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RECOMMENDED

HGCA

CRUSOE

WINTER WHEAT

HUSBANDRY GUIDELINES

INTRODUCTION

Crusoe is an exciting new winter wheat variety from Limagrain UK. It is a nabim Group 1 milling variety with a high yield potential, outstanding disease resistance and very good grain quality. To be classified in nabim Group 1 a variety has to show consistency of milling and baking performance during preliminary evaluation. To be added to the HGCA Recommended List (RL) a variety has to offer the potential to provide a consistent economic benefit to the whole industry. Crusoe raises the standard in this premium category and there is already strong demand for the variety from major millers and bakers.

The average life span of varieties in the four nabim quality categories on the RL varies considerably. Using the 2012/13 list the figures are:

Group 1 6.5 years; **Group 2** 4.4 years; **Group 3** 3.3 years; **Group 4** 2.8 years

The longevity of Group 1 varieties reflects the conservative nature of the milling and baking industry. Quality wheat growers tend to remain with varieties for longer than feed wheat growers. Varieties such as Avalon, Mercia, Hereward, Malacca and

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WINTER WHEAT

Solstice have served the industry well for a considerable time; the addition of Crusoe to this list suggests that it has the potential to meet end users' needs and provide high quality grain for many years to come.

Crusoe has many desirable traits and offers the grower a variety that is not difficult to grow. In fact... it is easier than many other varieties. By using the agronomic information provided from extensive trial work it is possible to gain an understanding of how best to farm Crusoe to maximise both yield and grain quality.

Limagrain introduced the concept of husbandry guidelines for new varieties many years ago and there is now sufficient information to produce this booklet for Crusoe. The first part provides some background information on Crusoe, the second section pointers on how best to manage it. The guide is not intended as a rigorous blueprint, but provides sufficient technical support to enable growers and agronomists to realise the genetic potential offered by this new and exciting variety.

CRUSOE - PEDIGREE AND SELECTION

Pedigree: Cordiale x Gulliver

Crusoe was bred by Limagrain UK from a selection between two winter wheat varieties Cordiale and Gulliver. Cordiale, a widely grown Group 2 variety has early maturity, stiff straw and good grain quality. Gulliver contains genetic material derived from a different source to many other UK wheats, *Triticum dicoccoidies*. This confers excellent disease resistance and improved bread-making quality to the cross as well as a distinctive green colour. The resulting variety, Crusoe, has a high yield potential, excellent grain quality for bread-making and very high levels of resistance to the main wheat diseases. The selection captured the best characteristics of both varieties, improved on some of them and produced an excellent variety that will remain a mainstream quality wheat for many years.

CRUSOE - YIELD POTENTIAL

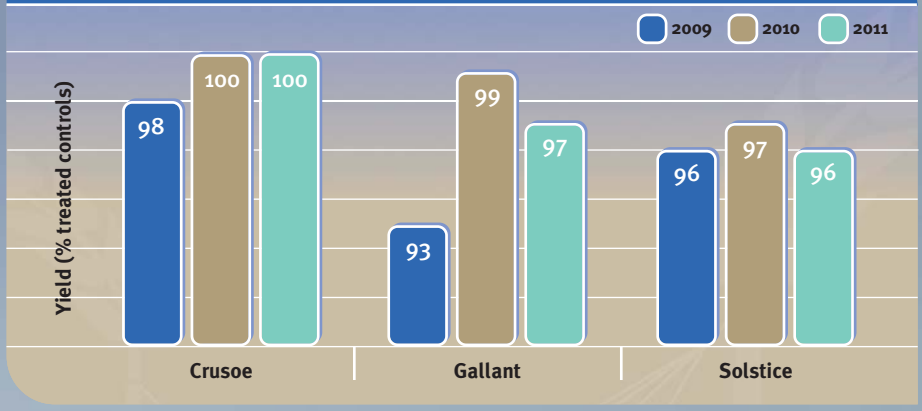
Crusoe demonstrates the highest yield potential within its market sector, as seen in its treated and untreated yields in HGCA Recommended List (RL) trials in comparison with Gallant and Solstice (Table 1). The yield of fungicide treated Crusoe is similar to Gallant and 2% above Solstice. Untreated, Crusoe's disease resistance is apparent where it is 6% above Gallant and 10% above Solstice.

Table 1: Yield Potential in HGCA Recommended List Trials

	Yield (% treated control)		
	Crusoe	Gallant	Solstice
UK (treated)	99	99	97
UK (untreated)	89	83	79

In addition, Crusoe has been very consistent in its performance during three years of National List and RL trials (Chart 1). In these trials over contrasting seasons, Crusoe's yields varied by only 2% (between 98% and 100%) and were similar to Solstice in this respect. Gallant's performance was more variable, showing a 6% difference between 93% and 99%.

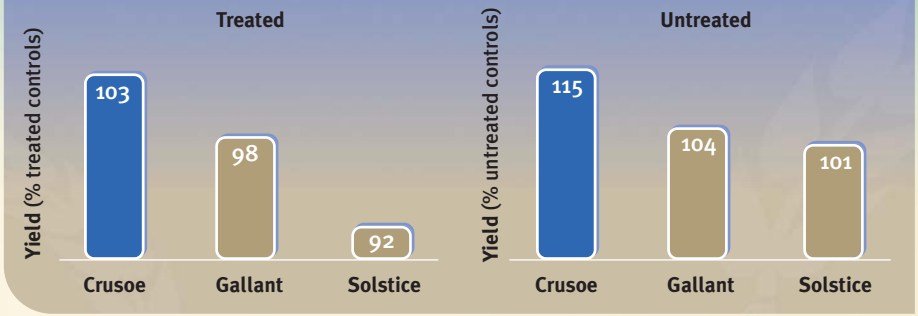
Chart 1: Consistency of Yield



HGCA RL trials are conducted with high levels of fungicide and PGR input, designed to keep disease levels to a minimum and measure the genetic potential of varieties. The programmes used in these trials cost in the region of £200/ha, considerably more than would be acceptable to farmers who would typically spend less than half this figure.

Each year, Limagrain UK conducts a number of 'farmer trials' where replicated plots of varieties are placed in commercial crops and managed by the grower using farm levels of inputs. These trials are designed to supplement the HGCA system and determine how varieties perform when given more realistic levels of management. In 2011 there were 11 farmer trials located at a range of locations around the UK from Cornwall to Perthshire. The results (Chart 2) support those from the RL system. They show Crusoe's high yield potential when managed as a commercial crop would be, with a 5% yield advantage over Gallant and 11% over Solstice when fungicide treated and 11 to 14% above these two varieties untreated.

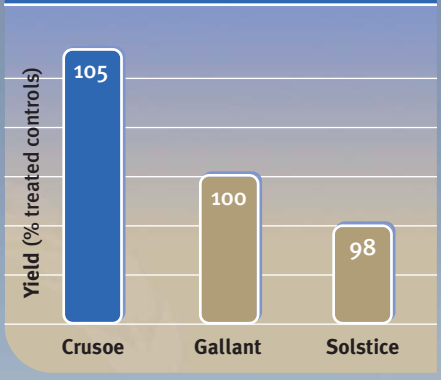
Chart 2: Yield Potential in Limagrain Farmer Trials



Source: Limagrain UK trials 2011

The Limagrain Farmer Trials are conducted in both first and second wheat situations enabling variety performance to be evaluated in these different cropping scenarios. The results for the second wheat trials (Chart 3) show Crusoe's ability to perform well in this more demanding rotational position and maintain its yield advantage over Gallant and Solstice.

Chart 3: Second Wheat Performance



Source: Limagrain UK trials 2010

Commercially, bread-making varieties are popular as a second cereal in the rotation where higher protein levels can be achieved and Crusoe is well suited to this situation.

CRUSOE - RESISTANCE TO DISEASES AND PESTS

A high level of genetic disease resistance is a key target in the Limagrain breeding programme. Crusoe has a very high level of resistance to the main wheat diseases with ratings for mildew, yellow rust, brown rust and *Septoria tritici* all a '7' or above (Table 2).

Table 2: Disease Resistance

	Crusoe	Gallant	Solstice
Mildew	9	5	4
Yellow rust	9	5	4
Brown rust	7	4	4
Septoria tritici	7	5	5
Eyespot	5	5	4
Fusarium ear blight	6	5	6

Septoria tritici is the most widespread and damaging foliar disease of winter wheat and fungicide programmes are frequently built around preventing serious losses from infection. Crusoe has excellent resistance to this disease and is one of only three varieties on the RL to be rated at a '7'. This genetic resistance should be used in conjunction with a targeted fungicide programme to give the highest level of disease control in the field.

The current brown rust rating for Crusoe (7) is likely to come down as it is affected by new races. However, Crusoe has adequate background resistance to ensure that an input programme designed to control *Septoria spp* will be sufficient to manage the crop effectively. Routine fungicide applications targeting other diseases on Crusoe, such as *Septoria*, should be sufficient to deal with the currently existing rust races.

Mildew resistance for Crusoe is also excellent, rated '9' and this disease should not require routine treatment. Mildew is frequently associated with thick crops and high humidity within the canopy, which can be avoided by appropriate management i.e. using lower seed rates and careful nitrogen timing.

Crusoe has similar ratings to Gallant and Solstice for eyespot resistance. This disease is influenced by a range of site and husbandry factors and development will need to be monitored on Crusoe with thicker, earlier sown crops on the heavier soil types being most at risk. Lesions penetrating the stem base are most likely to affect yield, increase the lodging risk and indicate the need for a fungicide with good eyespot activity.

Like Solstice, Crusoe has good resistance to *Fusarium* ear blight and its current rating gives a score of zero in the HGCA Mycotoxin risk assessment tool.

Crusoe does not carry resistance to Orange Wheat Blossom Midge (OWBM), so growers with crops at risk from this pest should make allowance for this when planning their pest control strategy.

OWBM has become less of a problem over the last few years as farmers have used insecticides prophylactically, as well as growing a higher proportion of resistant varieties. However, OWBM still represents a significant threat to crops if large hatch numbers coincide with ear emergence.

Under high risk situations, application of a chlorpyrifos based product should be considered, as this active ingredient has a high level of persistence and will kill both the adults and newly-emerged larvae.

More recently, approval has been given to products based on Lambda-cyhalothrin (e.g. Hallmark) and Thiacloprid (e.g. Biscaya). The former is a pyrethroid and will only kill insects present at the time of application, while the latter is a neonicotinoid and should be applied when OWBM thresholds are reached.

Attempting control using pyrethroid-based products may exacerbate the threat from OWBM as these products may reduce the numbers of hymenopterous parasitoids, the natural enemies of OWBM.

Growers should refer to the HGCA website (www.hgca.com) for more detailed advice.

CRUSOE - AGRONOMIC CHARACTERISTICS

Crusoe is a shorter strawed variety which stands well when treated with a PGR programme. Good straw strength is a positive attribute for a quality wheat variety. It is recommended that an effective PGR programme (see page 12) is planned for Crusoe in most situations to ensure its very high yield potential is realised.

Crusoe is slightly later to ripen than Solstice, allowing a longer grain filling period. Although there is not yet a RL rating for sprouting resistance, Crusoe's good Hagberg falling number suggests sprouting is unlikely to be a problem (Table 3).

Table 3: Agronomic Characters

	Crusoe	Gallant	Solstice
Straw height (cm) untreated	85	84	93
Resistance to lodging (with PGR)	7	8	8
Ripening (days ± Solstice, + = late)	+1	-2	0

CRUSOE - GRAIN QUALITY

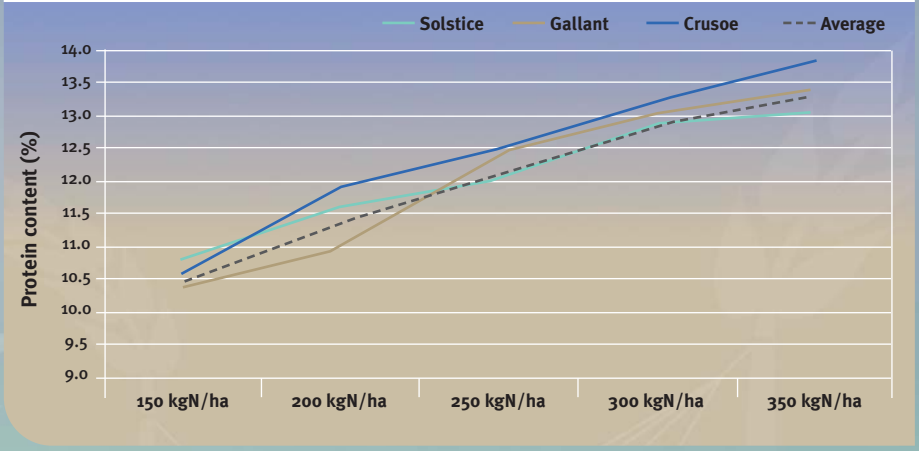
Table 4 shows Crusoe's physical grain quality. It has the highest protein content and specific weight within its nabim Group and a Hagberg falling number the same as Solstice.

Table 4: Grain Quality

	Crusoe	Gallant	Solstice
Endosperm texture ukp	Hard	Hard	Hard
Protein content (%)	12.2	12.0	11.9
Hagberg falling number	266	307	266
Specific weight (kg/hl)	78.1	77.9	78.0

Crusoe's ability to produce high protein levels was observed in an independent fertiliser management trial where varieties were treated with increasing levels of nitrogen to establish a response curve. The results for Crusoe, Gallant and Solstice are presented in Chart 4 and show that Crusoe had consistently higher grain protein over the range of nitrogen levels tested and was also well above the average for all varieties in the trial. It also suggests that Crusoe can achieve up to the 13% protein content required to meet Group 1 specification at commercially acceptable levels of applied nitrogen which are likely to comply with RB 209 guidelines.

Chart 4: Nitrogen Response Curve



Source: Agrii, Throws Farm, 2010.

Whilst high protein content is necessary to attain full bread-making specification, the quality of that protein is also fundamental to baking performance. This aspect of quality (often referred to as functionality) is genetic, an inherent property of the wheat variety grown and the reason why domestic end-users purchase wheat on the basis of variety. Crusoe has been in nabim milling and baking trials since 2009. After three years of evaluation, Crusoe was judged to have reached the very high standard of functionality required for a Group 1 milling wheat. nabim comment on Crusoe is:

'This variety has consistently demonstrated good protein content and quality. The bread crumb structure has been equal to that of Solstice. Over the three years of trials the baking performance has been good.'

Limagrain have fully evaluated the milling and baking quality of Crusoe each year since 2007. Crusoe has been remarkably consistent with regard to key quality criteria such as high protein content and exceptional whiteness of flour, as well as excellent overall baking performance.

CRUSOE - CROP DEVELOPMENT AND SOWING

Crusoe has a prostrate winter growth habit, with a similar tiller production pattern to Solstice. In the early spring Crusoe's growth habit becomes semi-erect, like Solstice. Table 5 shows the growth habit ratings for the Group 1 varieties along with Claire and Einstein for reference. Crusoe's score of 4.5 is the same as Solstice and sits in-between Claire, a more prostrate variety and Einstein which is more erect.

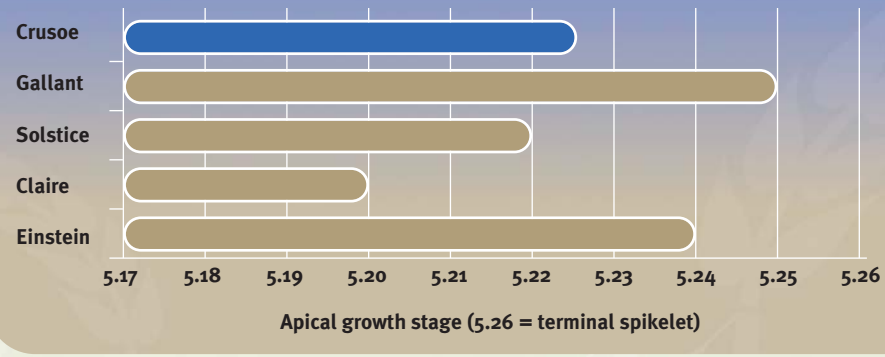
Table 5: Growth Habit

	Growth habit score (1 – 9 where 9 = prostrate)
Crusoe	4.2
Gallant	3.3
Solstice	4.2
Claire	7.0
Einstein	3.5

Source: Limagrain UK trials 2010

In the spring Crusoe moves through the ear primordial (growing point) development and stem internode growth stages rapidly. Chart 5 compares the ear development stages of the same varieties as above; it shows that Crusoe is again similar to Solstice in this respect, slower than Gallant but faster than Claire. This speed of development has implications for the timings of PGRs, see page 12.

Chart 5: Primordia Ear Development



Source: Limagrain UK trials 2010

SOWING DATE

This pattern shows that Crusoe develops quite rapidly in relation to some other winter wheat varieties and for this reason is not suitable for early September sowing.

Varieties with rapid development patterns initiate ear primordia earlier in the season than those with slower development, influenced primarily by day length and

temperature. These primordia are vulnerable to damage during the early spring. Hence sowing a rapid developing variety too soon can be detrimental, resulting in poor grain set and an associated increase in ear diseases as well as the risk of ergot.

Crusoe should therefore be sown at the traditional time for winter wheat, from mid September to the end of October, when it will have the best chance to express its high yield potential.

Crusoe has a high vernalisation requirement, the period of low temperatures that cereals require to ensure that their primordia switch from vegetative growth to reproductive growth and produce ears. Wheat varieties differ in their vernalisation requirements. Crusoe must not be drilled after the end of January.

SEED RATE

Seed rates for Crusoe should be based on those in Table 6 and reflect the drilling date and seedbed conditions.

Table 6: Seed Rates

	Seed rates (seeds/m²) for Crusoe				
Time of sowing	**Mid September**	**Late September**	**Early October**	**Mid October**	**Late October**
Seeds/m²	**180 - 220**	**220-260**	**220-260**	**275 - 350**	**300 - 350**

These seed rates are based on sowing into seedbeds where establishment is likely to be good. Under less favourable conditions they should be increased by 40 to 50 seeds/m² to allow for losses during establishment.

SEED TREATMENTS

All Crusoe seed should receive a 'single purpose' seed treatment as routine in order to control the commonly occurring seed borne diseases. For earlier sowings, broad spectrum dressings offering improvements in standing power and early season foliar disease protection should also be considered in high risk situations. Where take-all risk is high (second or continuous cereal crop) a specific dressing – such as Latitude or Jockey – may be of benefit.

Insecticide seed dressings such as Deter can provide good early season protection against aphids carrying barley yellow dwarf virus (BYDV) and help to reduce grain hollowing by slugs. Where crops are drilled in mid-September, an additional aphicide spray later in the season may also be required to maintain protection against BYDV.

CRUSOE - PLANT GROWTH REGULATOR USE

Crusoe is a relatively short strawed variety. Its RL ratings for height and standing are much the same as Gallant and Claire (85cm and a '7' respectively), so growers familiar with managing these varieties should adopt a similar approach with their PGR use on Crusoe.

Where high yields are expected (greater than 8t/ha), a routine application of a chlormequat based product will provide a very cost effective insurance against possible lodging and associated loss of yield and quality.

Limagrain recommend a split PGR application with 2/3 at Zadoks GS30 (or more precisely 'glume primordial stage') and the balance at GS31 (1st node detectable) as an ideal input for Crusoe. If the weather does not permit a split application, full rate CCC should be applied at Zadoks GS31. The addition of Moddus or Canopy at the first timing should be considered if the crop has a very high yield potential to further reduce crop height and lodging risk. Crusoe develops more quickly than other varieties in the spring and careful monitoring of the crop growth stages is essential for the correct timing of PGR inputs.

Where soil type, fertility, seasonal growth and previous experience suggest a high lodging risk then a late season ethephon based product (such as Terpal) could be used.

A managed approach should be adopted with Crusoe to reduce lodging by using a combination of the appropriate seed rate, controlling stem base diseases, applying nitrogen at the correct timing and early spring PGR applications.

CRUSOE - HERBICIDE TOLERANCE

Preliminary testing suggests that Crusoe is likely to be susceptible to chlorotoluron (CTU) based products and that they should not be used on the variety.

CRUSOE - CROP NUTRITION

Nitrogen recommendations for winter wheat have recently been updated to reflect recent trial results, NVZ regulations and the relative prices of grain and fertiliser. In particular, allowance can now be made for the high yield potential of varieties like Crusoe when calculating the total amount of nitrogen fertiliser to apply and comply with ‘N max’ limits.

With increasing scrutiny on nitrogen use it is imperative growers can justify the amount applied and should refer to Defra RB 209, HGCA Guidelines or SAC Technical Note 625 (as appropriate) and use a FACTS qualified adviser when calculating the rates to be applied to Crusoe.

The aim when growing a quality winter wheat variety such as Crusoe is to achieve the highest yield potential with good grain characteristics (particularly protein) but not to erode standing power. Thus an approach of ‘later rather than earlier’ with nitrogen application should be followed.

A three-way split nitrogen application has

been found to be more reliable than a two-split approach. The ideal target applications are based on the actual growth stage of the crop, specifically Zadoks GS30 (glume primordial stage) GS31-32 (terminal spikelet) and GS37 (flag leaf emergence).

The first treatment of nitrogen should consist of no more than 50kgN/ha. This could be reduced (or even omitted) if the crop was in a fertile situation where too much early fertiliser would be detrimental. Well tillered (> 1000/m^2) crops do not need nitrogen fertiliser at this stage.

However, in some second or continuous wheat crops, where a possible threat from take-all exists, an increased first nitrogen application would be desirable to reduce the impact of any take-all infection that might occur.

The second application should be targeted just prior to Zadoks 32 or to be more accurate at the terminal spikelet stage. This should be the main nitrogen application, in the region of 100kgN/ha.

The third application at flag leaf emergence delivers the remainder of the nitrogen required for maximum yield and can also include an additional quantity to raise grain protein levels. An extra 40kgN/ha can typically raise grain protein by 1.1%.

In simple terms the breakdown of the three split applications is 25% / 50% / 25% with an additional 40kgN/ha added to the final application to raise protein.

A common approach for quality wheat nitrogen management is to apply the extra 40kgN/ha to the crop as a late foliar application during, but not later than, the grain milky ripe stage (GS73 to GS77). This is quite a reliable method of increasing grain protein levels, an important intake assessment when delivering grain to end users. However, Limagrain do not advocate this approach and feel that growers should check with their buyers whether or not this treatment of late foliar nitrogen to boost 'grain protein' is acceptable.

Sulphur

It is now well accepted that sulphur deficiency is present in many soils in the country and therefore sulphur applications are desirable on most crops. Sulphur is an essential element in the production of protein, so it is very important that crops designated for bread-making are not short of sulphur. Crops at highest risk from sulphur deficiency are those grown on the lighter soils (chalks or sands), particularly where organic manures are not used. Deficiency is becoming more widespread and it is likely most bread-making crops will benefit from a sulphur application.

The best approach is to apply 15 to 20 kgS/ha (equivalent to 40 - 50 kgSO^3/ha) in the early spring but before stem extension. This may be combined with the first nitrogen application or split between the first and second applications. Later applications of sulphur may not be as effective in dealing with sulphur deficiency in wheat crops.

Trace elements such as manganese, copper, boron and iron are important during periods of rapid growth, especially around flag leaf emergence. Foliar applications of products such as Multimin will ensure that any transient deficiencies are met and will aid flowering synchronisation. The use of magnesium at T3 will help with grain fill and improve specific weight.

CRUSOE - FUNGICIDE PROGRAMMES

At the time of writing grain prices are higher, but more volatile, than have been seen for many years. With the prospect of high gross margins from wheat crops, using a reasonable fungicide programme on Crusoe will deliver an excellent return on the investment. Fungicide programmes should be targeted and take in to account its genetic resistance to the individual diseases outlined earlier. In HGCA RL trials Crusoe has shown an average response of 10% to a comprehensive programme, equivalent to just over 1.0/ha.

Having considered Crusoe's resistance to the main wheat diseases earlier (pages 6 and 7), it is possible to develop a fungicide strategy to optimise the performance of the variety. The aim should be to keep the crop clean to the ground but the flag leaf and top two leaves are particularly important with respect to grain filling. It is essential that *Septoria tritici* is controlled very effectively and crops receive adequate protection against the rusts, mildew and eyespot to compliment the disease resistance of the variety.

TO (Pre GS30)

This fungicide is frequently used as an early pre-season 'clean up' in wheat and as an insurance to help with disease management later on, particularly as mixing with the first part of a sequential PGR programme is possible (page 12).

Crusoe is unlikely to require a routine TO treatment but a reduced rate application of chlorothalonil will help to delay *Septoria* development.

T1 (GS31-32)

The main disease to be targeted at this time will continue to be *Septoria tritici* and the fungicide should be timed to coincide with the emergence leaf three. Sprays should be based on a triazole, with some chlorothalonil added to maintain protection.

TO and T1

If either mildew or eyespot is present at the TO or T1 timings these will need to be catered for in the fungicide mix. A number of very effective mildewicides are available i.e. Talius. Flexity has activity on mildew and eyespot, and Proline and Tracker are effective against eyespot and *Septoria*.

T2 (GS37 – 39)

Aimed at keeping the top two leaves clean and maintaining *Septoria* control, triazoles have proved to be very reliable at this timing. On Crusoe, which has very good resistance to *Septoria*, there is scope to use lower rates than on other more susceptible varieties. It is important that sufficient fungicide is applied – at least a half label rate – to maintain green leaf area of the upper leaves.

In crops with a high yield potential or where *Septoria* pressure is high, the new SDHI fungicides (Adexar, Aviator Xpro and Seguris) could be used where their persistence and effects on green leaf retention are most likely to be of benefit.

Strobilurins are frequently included in the fungicide mix at the T2 timing. On Crusoe their contribution to disease control is likely to be small but their physiological effects may be useful.

T3 (GS60 +)

An ear emergence fungicide will be valuable on Crusoe to maintain earlier disease control, provide protection against specific ear diseases and help to improve specific weight.

A number of products are available for ear disease control with those based on Proline ± a strobilurin performing well at this timing. A quarter to a half label dose is appropriate for additional disease control. A minimum of half dose is necessary for *Fusarium* control.

CRUSOE - RESPONSE TO FUNGICIDES

In addition to the Farmer Trials mentioned earlier, Limagrain conduct their own Agronomy Trials to investigate the response of varieties to different fungicide and PGR regimes. In 2011, Crusoe was included in these trials and treated with a comprehensive range of PGR and fungicide programmes. Although the trial was a first cereal drilled in good time, disease pressure was very low and the site suffered from a lack of rainfall during much of the spring growing season.

For the fungicide comparison trial, the treatments were:

- The HGCA programme, designed to keep disease levels to a minimum and measure the genetic potential of a variety
- A relatively inexpensive triazole based programme
- Programmes from Bayer, BASF and Syngenta, using largely triazole chemistry with the inclusion of strobilurins at T2 and T3 (Bayer and Syngenta) or 'stacked' triazoles (BASF)
- As above but with the addition of the new SDHI chemistry

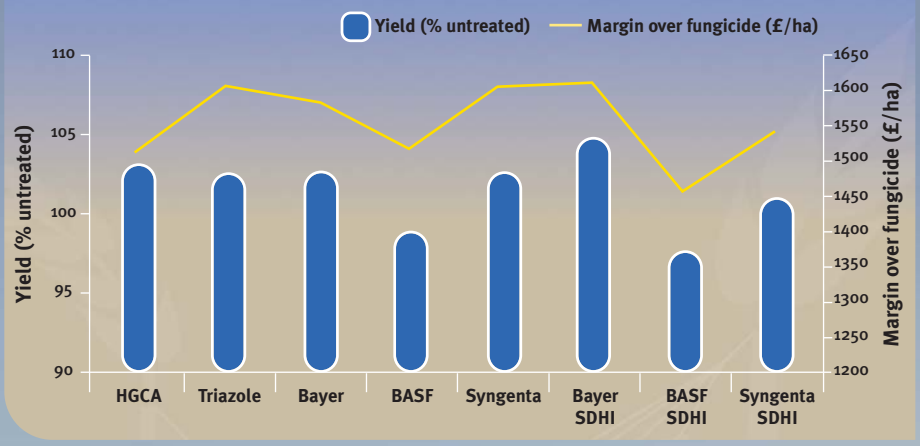
Full details of the treatments are given in Table 7, along with an indication of the cost/ha.

Table 7: Limagrain Fungicide Programme Trials 2011

	T0 GS30/31		T1 GS32		T2 GS39/45		T3 GS60/65		Approx cost £/ha
	Product	Rate (l/ha)	Product	Rate (l/ha)	Product	Rate (l/ha)	Product	Rate (l/ha)	
HGCA	Talius Ignite	0.15 0.625	Tracker Bravo Flexity	1.5 1 0.5	Aviator Talius	1 0.15	Proline Comet	0.72 0.75	178
Triazole	Opus Talius	0.4 0.15	Tracker Bravo	0.75 1	Opus Bravo	0.75 1	Caramba	0.5	76
Bayer	Opus Talius	0.4 0.15	Proline Bravo	0.6 1	Firefly	1.5	Firefly	1	103
BASF	Opus Talius	0.4 0.15	Tracker Bravo	1 1	Tracker Ignite	1 0.375	Brutus	1	105
Syngenta	Opus Talius	0.4 0.15	Cherokee	1.5	Amistar Opti Ignite	1.25 0.75	Amistar Opti Folicur	0.75 0.75	77
Bayer SDHI	Opus Talius	0.4 0.15	Proline Bravo	0.6 1	Aviator	1	Firefly	1	107
BASF SDHI	Opus Talius	0.4 0.15	Adexar Bravo	1 1	Adexar Comet 200	1.6 0.4	Brutus	1	146
Syngenta SDHI	Opus Talius	0.4 0.15	Amistar Opti Ignite	1.25 0.75	Seguris	1	Amistar Opti Folicur	0.75 0.75	116

The yields and margin over fungicides for the trial are presented in Chart 6.

Chart 6: Yield Response in Fungicide Programme Trials



Source: Limagrain 2011, Suffolk. Wheat price of £160/t + £20 premium used in the margin calculations.

The yield response to all of the TO treatments was small, in the range of 99% to 105% of the untreated control (9.1 t/ha), reflecting the generally low level of disease and Crusoe's good resistance. The HGCA and triazole based programmes had similar responses - 3% above the untreated - as did the Bayer and Syngenta treatments with the strobilurins added. Two of the SDHI programmes (BASF and Syngenta) showed no benefit over their non-SDHI counterparts with only the Bayer SDHI programme increasing yields by an additional 2%.

When a margin over fungicide cost (yield x £/tonne {£160 + £20 premium} – fungicide cost) is calculated, differences between treatments become more apparent with £154/ha separating the highest and lowest margin. The highest margins came from the two cheapest programmes (triazole and Syngenta strobilurin) and the Bayer SDHI. In margin terms the effects of adding either a strobilurin or an SDHI to the triazole programme were variable with no obvious benefits coming from the different fungicide groups in this trial.

Although the results were influenced by the season and low disease pressure, they do show the importance of matching fungicide use to the genetic resistance inherent in a variety such as Crusoe and how this can be reflected in the final margin.

CRUSOE - RESPONSE TO PGRs

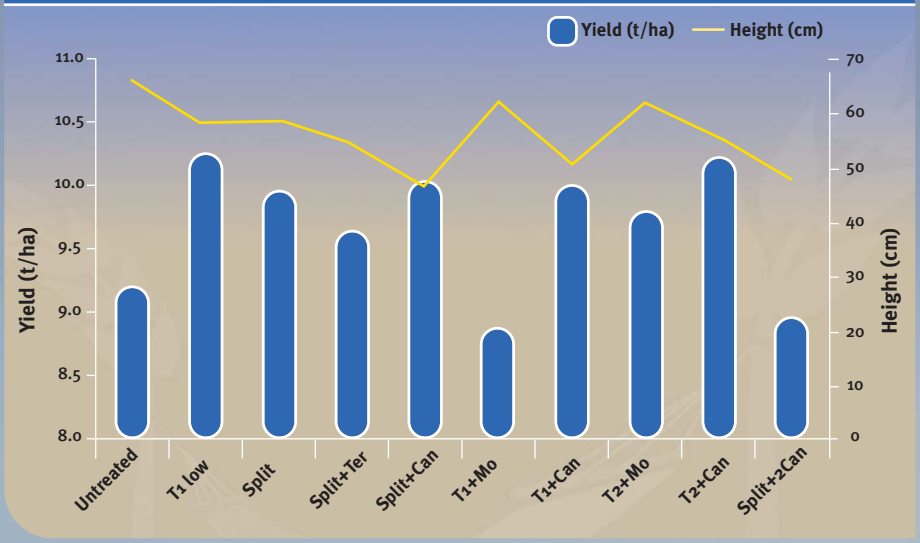
Crusoe was also included in a variety screen conducted by Limagrain in conjunction with BASF to measure the effects of PGR treatments on a number of varieties, details of which are presented in Table 8.

Table 8 Limagrain/BASF PGR Screen 2011

Treatment	T1 GS30/31		T2 GS31/32		T2 GS37	
	Product	Rate (l/ha)	Product	Rate (l/ha)	Product	Rate (l/ha)
Untreated						
T1 low	5C Cycocel	1.75				
Split	5C Cycocel	1.75	5C Cycocel	0.75		
Split+Ter	5C Cycocel	1.75	5C Cycocel	0.75	Terpal	0.75
Split+Can	5C Cycocel	1.75	5C Cycocel	0.75	Canopy	0.75
T1+Mo	5C Cycocel Moddus	1.75 0.2				
T1+Can	5C Cycocel Canopy	1.75 0.75				
T2+Mo			5C Cycocel Moddus	1.75 0.2		
T2+Can			5C Cycocel Canopy	1.75 0.75		
Split+T2Can	5C Cycocel	1.75	5C Cycocel Canopy	1.75 0.75		

The trial was affected by the same dry conditions as the fungicide trial: untreated Crusoe was 66cm tall compared with 85cm in HGCA trials. There was no lodging but differences in crop heights between treatments were recorded and the trial was taken to yield (Chart 7, overleaf).

Chart 7: PGR Screen: Crop Height and Yield



Source: Limagrain/BASF 2011

All the treatments reduced crop height when compared with the untreated - by 11cm on average - with large differences apparent between treatments. Those which included either a split Cycocel application and/or Canopy were the most effective in reducing height whilst those with Moddus tended to be less effective.

The majority of treatments gave an increase in yield (about 6% on average) when compared with the untreated, except for the 5C Cycocel + Moddus and the split Cycocel with Canopy at T2. Three of the four highest yielding treatments had 5C Cycocel at T1 and there was no obvious relationship between reductions in crop height and yield.

Clearly the results have to be interpreted with care given the dry spring conditions. They do show that Crusoe is responsive to PGR use and suggest that PGR applications which include 5C Cycocel split between GS30 and 32 can be very cost effective (see PGR section page 12). The general absence of any adverse effects from PGRs on Crusoe in this trial is also encouraging.

CRUSOE - HUSBANDRY SUMMARY

- Drill between mid-September and the end of October, adjusting seed rate to sowing date and soil conditions
- Apply nitrogen in three doses, split between three key growth stages with the option for an additional application to enhance protein levels
- Use a three spray fungicide programme targeted at *Septoria* and catering for the rusts, mildew and eyespot as necessary
- Assess lodging risk and use sequential spring PGRs in conjunction with seed rate, nitrogen timing and stem base disease control

Notes:
Full data, unless indicated otherwise, is from the HGCA Recommended Lists database, available at www.hgca.com.
On the 1-9 scales, high figures indicate that a variety shows the character to a high degree.

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