.1 l/ha	17/04/03
	(Terpal not applied due to growth stage of barley)		
Herbicides:	Panther	1.0 l/ha	31/10/02
	IPU	1.5 l/ha	31/10/02
	Duplosan	0.5 l/ha	31/10/02
	Ally	20 gm/ha	31/03/03
Insecticides:	Hallmark Zeon	0.07 l/ha	05/10/02
	Cypermethrin	0.25 l/ha	31/10/02
	Dursban	1.5 l/ha	15/02/03

Bainton - second cereal

Site Address:		Field House Farm, Bainton, Driffield, Yorkshire		
Altitude:		50m		
Soil Type:		Panholes		
Previous Crop:	Winter Barley			
Soil Analysis:	(ppm)	P- 21, K- 180, Mg- 73, Mn- 557, pH- 8.0, S- 5, OM- 4.2%, B- 2.31, Cu- 4.6		
Sowing Date:		18/09/02		
Harvest Date:		15/07/03		
Fertiliser:		0-20-30	363kg/ha N	30/08/02
		46% N Urea	67 kg/ha N	27/02/03
		34.5% N	126 kg/ha N	04/04/03
Fungicides:		Acanto	0.5 l/ha	09/04/03
		Unix	0.3 kg/ha	09/04/03
		Corbel	0.25 l/ha	09/04/03
		Amistar	0.25 l/ha	15/05/03
		Opus	0.25 l/ha	15/05/03
Growth Regulator:		Mirquat	1.7 l/ha	04/04/03
		Terpal	0.75 l/ha	01/05/03
Herbicides:		Panther	1.0 l/ha	12/12/02
		IPU	1.5 l/ha	12/12/02
Insecticides:		Hallmark Zeon	0.07 l/ha	05/10/02
		Cypermethrin	0.25 l/ha	12/12/02
Adjuvants:		Enhance	0.07 l/ha	01/05/03

Cirencester - first cereal

Trial name:	HGCA Hybrid barley
Crop:	Winter barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis (ppm):	P=320 K=15, Mg=97, S=5 pH=7.8
Previous crop:	WOSR
Drill date:	24/09/2002
Seed rate:	various
Harvest date:	24/07/2003
Variety:	NFC 200-57
Drilled plot size:	2m x 12m

Input type	Product	Item Rate	Date
Herbicide:	Ice	3.0l/ha	28/09/02
	Grasp	1.4l/ha	17/03/03
	Arelon 500	2.0l/ha	17/03/03
Fertiliser:	Double Top	50kg/ha N	05/03/03
	Ammonium Nitrate	150kg/ha N	17/04/03
Fungicide:	Acanto	0.25l/ha	09/04/03
	Opus Team	0.375l/ha	09/04/03
	Corbel	0.375l/ha	09/04/03
	Amistar	0.25l/ha	09/05/03
	Opus	0.25l/ha	09/05/03
	Corbel	0.25l/ha	09/05/03
Insecticide:	Toppel 10	0.25l/ha	17/03/03
PGR:	New 5C Cycocel	1.25l/ha	08/04/03
Molluscicides:	N/A		
Adjuvant:	Output	0.75l/ha	17/03/03
	Enhance	50ml/ha	08/04/03

Cirencester - second cereal

Trial name:	HGCA Hybrid barley
Crop:	Winter Barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis (ppm):	P=264, K=25, Mg86, S=5 pH=7.9
Previous crop:	Winter Wheat
Drill date:	27/09/2002
Seed rate:	250 seeds/m²
Harvest date:	20/07/2005
Variety:	NFC 200-57
Drilled plot size:	2m x 12m

Input type	**Product**	**Item Rate**	**Date**
Herbicide:	Ice	3.0l/ha	28/09/02
	Grasp	1.4l/ha	17/03/03
	Arelon 500	2.0l/ha	17/03/03
Fertiliser:	Double Top	50kg/ha N	05/03/03
Fungicide:	Acanto	0.25l/ha	09/04/03
	Opus Team	0.375l/ha	09/04/03
	Corbel	0.375l/ha	09/04/03
	Amistar	0.25l/ha	09/05/03
	Opus	0.25l/ha	09/05/03
	Corbel	0.25l/ha	09/05/03
Insecticide:	Toppel 10	0.25l/ha	17/03/03
PGR:	New 5C Cycocel	1.25l/ha	11/04/03
Molluscicides:	N/A		
Adjuvants:	Output	0.75l/ha	17/03/03
	Enhance	50ml/ha	11/04/03

Coldstream – first cereal

Site Address:	Coldstream, Scotland.		
Altitude:	50m		
Soil Type:	Medium Loam		
Previous Crop:	Winter Oilseed Rape		
Soil Analysis:	P-25, K-89, S – 4, pH – 6.2, Mg –162 , Mn –199, Cu – 1.7, B –1		
Sowing Date:	16/09/02		
Harvest Date:	21/07/03		
Fertiliser:	AN 34.5%	50 kg/ha N	13/03/03
	AN 34.5%	160 kg/ha N	08/04/03
Fungicides:	Acanto	0.5 l/ha	11/04/03
	Unix	0.4 l/ha	11/04/03
	Corbel	0.25 l/ha	11/04/03
	Acanto	0.35 l/ha	14/05/03
	Opus	0.25 l/ha	14/05/03
	Cropguard	1.0 l/ha	14/05/03
Growth Regulator:	3C Cycocel	1.7 l/ha	11/04/03
Herbicides:	Stomp	1.5 l/ha	02/10/02
	IPU	1.25 l/ha	02/10/02
Insecticides:	Fury	0.11 l/ha	02/10/02
Trace Elements:	Manganese	2.0 kg/ha	11/04/03
	Manganese	1.0 kg/ha	18/04/03

Coldstream – second cereal

Site Address:	Coldstream, Scotland.		
Altitude:	50m		
Soil Type:	Medium Loam		
Previous Crop:	Winter Wheat		
Soil Analysis:	P-24, K-150, S–3, pH–7.3, Mg–388, Mn–292, Cu–3, B–1.5		
Sowing Date:	16/09/02		
Harvest Date:	21/07/03		
Fertiliser:	AN 34.5%	50 kg/ha N	13/03/03
	AN 34.5%	160 kg/ha N	08/04/03
Fungicides:	Acanto	0.5 l/ha	11/04/03
	Unix	0.4 l/ha	11/04/03
	Corbel	0.25 l/ha	11/04/03
	Acanto	0.35 l/ha	14/05/03
	Opus	0.25 l/ha	14/05/03
	Cropguard	1.0 l/ha	14/05/03
Growth Regulator:	3C Cycocel	1.7 l/ha	11/04/03
Herbicides:	Stomp	1.75 l/ha	02/10/02
Insecticides:	Fury	0.1 l/ha	02/10/02
Trace Element:	Manganese	2.0 kg/ha	11/04/03
	Manganese	1.0 kg/ha	18/04/03

2004

Andover – first cereal

Trial Name:	HGCA Hybrid barley
Crop:	Winter barley
Location:	Tufton, Andover
Soil Type:	Andover Series 1
Soil Analysis:	P-30 , K-190 ,Mg-39 , Mn-569 , S-4 , pH-8.1 OM-5.3 ,
Previous Crop:	Beans
Drill Date:	25/09/03
Seed Rate:	350 seeds/m2
Harvest Date:	4/08/04
Variety:	Colossus
Drilled Plot Size:	2m x 12m
Replicates:	X 3

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Panther	1.0 l/ha	27/10/03
	IPU	2.0 l/ha	27/10/03
	Grasp	1.4 l/ha	08/04/04
Fertiliser:	Double Top	50 kg/ha N 22 kg/ha S	02/03/04
	AN 34.5%	125 kg/ha N	14/04/04
Fungicide:	Acanto	0.5 l/ha	09/04/04
	Opus	0.25 l/ha	09/04/04
	Corbel	0.25 l/ha	09/04/04
	Acanto	0.25 l/ha	07/05/04
	Opus	0.25 l/ha	07/05/04
	Corbel	0.125 l/ha	07/05/04
Insecticide:	Hallmark Zeon	0.05 l/ha	27/10/03
PGR:	5C Cycocel	1.75 l/ha	31/03/04
	Terpal	1.0 l/ha	02/05/04
Adjuvants:	Output	0.75 l/ha	08/04/04

Andover – second cereal

Trial Name:	Winter Barley Feed DL
Crop:	Winter Barley
Location:	Andover
Soil Type:	Andover series 1
Soil Analysis:	P-27 ppm , K- 156 ppm ,Mg- 48 ppm , Mn- 5 ppm , S- 6 ppm , pH- 8.0 , OM- 5.5% ,
Previous Crop:	Spring Barley
Drill Date:	27/09/03
Seed Rate:	350 seeds m2
Harvest Date:	28/07/04

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Panther	1.0 l/ha	27/10/03
	IPU	2.0 l/ha	27/10/03
	Grasp	1.4 l/ha	08/04/04
Fertiliser:	Double Top	50 kg/ha N 22 kg/ha S	02/03/04
	AN 34.5%	125 kg/ha N	14/04/04
Fungicide:	Acanto	0.5 l/ha	09/04/04
	Opus	0.25 l/ha	09/04/04
	Corbel	0.25 l/ha	09/04/04
	Acanto	0.25 l/ha	07/05/04
	Opus	0.25 l/ha	07/05/04
	Corbel	0.125 l/ha	07/05/04
Insecticide:	Hallmark Zeon	0.05 l/ha	27/10/03
PGR:	5C Cycocel	1.75 l/ha	31/03/04
	Terpal	1.0 l/ha	02/05/04
Adjuvants:	Output	0.75 l/ha	08/04/04

Bainton – first cereal

Trial Name:	HGCA hybrid barley		
Crop:	Winter Wheat		
Location:	Bainton		
Soil Type:	Panholes- sandy clay loam		
Soil Analysis:	P- 20 , K-160 ,Mg-59 , Mn-482 , S-5 , pH-7.9		
	OM- 4.1 , B-2.19		
Previous Crop:	Peas		
Drill Date:	23/09/03		
Seed Rate:	300 seeds m2		
Harvest Date:	21/07/04		
Variety:	Colossus		
Drilled Plot Size:	2m x 10m		
Replicates:	X 3		
Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Panther	1.25 l/ha	27/10/03
	IPU	1.25 l/ha	27/10/03
	Optica	0.5 l/ha	27/10/03
Fertiliser:	0-26-26	345 kg/ha	02/08/03
	Urea 46%	59 kg N/ha	26/03/04
	Urea 46%	82 kg N/ha	20/04/04
	Litfert 34.4%	66 kg N/ha	14/05/04
Fungicide:	Opus	0.5 l/ha	24/04/04
	Bravo 500	1.0 l/ha	24/04/04
	Landmark	0.7 l/ha	16/05/04
	Bravo 500	1.0 l/ha	16/05/04
	Folicur	0.4 l/ha	08/06/04
	Amistar	0.3 l/ha	08/06/04
Insecticide:	Cypermethrin	0.25 l/ha	18/10/03
	Dursban	1.5 l/ha	09/02/04
	Hallmark Zeon	50ml/ha	08/06/04
PGR:	3C Chlormequat	1.2 l/ha	09/04/04
	Moddus	0.1 l/ha	09/04/04
	3C Chlormequat	1.1 l/ha	23/04/04
	Moddus	0.1 l/ha	23/04/04
	Terpal	1.0 l/ha	15/05/04
Molluscicides:			
Adjuvants:	Activator 90	0.14 l/ha	15/05/04
Trace Elements:			

Bainton – second cereal

Trial Name:	HGCA Hybrid Barley		
Crop:	Winter Barley		
Location:	Bainton		
Soil Type:	Panholes- sandy clay loam		
Soil Analysis:	P-24, K-228 ,Mg-73, Mn-506, S-5, pH-8.2, OM- 4.3		
	B-2.45		
Previous Crop:	Winter wheat		
Drill Date:	24/09/03		
Seed Rate:	350 seeds m²		
Harvest Date:	27/27/04		
Variety:	Various		
Drilled Plot Size:	2m x 10.2m		
Replicates:	X 3		
Input Type	**Product**	**Item Rate (ml, kg)**	**Date**
Herbicide:	Plinth	1.8 l/ha	27/10/03
	IPU	2.0 l/ha	27/10/03
Fertiliser:	0-26-26	345 kg/ha	02/08/03
	Urea 46%	59 kg N/ha	01/03/04
	Urea 46%	106 kg N/ha	20/03/04
Fungicide:	Acanto	0.5 l/ha	14/04/04
	Unix	0.3 kg/ha	14/04/04
	Corbel	0.25 l/ha	14/04/04
	Amistar	0.25 l/ha	17/05/04
	Opus	0.25 l/ha	17/05/04
	Corbel	0.25 l/ha	17/05/04
	Cypermethrin	0.25 l/ha	27/10/03
PGR:	3C Chlormequat	1.75 l/ha	14/04/04
	Terpal	1.25 l/ha	02/05/04
Adjuvants:	Activator 90	0.14 l/ha	02/05/04

Coldstream – first cereal

Location:	Coldstream, Scotland		
Soil Type:	Salop, fine loam over clay		
Soil Analysis:	P- 37, K- 159, Mg- 306, Mn- 129, S-12, pH- 6. OM- 3.5, B- 1.22, Cu-3.6		
Previous Crop:	Winter Oilseed Rape		
Drill Date:	24/09/03		
Seed Rate:	various		
Harvest Date:	02/08/04		
Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	IPU	1.5	04/10/03
	Stomp	1.75	04/10/03
	Starane	0.5	01/05/04
Fertiliser:	Phosphorous	75 kg/ha	17/09/03
	Potassium	75 kg/ha	17/09/03
	AN 34.5%	50 kg/ha N	17/03/04
	AN 34.5%	110 kg/ha N	21/04/04
Fungicide:	Corbel	0.3	08/04/04
	Acanto	0.4	08/04/04
	Unix	0.4	08/04/04
	Acanto	0.35	19/05/04
	Bravo	1.0	19/05/04
	Opus	0.25	19/05/04
Insecticide:	Fury	0.1	04/10/03
PGR:	CCC	1.75	08/04/04
	Terpal	1.3	01/05/04
Trace Elements:	Manganese	2.0	08/04/04

Coldstream – second cereal

Location:	Coldstream, Scotland		
Soil Type:	Salop, fine loam over clay		
Soil Analysis:	P- 37, K- 159, Mg- 306, Mn- 129, S-12, pH- 6. OM- 3.5, B- 1.22, Cu-3.6		
Previous Crop:	Winter Wheat		
Drill Date:	25/09/03		
Seed Rate:	various		
Harvest Date:	02/08/04		
Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	IPU	1.5	04/10/03
	Stomp	1.75	04/10/03
	Starane	0.5	01/05/04
Fertiliser:	Phosphorous	75 kg/ha	17/09/03
	Potassium	75 kg/ha	17/09/03
	AN 34.5%	50 kg/ha N	17/03/04
	AN 34.5%	110 kg/ha N	21/04/04
Fungicide:	Corbel	0.3	08/04/04
	Acanto	0.4	08/04/04
	Unix	0.4	08/04/04
	Acanto	0.35	19/05/04
	Bravo	1.0	19/05/04
	Opus	0.25	19/05/04
Insecticide:	Fury	0.1	04/10/03
PGR:	CCC	1.75	08/04/04
Trace Elements:	Manganese	2.0	08/04/04

Cirencester – first cereal

Trial name:	HGCA Hybrid Seed Rate In 1st Cereal
Crop:	Winter Barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis:	P=23, K=285, Mg=85, S=7, pH=7.8
Soil nitrogen:	N/A
Previous crop:	Winter oilseed rape
Drill date:	24/09/2003
Seed rate:	250, 300, 350 seeds/m^2
Harvest date:	27/07/04
Variety:	Colossus
Drilled plot size:	2m x 12m
Replicates:	X3

Input type	**Product**	**Product Rate**	**Date**
Herbicide:	Ice	3.0 l/ha	29/09/03
	Arelon	3.0 l/ha	06/11/03
	Stomp	3.0 l/ha	06/11/03
Fertiliser:	Sulphur Gold	50kg/ha N + 22kg/ha S	05/03/04
	Ammonium Nitrate	150kg/ha N	13/04/03
Fungicide:	Acanto	0.5 l/ha	08/04/04
	Opus	0.25 l/ha	08/04/04
	Corbel	0.125 l/ha	08/04/04
	Opus	0.25 l/ha	07/05/04
	Corbel	0.125 l/ha	04/05/04
Insecticide:	Toppel 10	0.25	06/11/03
PGR:	5C Cycocel	1.25 l/ha	08/04/04
	Terpal	0.75 l/ha	26/04/04
Adjuvants:	Wetta Plus	0.2 l/ha	26/04/04
Trace elements:	N/A		

Cirencester – second cereal

Trial name:	HGCA Hybrid barley
Crop:	Winter Barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis:	P=23, K=285, Mg=85, S=7, pH=7.8
Previous crop:	Winter wheat
Drill date:	24/09/2003
Seed rate:	250, 350 seeds/m^2
Harvest date:	20/07/04
Variety:	Colossus/Siberia
Drilled plot size:	2m x 12m
Replicates:	X3

Input type	**Product**	**Product Rate**	**Date**
Herbicide:	Ice	3.0 l/ha	29/09/03
	Arelon	3.0 l/ha	06/11/03
	Stomp	3.0 l/ha	06/11/03
Fertiliser:	Sulphur Gold	50kg/ha N + 22kg/ha S	05/03/04
	Ammonium Nitrate	150kg/ha N	13/04/04
Fungicide:	Acanto	0.5 l/ha	08/04/04
	Opus	0.25 l/ha	08/04/04
	Corbel	0.125 l/ha	08/04/04
	Opus	0.25 l/ha	07/05/04
	Corbel	0.125 l/ha	04/05/04
Insecticide:	Toppel 10	0.25	06/11/03
PGR:	5C Cycocel	1.25 l/ha	08/04/04
	Terpal	0.75 l/ha	26/04/04
Adjuvants:	Wetta Plus	0.2 l/ha	26/04/04
Trace elements:	N/A		

2005
Andover first cereal

Site address:	Home field, Lower Norton Farm, Norton. Sutton Scotney Hants
Soil type:	Andover series
Previous crop:	Set-a-side
Sowing date:	28/09/04
Seed Rate:	250 seeds m²
Soil Analysis: (ppm)	Phosphorus 32 Potassium 245 Magnesium 52 Sulphur 8 pH 7.9

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Glyphogan	3.0 l/ha	16/09/04
	IPU	1500g ai/ha	05/11/04
	DFF	50 g/ha	05/11/04
	HBN	1.5 l/ha	05/11/04
Fertiliser:	Double Top	50 kg/ha	07/03/05
	AN 34.5%	125 kg/ha	15/04/05
Fungicide:	Opus	0.5 l/ha	05/04/05
	Acanto	0.5 l/ha	05/04/05
	Acanto	0.5 l/ha	29/04/05
	Proline	0.4 l/ha	29/04/05
Adjuvants:	Hallmark Zeon	50 ml/ha	11/11/04
PGR:	Chlormequat 700	1.75 l/ha	11/04/05
	Terpal	1.0 l/ha	29/04/05

Andover – second cereal

Site:	Footpath, Lower Norton Farm, Norton. Sutton Scotney Hants
Soil type:	Andover series
Previous Crop:	Winter wheat
Sowing date:	27/09/04
Seed Rate:	250 seeds m²
Soil Analysis: (ppm)	Phosphorus 30 Potassium 156 Magnesium 82 Sulphur 9 pH 7.4

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Gramoxone 100	3.0 l/ha	24/09/04
	IPU	2500g ai/ha	05/11/04
	Stomp	3 l/ha	05/11/04
Fertiliser:	Double Top	50 kg/ha	07/03/05
	AN 34.5%	125 kg/ha	15/04/05
Fungicide:	Opus	0.5 l/ha	05/04/05
	Acanto	0.5 l/ha	05/04/05
	Acanto	0.5 l/ha	29/04/05
	Proline	0.4 l/ha	29/04/05
Insecticides:	Hallmark Zeon	50 ml/ha	11/11/04
PGR:	Terpal	1.0 l/ha	29/04/05

Bainton – first cereal

Location:	Bainton, Yorkshire		
Soil Type:	Panholes- sandy clay loam		
Soil Analysis:	P-18, K-130, Mg-67, Mn-502, S-5, pH-7.7, OM- 3%, B-1.22, Cu-5.6		
Previous Crop:	Peas		
Drill Date:	23/09/03		
Seed Rate:	250 seeds m2		
Harvest Date:	20/07/05		
Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	Picopro	1.8 l/ha	01/11/04
	IPU	2.0 l/ha	01/11/04
	Optica	0.7 l/ha	01/11/04
Fertiliser:	AN 34.5%	50 kg/ha N	14/03/05
	AN 34.5%	130 kg/ha N	31/03/05
Fungicide:	Acanto	0.30 l/ha	11/04/05
	Proline	0.30 l/ha	11/04/05
	Corbel	0.25 l/ha	11/04/05
	Amistar	0.25 l/ha	14/05/05
	Opus	0.25 l/ha	14/05/05
	Corbel	0.25 l/ha	14/05/05
Insecticide:	Cypermethrin	0.25 l/ha	04/11/04
PGR:	3C Chlormequat	1.70 l/ha	02/04/05
	Moddus	0.15 l/ha	02/04/05
	Terpal	1.25 l/ha	25/04/05
Adjuvants:	Agral	0.06 l/ha	25/04/05

Bainton – second cereal

Location:	Bainton, Yorkshire
Soil Type:	Panholes- sandy clay loam
Soil Analysis:	P-16, K-187, Mg-73, Mn-594, S-6, pH-7.8, OM-4.5%, B-1.86, Cu-6.3
Previous Crop:	Winter Wheat
Drill Date:	27/09/04
Seed Rate:	350 seeds m2
Harvest Date:	19/07/05

Input Type	Product	Item Rate (ml, l, kg)	Date
Herbicide:	Plinth	1.8 l/ha	04/11/04
	IPU	2.0 l/ha	04/11/04
Fertiliser:	Double Top	40 kg/ha N	10/03/05
	34.5 % N	102 kg/ha N	21/04/05
Fungicide:	Acanto	0.30 l/ha	11/04/05
	Proline	0.30 l/ha	11/04/05
	Corbel	0.25 l/ha	11/04/05
	Amistar	0.25 l/ha	14/05/05
	Opus	0.25 l/ha	14/05/05
	Corbel	0.25 l/ha	14/05/05
Insecticide:	Cypermethrin	0.25 l/ha	04/11/04
PGR:	3C Chlormequat	1.70 l/ha	02/04/05
	Moddus	0.15 l/ha	02/04/05
	Terpal	1.25 l/ha	25/04/05
Adjuvants:	Agral	0.06 l/ha	25/04/05

Coldstream – first cereal

Location:	Coldstream, Scotland
Soil Type:	Salop, fine loam over clay
Soil Analysis:	P- 19, K- 91, Mg- 193, Mn- 266, S-5, pH- 6.7 , OM- 2.7%, B- 0.72, Cu-4.1
Previous Crop:	Winter Oilseed Rape
Drill Date:	22/09/04
Seed Rate:	various
Harvest Date:	24/07/05

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	IPU	2.0 l/ha	07/10/04
	Stomp	1.5 l/ha	07/10/04
	Starane	0.5 l/ha	04/05/05
Fertiliser:	AN 34.5%	50 kg/ha N	
	AN 34.5%	110 kg/ha N	
Fungicide:	Corbel	0.3 l/ha	11/04/05
	Fandango	0.4 l/ha	11/04/05
	Acanto	0.3 l/ha	26/05/05
	Bravo	1.0 l/ha	26/05/05
	Opus	0.25 l/ha	26/05/05
Insecticide:	Fury	0.08 l/ha	07/10/04
PGR:	CCC	1.5 l/ha	04/05/05
	Moddus	0.1 l/ha	04/05/05
	Terpal	1.4 l/ha	04/05/05
Trace Elements:	Manganese	1.5 kg/ha	11/04/05

Coldstream – second cereal

Location:	Coldstream, Scotland
Soil Type:	Salop, fine loam over clay
Soil Analysis:	P- 31, K- 265, Mg- 117, Mn- 82, S-6, pH- 6.3 , OM- 4.2%, B- 0.87, Cu-5.3
Previous Crop:	Winter Wheat
Drill Date:	25/09/03
Seed Rate:	various
Harvest Date:	02/08/04

Input Type	**Product**	**Item Rate (ml, l, kg)**	**Date**
Herbicide:	IPU	2.0 l/ha	07/10/04
	Stomp	1.5 l/ha	07/10/04
	Starane	0.5 l/ha	04/05/05
Fertiliser:	AN 34.5%	50 kg/ha N	22/03/05
	AN 34.5%	130 kg/ha N	14/04/05
Fungicide:	Corbel	0.3 l/ha	11/04/05
	Fandango	0.4 l/ha	11/04/05
	Acanto	0.3 l/ha	26/05/05
	Bravo	1.0 l/ha	26/05/05
	Opus	0.25 l/ha	26/05/05
Insecticide:	Fury	0.08 l/ha	07/10/04
PGR:	CCC	1.5 l/ha	04/05/05
	Moddus	0.1 l/ha	04/05/05
	Terpal	1.4 l/ha	04/05/05
Trace Elements:	Manganese	1.5 kg/ha	11/04/05

Cirencester – first cereal

Trial name:	HGCA Hybrid barley
Crop:	Winter Barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis:	P=28, K=304, Mg=73, S=8, pH=8.0
Soil nitrogen:	N/A
Previous crop:	Winter Oilseed Rape
Drill date:	23/09/2004
Seed rate:	245, 298, 350 seeds/m^2
Harvest date:	20/07/05
Variety:	Colossus
Drilled plot size:	2m x 12m
Replicates:	X3

Input type	**Product**	**Product Rate**	**Date**
Herbicide:	Liberator	0.5 l/ha	30/09/04
	Treflan	2.0 l/ha	30/09/04
	Alpha IPU	3.0 l/ha	25/11/04
	Stomp	3.0 l/ha	25/11/04
Fertiliser:	Double Top	50 kg/ha N	25/02/05
	Ammonium Nitrate	125 kg/ha N	16/04/05
Fungicide:	Acanto	0.25 l/ha	11/04/05
	Proline	0.3 l/ha	11/04/05
	Amistar	0.25 l/ha	11/05/05
	Opus	0.25 l/ha	11/05/05
	Corbel	0.125 l/ha	11/05/05
Insecticide:	Permasect C	0.25	25/11/04
PGR:	5C Cycocel	1.5 l/ha	25/03/05
	Terpal	0.75 l/ha	06/05/05
Molluscicides:	New Draza	5 kg/ha	04/11/04
Adjuvants:	Wetta Plus	0.2 l/ha	06/05/05

Cirencester – second cereal

Trial name:	HGCA Hybrid barley
Crop:	Winter Barley
Location:	Cirencester
Soil type:	Elmton
Soil analysis:	P=28, K=304, Mg=73, S=8, pH=8.0
Soil nitrogen:	N/A
Previous crop:	Winter Wheat
Drill date:	23/09/2004
Seed rate:	245, 298, 350 seeds/m^2
Harvest date:	20/07/05
Variety:	Colossus
Drilled plot size:	2m x 12m
Replicates:	X3

Input type	**Product**	**Product Rate**	**Date**
Herbicide:	Liberator	0.5 l/ha	30/09/04
	Treflan	2.0 l/ha	30/09/04
	Alpha IPU	3.0 l/ha	25/11/04
	Stomp	3.0 l/ha	25/11/04
Fertiliser:	Double Top	50 kg/ha N	25/02/05
	Ammonium Nitrate	125 kg/ha N	16/04/05
Fungicide:	Acanto	0.25 l/ha	11/04/05
	Proline	0.3 l/ha	11/04/05
	Amistar	0.25 l/ha	11/05/05
	Opus	0.25 l/ha	11/05/05
	Corbel	0.125 l/ha	11/05/05
Insecticide:	Permasect C	0.25	25/11/04
PGR:	5C Cycocel	1.5 l/ha	25/03/05
	Terpal	0.75 l/ha	06/05/05
Molluscicides:	New Draza	5 kg/ha	04/11/04
Adjuvants:	Wetta Plus	0.2 l/ha	06/05/05