



Barley

Introduction

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This variety guide is designed as a reference to help determine which barley variety to grow in your region. It provides market feedback, relative grain yield and grain quality comparisons, disease ratings and agronomic information for malt barley varieties segregated in Western Australia (WA), those in Stage Two of malt accreditation with Grains Australia and selected varieties deliverable as feed to the WA bulk handling system (Tables 1–15; Figures 1–7).

The removal by China on 05 August 2023 of the 80.5% anti-dumping and countervailing duty measures imposed on Australian barley in 2020 is good news for all Australian barley growers. The re-opening of trade with China is expected to benefit WA malt barley growers significantly, given the strong history of our relationship with China and the excellent fit that our varieties have in their malting and brewing systems. However, Chinese maltsters and brewers will need to adjust to the change in the malt variety mix since they implemented tariffs in 2020. For example, varieties such as La Trobe and Scope CL are no longer segregated, and WA growers have switched from Spartacus CL (relatively new in 2019) to Maximus CL. In 2024, six varieties could be accredited by Grains Australia.

With China out of the market over the past three harvests, diversification (and acceptance) of Australian barley grain and malt to Africa, Mexico, and South America has occurred, along with continued sales to long-standing customers in South-East Asia and Japan. As Australian barley grain can now start flowing into China, there will be disruptions to international trade flows.

Over time, if China offers a market price superior to other options, China can be expected to again become a significant trading partner for Australian barley. Chinese demand is significantly higher than other markets we have serviced over the past three seasons. The relationships developed with maltsters and brewers in Africa, Mexico, and South America will, however, continue and provide a broader market opportunity for our barley.

High-quality malt barley that can be malted without processing aids is in strong demand from export customers of our malt barley grain and domestic processors of export malt. Demand for Bass, Flinders and RGT Planet has influenced premiums for malt over feed, especially in the Kwinana port zone, with significant premiums offered over the past two years. The low supply of Bass, Flinders, and RGT Planet will exclude WA malt barley in several premium markets in Asia until production ramps up of new varieties suited to malting without processing aids. Unfortunately, Spartacus CL and Maximus CL are less suited to malting without processing aids.

With the Australian Export Grains Innovation Centre (AEGIC) building technical capability and production knowledge in South-East Asia (focusing on Vietnam, Thailand, Philippines and Indonesia), there is a growing awareness of the value proposition afforded from including barley in animal feed rations. Such diversification opportunities enable feed barley sales to a broader range of international animal feed markets. While Saudi Arabia is the largest feed market for Australian feed barley, Iran, Jordan, Kuwait, and Qatar are also crucial, with demand from the Philippines and Vietnam rising steadily.

Deciding whether to grow barley for malt or feed classification still depends on five main factors:

1. Premium paid for different varieties when segregated.
2. Relative grain yield of malt and feed grade barley varieties.
3. Differences in input costs due to their agronomic and disease characteristics.
4. Likelihood of meeting malt barley receival specifications with a malt variety.
5. Location of receival segregations for malt barley varieties.

The decision to sow wheat instead of barley depends on:

1. The price spread between wheat and barley.
2. Relative grain yield of malt barley, feed barley and wheat.
3. Availability of premiums for malt grade barley.

WA’s receival standards for BFED1 (feed barley) focus primarily on hectolitre weight (minimum of 56kg/hL) as the critical quality trait. This differs from growers in eastern Australia who deliver against Grain Trade Australia (GTA) Barley1 (feed barley) receival standards and are required to meet both hectolitre weight (minimum of 62.5kg/hL) and screenings targets (maximum of 15% through a 2.2mm slotted sieve). Therefore, feed barley

production systems in WA can focus on targeting yield (with minimal consideration of quality), which enables the sowing of the highest-yielding variety (regardless of its malt accreditation or segregation opportunity). Production systems that maximise grain yield potential include a mid-April to mid-May sowing, targeting a density of 180–220 plants/m² with nutrition, herbicide and fungicide strategies in line with the yield potential, deficiencies and risks of the site and the variety sown.

When sowing a malt variety targeting MALT1, it will be necessary to hold discussions with domestic processors and the trade before planting to understand better which malt segregations are likely to be available and the potential premium for MALT1 barley. Growers are encouraged to deliver malt barley grain between 10.3–10.8% protein for domestic sales and 10.5–11.0% for export sales (even though the receival window is 9.5–12.8%) with a minimum of 80% retention on a 2.5mm sieve, a hectolitre weight above 64kg/hL with ryegrass ergot less than 3cm, no whole snails and no glyphosate use near harvest.

Barley varieties differ in their agronomic fit across WA, and market demand for malt barley varieties varies by port zone due to the various domestic and international markets serviced by each port zone. Therefore, choosing a variety that suits your farming business and meets the needs of different customers can be complicated.

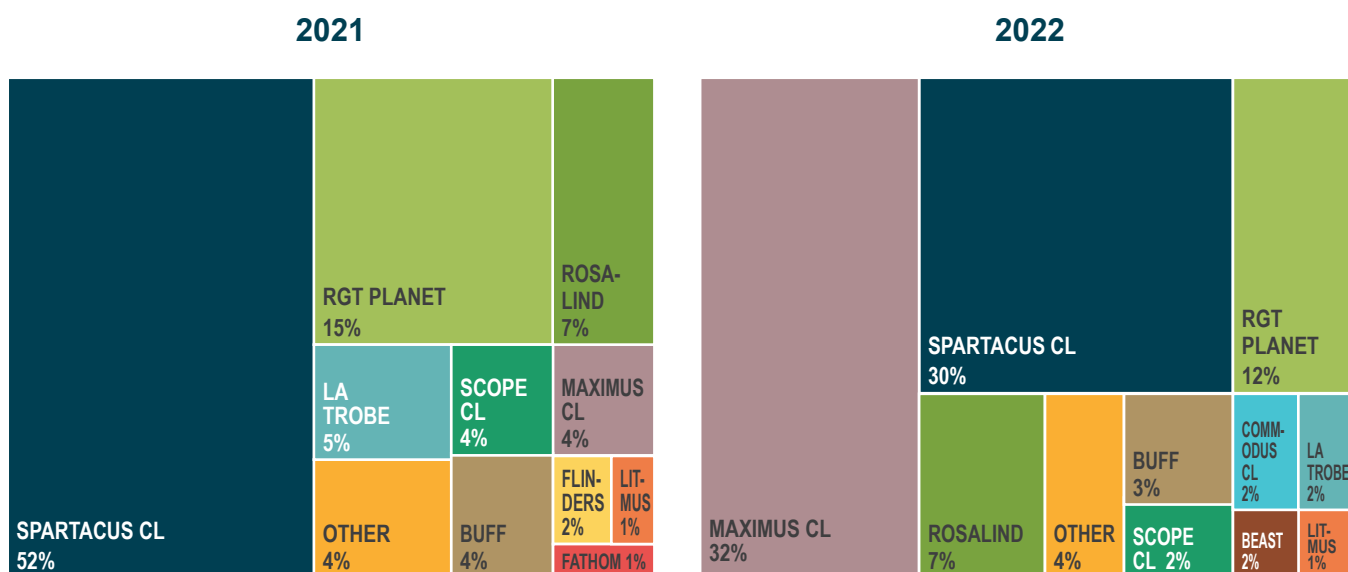


Figure 1. Relative popularity (percentage of barley area) of the top ten barley varieties plus the combined area sown to the other 20 varieties delivered in WA in 2021 and 2022. The top ten varieties occupied 96% of the area planted to barley in both seasons.

Source: grower estimates provided to CBH for 2021 and 2022

Table 1. Comparison of barley variety traits across seven of the more popular varieties grown in WA

Trait	Beast	Buff	Commodus CL	RGT Planet	Rosalind	Spartacus CL	Maximus CL
First year in variety trials in WA	2019	2016	2020	2016	2014	2014	2018
Statewide MET yield (% site mean) ¹	107%	103%	100%	102%	108%	102%	106%
Maturity (sown in late May)	Early spring	Early spring	Early spring	Medium spring	Early spring	Early spring	Early spring
Deliverable as / accreditation stage ²	Stage 2	Malt	Stage 2	Malt	Feed	Malt	Malt
Brewing demand (barley and malt) ³	-	-	-	Preferred	-	Acceptable	Acceptable
Straw strength (excl. head loss)	Fair	Moderately good	Fair	Good	Good	Good	Good
Sc ⁴	S	MS	MSS	MR	MSS	MR	MR
NFNB – Beecher virulent	MRMS	MS	MRMS	S	MS	MS	MRMS
NFNB – Beecher avirulent	MS	MRMS	MRMS	MS	MR	MS	MRMS
NFNB – Oxford virulent	MSS	MS	MSS	SVS	MSS	S	S
SFNB	MSS	S	MSS	S	S	SVS	MSS
PM	MR	S	MR	R	MSS	MS	RMR
BLR	MSS	S	MSS	MRMS (late APR)	MR	MSS	MSS

Source: Blakely Paynter, Sanjiv Gupta, GIWA, Grains Australia and NVT Online nvtonline.com.au

¹Regional differences in grain yield are masked when using a statewide average of the WA barley NVT MET data (2018–2022). Growers are directed to Tables 4 to 10 for a more precise estimate of variety performance in their region and Figures 2 and 3 for an indication of relative variety performance at different site yields.

²Varieties classed as malt have been accredited by Grains Australia. Varieties classed as Stage 0, 1 or 2 are under evaluation for their malting and brewing end-use in the Grains Australia Malt Accreditation Program

³For more information on malting and brewing demand, go to the 'Market feedback' section.

⁴Adult plant foliar disease abbreviations: Sc = Scald, NFNB = net-form net blotch, SFNB = spot-form net blotch, PM = powdery mildew, BLR = barley leaf rust and APR = adult plant resistance. Resistant varieties (non-*mlo*) may show a variable reaction to strains of PM present in the southern regions of WA.

Barley variety choice in 2024 – what should I grow?

The change in variety popularity from 2019 to 2021 saw an increase in the area sown to Spartacus CL and a plateauing of RGT Planet. Growers began switching from Spartacus CL to Maximus CL in 2022, resulting in both varieties having similar popularity at seeding (Figure 1). Growers have continued to reduce the area sown to Bass, Flinders, La Trobe, RGT Planet and Scope CL while increasing the area to Beast and Commodus CL. The proportion of the area sown to Buff and Rosalind stabilised in 2022.

The removal of tariffs on Australian barley exports to China provides greater market opportunities for WA, especially for growers in the Albany and Esperance port zones. There will be increased demand for varieties that meet MALT1 specifications, requiring a sharpened focus on varieties with a high yield potential and good grain quality while managing their susceptibility to leaf diseases. Sowing date, location, yield potential,

disease pressure, soil type, herbicide system and segregation options will drive individual choices.

Since its release, Rosalind has been the yield benchmark in WA and remains an attractive option when targeting yield across a range of yield potentials. Combat and Cyclops have now superseded Rosalind for grain yield potential in the medium to high rainfall areas. Beast and Titan AX are benchmarks in lower rainfall areas, and Buff is a benchmark on acidic and non-acidic soils in low rainfall areas north of the Great Eastern Highway.

RGT Planet has remained a good option, particularly in higher rainfall areas where it performs increasingly well as yield potential increases. However, as disease pressure starts to bite, alternatives such as Cyclops, Laperouse and Minotaur are being considered. Zena CL is another option, but its only advantage over RGT Planet is its tolerance to imidazolinone (IMI) herbicides, as it has the same disease risk.

Growers targeting barley for sowing in an IMI herbicide management system have many plant types available, including Commodus CL

Table 2. Comparison of barley variety traits across six of the newer varieties and the most widely sown variety, Maximus CL

Trait	Combat	Cyclops	Laperouse	Minotaur	Titan AX	Zena CL	Maximus CL
First year in variety trials in WA	2021	2020	2016	2020	2021	2021	2018
Statewide MET yield (% site mean) ¹	111%	109%	106%	106%	105%	101%	106%
Maturity (sown in late May)	-	Early spring	Medium spring	Medium spring	-	Medium spring	Early spring
Deliverable as / accreditation stage ²	Feed	Stage 2	Stage 2	Stage 2	Stage 1	Stage 2	Malt
Brewing demand (barley and malt) ³	-	-	-	-	-	-	Acceptable
Straw strength (excl. head loss)	-	Good	Good	Good	Fair	Good	Good
Sc ⁴	S	MRMS	S	VS	S	MR	MR
NFNB – Beecher virulent	MSS	MRMS	MRMS	MRMS	MRMS	MS	MRMS
NFNB – Beecher avirulent	MSS	MRMS	MRMS	MRMS	MRMS	MRMS	MRMS
NFNB – Oxford virulent	MS	MSS	MSS	MS	MS	SVS	S
SFNB	MRMS	MSS	MSS	S	MSS	SVS	MSS
PM	R	MR	MR	S	RMR	R	RMR
BLR	MRMS _p (late APR)	S	MSS	S	S	MRMS (late APR)	MSS

Source: Blakely Paynter, Sanjiv Gupta, GIWA, Grains Australia and NVT Online nvtonline.com.au

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(semi-erect and tall), Maximus CL (erect and medium height), Scope CL (semi-erect and tall), Spartacus CL (erect and medium height) and Zena CL (prostrate and medium height). Varieties with tolerance to IMI herbicides occupied two in every three barley hectares in 2022. Commodus CL offers greater early vigour at a similar yield potential but with increased lodging risk. Even if accredited by Grains Australia, the industry does not expect Commodus CL to be segregated in WA due to its malt quality profile (low fermentability). Maximus CL has a similar plant type to Spartacus CL, and growers consider this plant type to be less competitive with weeds. Maximus CL has replaced Spartacus CL as the dominant variety being grown in the state. Scope CL is still a popular variety well suited to early sowing opportunities. Zena CL is modelled on RGT Planet, offering the same plant type and similar agronomic performance but tolerant of IMI-herbicides. The industry expects Zena CL to have a similar market fit to RGT Planet if accredited by Grains Australia, subject to market sensitivities around herbicide residues in this well-known malt background.

There is strong demand for Bass, Flinders and RGT Planet from malting and brewing customers in South-East Asia and Japan as the varieties can be malted without processing aids and are well-known by the market. All three varieties are in production decline. Growers should expect price premiums over and above other malt barley options (i.e. Buff, Maximus CL and Spartacus CL). Segregations of Flinders will cease after the 2023–24 harvest, while the 2024–25 harvest will be the last harvest for Bass segregations. Production volumes of Buff are sufficient to support segregations in the Kwinana port zone. Feedback from domestic maltsters suggests Buff could be suitable for malting without processing aids and, therefore, might be an alternative to Bass, Flinders and RGT Planet. There is the opportunity for contract production of Bottler and LG Alestar for domestic processing, as their production volumes are too low to support segregation in WA. Bottler and LG Alestar are suitable for malting without processing aids and could fill a gap in the market due to the reduced supply of Bass, Flinders and RGT Planet, which require a sustainable production level in WA to warrant domestic demand.

Barley varieties with specific traits have a functional agronomic fit in certain areas, such as Buff on soils with a subsoil pH_{Ca} below 4.8; Scope CL for early sowing and grazing systems where an IMI herbicide might be needed; Banks for early sowing; Beast, Combat and Laperouse where a more weed-competitive growth habit might be helpful; and Combat where the risk of SFNB is high.

Titan AX is a new herbicide-tolerant barley option that allows growers to apply Aggressor® (quizalofop-P-ethyl), a Group 1 herbicide, to control in-crop brome grass, barley grass, wild oats, susceptible ryegrass and ALS (Group 2) resistant weeds. The advantage of this system over the IMI system is that there are no soil and grain residues when applied according to the label. Titan AX has a similar plant type to Compass and, therefore, has the advantage of being competitive against weeds.

Barley varieties suited to low rainfall environments include Beast (weed competitive and taller plant type), Buff (acid soil tolerance and for delivery into MALT1 segregations), Commodus CL (IMI herbicide system and weed competitive plant type), Maximus CL (if MALT1 is the target or an IMI system is practised), Rosalind (reliable yield performance) and Titan AX (alternative to IMI system).

For medium rainfall environments, Combat (where SFNB is an issue and a new yield benchmark), Cyclops (Rosalind replacement and a future malt option if accredited), Maximus CL (if MALT1 is the target or an IMI system is practised) and Titan AX (alternative to IMI system) are excellent options. Neo CL (IMI herbicide system) could also be a good fit for medium rainfall areas.

For higher rainfall areas, Bass (for use by domestic maltsters), Combat (where SFNB is an issue and a new yield benchmark), Cyclops (Rosalind replacement and a future malt option if accredited), Maximus CL (if MALT1 is the target or an IMI system is practised), Laperouse (disease resistance and taller straw), Neo CL (yield or an IMI system is practised), RGT Planet (yield and competitive plant type), and Zena CL (yield and competitive plant type in an IMI background) are worth growing after considering their relative strengths and weaknesses.

This bulletin outlines the characteristics of current malt varieties, newer options and selected older barley varieties. More information about each suggested barley variety for WA can be found in the variety snapshot section, with additional commentary on the newer barley varieties in the 'New in 2024' section below. The 'Market feedback' section provides specific market information published by the Grain Industry Association of Western Australia (GIWA) for varieties received as malt.

New in 2024

A suite of new barley varieties has become available to growers. AGT has released Cyclops (tested as AGTB0200), Minotaur (tested as AGTB0213) and Titan AX (tested as AGTB0325). InterGrain has released Combat (IGB1944), Commodus CL (tested as IGB1908T), Neo CL (tested as IGB22102T) and Zena CL (tested as IGB20125T). SECOBRA Recherches, through Seednet partners, are progressing Laperouse (tested as WI4592).

When deciding which barley variety to sow, grain yield potential needs to be balanced against trade-offs with agronomy, disease resistance, grain quality, segregation opportunities and market demand. Commonly-grown varieties differ in their agronomic traits and the pathways to building yield (i.e. trade-offs between tiller number, grains per ear and grain weight). These phenotypic differences may favour one variety over another in some seasons but not in others. Therefore, looking across seasons and sites is vital when assessing which variety best suits each farming business.

The following are notes on these newer barley varieties: Combat, Commodus CL, Cyclops, Laperouse, Minotaur, Neo CL, Titan AX, and Zena CL.

Combat

Key points:

- Released as a feed-only variety and not being evaluated for brewing potential.
- Targeted for sowing across various environments from low to high rainfall zones.
- Combat has been tested in WA barley NVT since 2021.
- New yield benchmark above 5t/ha.
- Comparable resistance to Fathom for SFNB, PM and BLR but with higher yield potential.
- Scald management is required in adult plants.

Combat (tested as IGB1944) is a medium-height, medium-spring, two-row feed variety bred by InterGrain and registered as a variety in August 2022.

Combat has the highest multi-year weighted NVT yield in WA at 111% of the site mean compared to Beast at 107%, Cyclops at 109% and Rosalind at 108%. In a linear regression analysis (2021–2022), Combat had a yield advantage over other varieties when the site yielded more than 5t/ha (Figure 3). Across 52 WA barley NVT (2021–2022), Combat yielded less than Rosalind in 4% of trials, the same in 21% and higher in 75% (Table 12). Relative to Cyclops, Combat yielded less in 10% of trials, the same in 46% of trials and higher in 44% (data not shown).

Combat is an allrounder suited to various growing environments, with good early canopy size and ground coverage for weed suppression. It has moderate straw strength and a medium risk of head loss.

Combat has valuable resistance to SFNB, powdery mildew (PM) and BLR (with late adult plant resistance, APR) but may need management for scald (Tables 13 and 14). As a seedling, it is rated as S to the Beecher and SVS to the Oxford virulent strains of NTN, with slightly better resistance as an adult (MSS and MS, respectively). It has better tolerance to the Beecher avirulent strain of NTN, being MRMS as a seedling and MSS as an adult.

Seed is available for planting in 2024 from Seedclub members and resellers.

Commodus CL

Key points:

- In Stage Two assessment for malt accreditation in 2023, with the earliest accreditation date March 2024.
- Targeted for sowing in low to medium rainfall zones and lighter soil types.
- Commodus CL has been tested in WA barley NVT since 2020.
- The statewide MET yield for Commodus CL is 3% below Compass, the variety it is modelled on. Its yield disadvantage relative to Compass was more evident at lower-yielding sites than higher-yielding sites.
- Commodus CL, like Spartacus CL, Maximus CL and Zena CL, has the gene conferring tolerance to label application rates of registered IMI products.
- Susceptible to PM in the presence of *MILa* virulence.

Commodus CL (tested as IGB1908T) is an IMI-tolerant, tall-height, early spring, two-row variety bred by InterGrain and registered as a variety in October 2020. Commodus CL has a similar genetic background to Compass. Feedback from the breeder suggests that even if accredited by Grains Australia, WA has no interest in processing Commodus CL into malt. Likewise, the trade has expressed little interest in segregating it for export as grain for brewing end-use. Commodus CL is a variety with a low fermentability profile.

Across 79 WA barley NVT (2020–2022), Commodus CL yielded less than Compass in 29% of trials, the same in 71% and higher in 0% (data not shown). Relative to Maximus CL, Commodus CL yielded less in 53% of 79 WA barley NVT (2020–2022), the same in 34% and higher in 11% (Table 11).

Commodus CL is best suited to low and medium rainfall environments, has good early canopy size and ground coverage for weed suppression, high grain plumpness and is of a similar plant height to Compass but is tolerant to IMI herbicides. Straw strength may be an issue in longer-growing environments and sites with higher yield potential. Head loss risk is expected to be like Compass.

Commodus CL has useful resistance to NFNB (Beecher avirulent and virulent) and PM (except in the presence of *MILa* virulence) with a lower level of resistance to scald, NFNB (Oxford virulent) and BLR (Tables 13 and 14). It is rated as MRMS as a seedling and MSS as an adult plant to SFNB, limiting disease expression.

Seed is available for planting in 2024 from Seedclub members and resellers. It is not legal to acquire Commodus CL via farmer-to-farmer trading.

Cyclops

Key points:

- In Stage Two assessment for malt accreditation in 2023, with the earliest accreditation date March 2024.
- Targeted for sowing in all rainfall zones, but better suited to medium and higher rainfall areas.
- Cyclops has been tested in WA barley NVT since 2020.
- Has shown a yield advantage over Rosalind, primarily in environments that yielded less than 2t/ha or more than 4t/ha.
- Requires management of NFNB (Oxford avirulent) and BLR.

Cyclops (tested as AGTB0200) is a medium-height, early spring, two-row variety bred by AGT and registered as a variety in August 2021. Cyclops has the same erect-growing habit as La Trobe (due to similar dwarfing genetics), with short coleoptile and short rachilla hairs, making it a low itch variety. The breeder has engaged with grain marketers and malt companies operating in WA, and there is positive interest in Cyclops subject to Grains Australia accreditation and sufficient scale of production.

Across 59 WA barley NVT (2020–2022), Cyclops yielded more than RGT Planet in three of every four WA barley NVT (Table 11), with an advantage below 6t/ha (Figure 4). Relative to Rosalind, Cyclops was lower yielding in 22% of 79 WA barley NVT (2020–2022), the same in 42% of trials and higher yielding in 40% of trials (Table 12), with the yield advantage most apparent in environments yielding below 2t/ha or above 4t/ha (Figure 3).

According to the breeder, Cyclops is adapted to a wide range of environments and has a competitive grain quality package. Growers should expect its agronomic attributes (i.e. lodging and head loss risk) to be similar to those displayed in varieties with similar dwarfing genes, like La Trobe and Spartacus CL.

The grain quality of Cyclops is an improvement on Spartacus CL for grain plumpness with a lower hectolitre weight and a similar grain protein concentration at the same grain yield (data not shown). Cyclops grain has a lower hectolitre weight and retention (Figures 5 and 6) at the same grain protein concentration for a given grain yield (data not shown) relative to Maximus CL. A slightly lower probability of receival as MALT1 is likely. There is insufficient evidence to determine if Cyclops has the same germ-end staining risk as Maximus CL and Spartacus CL.

Cyclops has useful resistance to scald, NFNB (Beecher virulent), and PM but may need management for NFNB (Oxford avirulent) and BLR (Tables 13 and 14). It is rated MSS to SFNB (seedling and adult plant), limiting disease expression relative to susceptible varieties like RGT Planet, Rosalind and Spartacus CL. Given its genetic background, it is unknown if it carries the same risk of smut as Maximus CL and Spartacus CL.

Seed is available for planting in 2024 from AGT Affiliates and resellers. Seed is also free to trade from farmer to farmer by complying with the AGT Seed Sharing Licence Agreement (agtbreeding.com.au/sourcing-seed/seed-sharing).

Laperouse

Key points:

- In Stage Two assessment for malt accreditation in 2023, with the earliest accreditation date March 2024.
- Targeted for sowing in medium to higher rainfall areas.
- Laperouse has been tested in WA barley NVT since 2016.
- Statewide grain yields of Laperouse have been competitive with Rosalind.
- Needs management for scald and NFNB (Oxford virulent).

Laperouse (tested as WI4592) is a medium-height, medium-spring, two-row barley bred by the University of Adelaide barley breeding program, licenced to SECOBRA Recherches. It was registered as a variety in September 2019 and is being commercialised by Seednet. The breeder has engaged with malt companies operating in WA, and there is positive interest in Laperouse subject to Grains Australia accreditation and sufficient scale of production.

Laperouse is targeted for sowing in medium to higher rainfall areas. It has good straw strength and head retention but no tolerance to IMI-herbicides. Across 119 WA barley NVT (2018–2022), Laperouse yielded less than Maximus CL in 26% of trials, the same in 44% and higher in 30%, with a statewide MET yield the same as Maximus CL at 106% of the site mean (Tables 10 and 11). Since 2020, the yield of Laperouse and Maximus CL (assessed by linear regression) has been similar at sites ranging from 1 to 7t/ha (Figure 4). Across 119 WA barley NVT (2018–2022), Laperouse yielded more than RGT Planet at just over half the sites (Table 11), with this yield advantage over RGT Planet apparent at sites where the yield is below 4.5t/ha (Figure 4).

When grown under the same management in NVT trials, Laperouse grain tends to have a slightly lower hectolitre weight than Maximus CL (Figure 5), with fewer screenings (Figure 6) and a lower grain protein concentration at the same grain yield (data not shown). Laperouse's grain quality profile suggests that the probability of receival MALT1 would be higher than RGT Planet if accredited by Grains Australia and segregated in WA.

Laperouse has excellent resistance to PM and useful resistance to NFNB and SFNB. It is rated MRMS as a seedling to SFNB and MSS as an adult plant, limiting disease expression. Laperouse is less suited to areas where scald is a regular production constraint (Tables 13 and 14). While RGT Planet may have a yield advantage over Laperouse at sites that yield more than 5t/ha, Laperouse is likely to have a lower fungicide cost in these environments due to a higher resistance level to NFNB and SFNB.

Seed is available for planting in 2024 from Seednet partners. In WA, farmer-to-farmer trading is also allowed.

Minotaur

Key points:

- In Stage Two assessment for malt accreditation in 2023, with the earliest accreditation date March 2024.
- Targeted for sowing in medium to high rainfall zones.
- Minotaur has been tested in WA barley NVT since 2020.
- Statewide performance is an improvement over RGT Planet in environments that yield less than 4t/ha.
- Below 4t/ha, Minotaur is not competitive against Cyclops or Rosalind.
- Requires management for scald, SFNB, PM and BLR.

Minotaur (tested as AGTB0213) is a medium-height, medium-spring, two-row variety bred by AGT and registered as a variety in August 2021. Minotaur has the prostrate growth habit of RGT Planet with a medium coleoptile. Minotaur was produced by crossing European and Australian genetics. The breeder has engaged with grain marketers and malt companies operating in WA, and there is positive interest in Minotaur subject to Grains Australia accreditation and sufficient scale of production.

Across 79 WA barley NVT (2020–2022), Minotaur yielded less than RGT Planet in 13% of trials, a similar amount in 33% of trials and higher in 54% of trials (Table 11), with an advantage at sites yielding less than 4t/ha (Figure 4). In those same trials, Minotaur yielded less than Maximus CL in 32% of trials, similar in 27% and higher in 54%, with an advantage above 5t/ha.

Minotaur is suited to a broader range of environments than RGT Planet and offers improvements in physical grain quality, often delivering a higher hectolitre weight (Figure 5). Minotaur's hectolitre weight is, however, poorer than Maximus CL (Figure 5). Grain plumpness is slightly better than RGT Planet but not as good as Maximus CL (Figure 6). If accredited by Grains Australia and segregated in WA, Minotaur should have a higher probability of receival as MALT1 than RGT Planet but lower than Maximus CL.

Minotaur has excellent resistance to NFNB (Beecher virulent and avirulent) and limited resistance to NFNB (Oxford avirulent) but needs management for scald, SFNB, PM and BLR (Tables 13 and 14). Minotaur is rated as VS to scald and should be closely monitored.

Seed is available for planting in 2024 from AGT Affiliates and resellers. Seed is also free to trade from farmer to farmer by complying with the AGT Seed Sharing Licence Agreement (agtbreeding.com.au/sourcing-seed/seed-sharing).

Neo CL

Key points:

- Has been entered into Stage One of the Grains Australia Malt Accreditation program in 2023, with the earliest accreditation date being March 2025.
- Targeted for sowing in medium and high rainfall areas.
- Neo CL first entered WA barley NVT in 2023 with little independent data available in WA from environments that yield less than 3t/ha. Trials undertaken by DPIRD and FAR Australia in 2022 had yield potentials above 4t/ha.
- InterGrain internal data suggests Neo CL is a new yield benchmark for IMI-tolerant varieties in WA.
- Later flowering than RGT Planet when sown in mid-April, but similar in May.
- The InterGrain brochure indicates improved SFNB and NFNB resistance compared to RGT Planet.

Neo CL (tested as IGB22102T) is an IMI-tolerant, medium-height, medium-spring, two-row barley bred by InterGrain and registered as a variety in August 2022. Neo CL is a cross between Australian genetics with tolerance to IMI-herbicides and RGT Planet, with RGT Planet representing 25% of the pedigree.

Due to the lack of independent data available for Neo CL, growers should be cautious in purchasing seed. With Neo CL only being tested in WA barley NVT for the first time in 2023, growers should not assume that its performance in 2023 represents future performance. At least three seasons of data are generally required to indicate long-term

performance. The 2023 WA barley NVT and additional data collected by DPIRD will, however, provide a broader picture of the adaptation of Neo CL to environments that yield from 1–7t/ha to support seed purchasing decisions.

DPIRD data from 2022 saw Neo CL yielding similar to or higher than Maximus CL and RGT Planet at a range of nitrogen (N) levels when averaged over three sites (all sites yielded more than 4t/ha) (Figure 7). The hectolitre weight of Neo CL was similar to RGT Planet but poorer than Maximus CL and Spartacus CL. The grain plumpness of Neo CL was comparable to Spartacus CL, lower than Maximus CL and an improvement over RGT Planet. DPIRD's observations from a limited number of sites align with comments made by the Neo CL breeder.

Neo CL has been screened in NVT disease trials for only one season (2022), so its disease resistance ratings are provisional. According to the breeder, Neo CL appears to have helpful resistance to scald, NTNB, SFNB, and PM, improving the resistance of RGT Planet to NFNB and SFNB.

Seed will be available for planting in 2024 from Seedclub members and resellers. It is not legal to acquire Neo CL via farmer-to-farmer trading.

Titan AX

Key points:

- Has been entered into Stage One of the Grains Australia Malt Accreditation program in 2023, with the earliest accreditation date being March 2025.
- Targeted for sowing in low to medium rainfall zones.
- Titan AX has been tested in WA barley NVT since 2021, with only five sites in 2021 and 29 in 2022.
- Tolerant to Group 1 herbicide Aggressor® (quizalofop-P-ethyl).
- Requires management for scald and BLR.

Titan AX (tested as AGTB0325) is a herbicide tolerant, tall-height, medium-spring, two-row variety bred by AGT and was registered as a variety in April 2022. Titan AX has a similar genetic background to Compass. According to the breeder, Titan AX suits low and medium rainfall environments where early vigour and longer straw are preferred, and lodging is less of an issue.

Straw strength may be an issue in longer-growing environments and sites with high-yield potential. Head loss risk is expected to be like Compass.

Titan AX has not yet undergone any evaluation by DPIRD in small plot trials (aside from phenology). As such, we have limited independent information to help guide growers and the industry of its weaknesses and strengths. With Titan AX only being tested in WA barley NVT for the first time in 2021, and only five sites in Agzone 5 in its first year, growers should not assume that its statewide performance in 2022 represents future performance. At least three seasons of data are generally required to indicate long-term performance.

Across 34 WA barley NVT (2021–2022), Titan AX yielded less than Maximus CL in 26% of trials, the same in 27% and higher in 47% of trials (Table 11). The sites where Titan AX performed better than Maximus CL did not appear related to site potential (data not shown). The performance of Titan AX has been comparable to Beast. Across 34 WA barley NVT (2021–2022), Titan AX yielded less than Beast in 26% of trials, the same in 53% and higher in 21% of trials (data not shown).

Titan AX is the first barley variety in the world to carry tolerance to the herbicide Aggressor®, which allows growers to control susceptible populations of barley grass, brome grass, annual ryegrass, wild oats and other grass weeds in the barley phase of the rotation without the residue issues (soil and grain) associated with IMI-herbicide systems.

Titan AX has valuable resistance to NFNB (Beecher virulent and avirulent) and PM (may be susceptible to the *MILa* virulence) but is less tolerant of scald, NFNB (Oxford virulent), SFNB and BLR.

Seed is available for planting in 2024 from AGT Affiliates and resellers. Seed is also free to trade from farmer to farmer by complying with the AGT Seed Sharing licence (agtbreeding.com.au/sourcing-seed/seed-sharing). All Titan AX growers must complete an online CoAXium® stewardship program (coaxium.com.au/stewardship). Sipcam administers the distribution of Aggressor® herbicide and the CoAXium® stewardship program.

Zena CL

Key points:

- In Stage Two assessment for malt accreditation in 2023, with the earliest accreditation date March 2024.
- Targeted for sowing in medium to high rainfall zones.
- Zena CL has been tested in WA barley NVT since 2021.
- Statewide NVT yields were comparable to RGT Planet.
- Zena CL, like Commodus CL, Spartacus CL and Maximus CL, possesses the gene conferring tolerance to label application rates of registered IMI products.
- As with RGT Planet, it requires management for NFNB (Oxford virulent) and SFNB.

Zena CL (tested as IGB20125T) is an IMI-tolerant, medium height, medium spring, two-row variety bred and developed collaboratively by InterGrain and Grains Innovations Australia (GIA). It was registered as a variety in February 2022. Zena CL has the same genetic background as RGT Planet but possesses the Clearfield® herbicide tolerance trait developed by Agriculture Victoria Services, which is currently exclusively licensed to InterGrain. If accredited by Grains Australia, the breeder expects the variety to have a similar malt and brewing market fit as RGT Planet.

Zena CL is best suited to medium and high rainfall environments. Across 52 WA barley NVT (2021–2022), Zena CL yielded the same as RGT Planet in all trials (Table 11). It has good early canopy size and ground coverage for weed suppression, with similar agronomic and grain quality characteristics as RGT Planet. Unlike RGT Planet, it is tolerant of IMI herbicides.

Zena CL has excellent resistance to scald, NFNB (Beecher avirulent), PM and BLR but will need management for NFNB (Oxford virulent) and SFNB. The same disease risks that exist with RGT Planet apply to Zena CL.

Seed is available for planting in 2024 from Seedclub members and resellers. It is not legal to acquire Zena CL via farmer-to-farmer trading.

Other considerations for barley growers

Changes in disease pathogens

New pathotypes and diseases detected in WA in recent years have ramifications for variety choices and fungicide strategies. Growers, particularly those on the south coast, should be watchful for the Oxford virulent NFNB pathotype, *Ramularia* leaf spot (RLS) and potential changes in the virulence of PM with the detection of virulence to the *MILa* gene (such as is present in Compass, Rosalind, and Spartacus CL).

Tips for managing grain protein in malt barley

When growing barley for malting, higher protein levels can be achieved by altering the timing of nitrogen (N) supply, applying more N, sowing into legume stubble or planting a higher-protein variety.

The grain protein concentration of a crop is determined by the balance of N supply and demand, a relationship heavily influenced by seasonal conditions. While it is common practice to apply the bulk of fertiliser N from seeding up to four weeks after seeding, it is not necessarily the most effective strategy for producing yield and protein. Strategies to boost grain protein include applying higher levels of N fertiliser and incorporating legumes into the rotation to increase soil N supply. Variety choice and the timing of fertiliser N applications are additional management options that can assist if current practices are not consistently delivering grain above 9.5% protein. Sowing higher protein varieties, such as Bass or even Spartacus CL and Maximus CL (where suitable), can achieve a grain protein concentration 1% higher than sowing lower protein varieties (at a similar yield level). Targeting around two-thirds of the recommended N fertiliser rate for application around the stem elongation stage of crop growth can also increase grain protein with negligible impacts on grain yield. Additional N application around flag leaf emergence can boost grain protein in some seasons. Ensuring adequate and appropriate N supply is critical in maximising grain yield at a sufficient grain protein concentration. However, delayed N strategies have the added benefit of providing a greater understanding of season potential at the time of N application.

Target plant density

When chasing grain yield in medium to higher rainfall areas, the target density for feed barley is higher than when growing barley for delivery into malt segregations.

When considering the seed rate for planting, it is essential to consider target plant density (plants per square metre) rather than set machinery seeding rates (kg/ha). While plant density is a fixed target, a fixed seeding rate in kg/ha will show variable plant density across seasons due to seed size (which varies with variety and seed source), seed viability and establishment conditions.

For malt barley, a target density of 150–180 plants/m² is appropriate to maximise yield while maintaining grain quality. For feed barley, a higher target density of 180–220 plants/m² is suggested to improve the competitiveness of the crop against weeds and maximise yield. If growing feed barley in paddocks without weeds, the target density can be adjusted downwards to 150–180 plants/m². There is, however, a 1–3% yield advantage obtained by keeping target densities at the higher density (180–220 plants/m²) suggested for feed barley, even in the absence of weeds. The impact of sowing at a higher plant density to maximise grain yield on feed grain quality is low, with a reduced hectolitre weight of less than 0.5kg/hL expected.

The target density in plants/m² determines the seeding rate in kg/ha and is calculated using the following formula:

$$\text{Seed rate (kg/ha)} = \frac{1000 \text{ kernel weight (g)} \times \text{target density (plants/m}^2\text{)}}{\text{germination \%} \times \text{establishment \%} \times 100}$$

For example, if sowing RGT Planet barley with a kernel weight of 45g per 1000 kernels at a target density of 180 plants/m² with a germination of 96% and an expected establishment of 80%, then the seed rate in kg/ha required to establish 180 plants/m² is:

$$\text{seed rate in kg/ha} = 105 \text{ kg/ha} = \frac{45 \times 180}{0.96 \times 0.80 \times 100}$$

Table 3. Western Australian malt barley variety segregation recommendations by Port Zone for the 2024–2025 harvest

YES	This is a recommended variety for this production zone. Segregations will be preferentially allocated to this variety.
Limited	Limited segregations are likely due to low production hectares, limited market demand, a new variety going through market development or phasing out an old variety.
Niche	Subject to availability. Niche segregation is only available if a marketer has sufficient tonnage to supply domestic or international customers. Marketers should contact CBH to negotiate niche segregation and growers should contact their preferred marketer to determine availability.
NO	Variety has been phased out, or marketers are not looking to accumulate this variety in this production zone.

Port Zone	Geraldton	Kwinana			Albany		Esperance	Comments
		North (Midlands)	South	North (East)	North	South		
Bass	NO	Limited	Limited	NO	NO	NO	NO	Limited supply available due to low hectares sown. Important variety for markets that do not allow processing aids during malting. 2024–25 harvest will be the last harvest Bass is segregated in WA.
Buff	NO	NO	NO	Limited	NO	NO	NO	Popular variety in eastern wheatbelt with good volumes expected at the 2024–25 harvest. Interest for domestic processing as an additive-free malt variety.
Maximus CL	YES	YES	YES	YES	YES	YES	YES	The dominant variety in each port zone. Not yet approved by all export malt and brewing customers. Market expects full acceptance by the 2024–25 harvest.
RGT Planet	NO	YES	YES	NO	YES	YES	YES	Medium market pull. Important variety for customers seeking malt made without processing aids.
Spartacus CL	NO	YES	YES	YES	YES	YES	YES	Well regarded and in-demand variety, but on-farm production is being rapidly replaced by Maximus CL.

Source: GIWA Barley Council

Market feedback

Grain Industry Association of Western Australia (GIWA)

For the 2024–25 harvest, the following observations are relevant:

- While there has been increased trade to Mexico and South America in recent years there has not been any material change in the quality profile sought by brewers in those countries relative to the quality profile previously bought by China. Mexico and South America markets have been pleased with Spartacus CL, and traders of Australian grain expect this to roll onto Maximus CL. The likelihood that international traders will seek varieties with a lower fermentability profile (e.g. Compass) for export from WA remains low.
- Perth's Boortmalt and United Malt malhouses are the largest customers of WA malt barley grain. The two Perth plants procure over 300,000 tonnes of malting barley grain annually from growers in the Kwinana and parts of the Albany port zones.
- Both domestic processors have strong demand from South-East Asia and Japan for barley varieties that malt without processing aids, namely Bass, Flinders and RGT Planet. Due to tight supply, premiums for these three varieties through the 2022–23 harvest were significant. Growers should expect premiums to remain in the 2023–24 and 2024–25 harvests.
- Unfortunately, the low supply of Bass, Flinders and RGT Planet will exclude WA malt barley from several premium markets in Asia until the production of new varieties suited to malting without processing aids ramps up.
- Growers planning to continue sowing Bass and Flinders should communicate with domestic processors (through their buyers) to help procure enough of these high market-demand varieties. Sales might be through direct contracts rather than through delivering into the CBH system.
- Growers delivering RGT Planet into Albany port zone sites should be aware of the high demand for this variety. A higher return after costs could be achieved by instead delivering RGT Planet to a receival point in the Kwinana port zone. As Chinese maltsters and brewers will be familiar with RGT Planet from non-Australian origins, there could be strong support for exporting RGT Planet from the Albany and Esperance port zones as they learn how to brew with Maximus CL.
- Segregations of Flinders will cease after the 2023–24 harvest, while the 2024–25 harvest will be the last harvest for Bass segregations. The industry is carefully watching the decline in production of RGT Planet and are seeking a better understanding of the new options that growers in WA may adopt. Potential options include recently accredited varieties Bottler, Buff and LG Alestar, and those in Stage 2 accreditation, particularly Cyclops, Laperouse, Minotaur and Zena CL.
- Production volumes of Bottler and LG Alestar are too low to support segregation in WA and their pathway to market for domestic processing is only via direct contracts. Bottler and LG Alestar are suitable for malting without processing aids. Another advantage of LG Alestar for domestic processors is its quick time from germination to finished malt, which is quicker than most varieties in the market. These varieties require a sustainable production level in WA to warrant further evaluation and domestic demand.
- Production volumes of Buff are sufficient to support segregations in the Kwinana port zone. Feedback from the domestic maltsters suggests Buff could be suitable for malting without processing aids, as with Bass, Flinders and RGT Planet.
- Maximus CL is now the dominant barley variety in WA. Not all our brewing customers have approved its use, especially those in China. Maximus CL has different malting characteristics to Spartacus CL. Malt premiums might be lower than established varieties until full brewer approval occurs, which is expected within 12 months.
- Spartacus CL has good international market recognition, with export market opportunities in Asia, China, Mexico, South Africa and South America. Maximus CL has quickly replaced Spartacus CL on-farm, and there is an expectation that most international markets will likewise support Maximus CL.
- Segregation opportunities for Bass, Buff, Maximus CL, RGT Planet and Spartacus CL vary by port zone across WA and within a port zone for the Kwinana and Albany ports (Table 3).

Why rationalise malt varieties?

In line with previous advice, the WA barley industry supports the long-term aim of segregating up to two major malt varieties per port zone, with limited segregations for minor, new or niche malt varieties. Segregating fewer malt varieties improves logistics (reducing storage and handling costs), makes segregation planning at a bin level easier and encourages more robust demand from traders who are unwilling to risk buying small, unsaleable parcels.

At the same time, it is vital to have a range of varieties differing in management, to spread agronomic risk, and in malt characteristics to allow the blending of processed malt to customer specifications. Treating malt barley crops with some chemicals could limit market access, as not all markets have import tolerances equal to Australia. For example, opportunistic markets like Europe currently do not purchase barley with imazapyr residue nor barley with detectable levels of diquat herbicide. Such markets might require specific segregations if they became regular and not opportunistic.

GIWA (through the GIWA Barley Council) developed these recommendations in consultation with the WA barley supply chain with the aim of guiding growers and consultants in the planning of the 2024 barley cropping program. A plan review will occur in Autumn 2024, and any changes in demand will be presented to growers. Malt variety recommendations in this document could differ from those of eastern Australia due to WA's focus on international markets.

Malt variety-specific recommendations

With new malt varieties being released and adopted by growers faster than the phasing out of old malt varieties, the rapid turnover of varieties is a common sticking point for end-users who desire long-term supply and familiarity to optimise their end-use. New varieties also create inefficiency for bulk handlers, with each malt segregation adding to storage and handling costs. The GIWA barley variety rationalisation plan attempts to balance the benefits to growers from access to new malt varieties with the demand from customers for access to large parcels of the same malt variety over at least five years.

Each malt barley variety grown in WA has unique malting attributes. Consequently, brewers purchase varieties subject to their availability, familiarity, price, style of beer they produce and the type and level of adjunct used in their brewing recipe.

Growers should use the market signals in this document to help decide which malt variety or varieties to sow in 2024. Market demand, pricing signals and segregation locations should be considered in determining malt variety choice, along with the agronomic management required and the risk associated with delivering malt-grade barley. Varieties listed as PREFERRED are more likely to attract higher premiums than ACCEPTABLE varieties. As these industry recommendations are a guide, the segregations implemented at the 2024–25 harvest might differ from those proposed in this document. Growers should liaise regularly with their bulk handlers to confirm segregation.

The malt barley recommendations for the 2024 season are as follows:

Bass

- Bass is a 'market leader' for malt quality, with demand for domestic processing and exporting as malt. It is acceptable for export as grain, but volumes do not support segregation.
- Not suitable for the manufacture of shochu in Japan.
- Bass is well recognised in the international malt barley market and until there is a replacement will remain a critical malt variety in the supply of premium malt to key customers.
- South-East Asia and Japan seek malt made without processing aids. Bass is suitable for additive-free malting. WA's low supply of Bass limits sales to these markets and might result in our exclusion from several premium markets until production of varieties that malt well without processing aids ramps up.
- Frequently used when blending malt to customer specifications.
- Bass malt has excellent extract and filterability, and its quality profile matches the market needs of brewers using high levels of starch adjuncts. Bass grain has a higher grain protein concentration than other malt varieties received, which makes it attractive to starch-adjunct brewers, but not all brewers we service.

- Bass has a higher selection rate for malt than Maximus CL, RGT Planet and Spartacus CL but is outclassed for grain yield.
- Target production zones in 2024 are Kwinana-North (Midlands) and Kwinana-South. Limited segregation opportunities (if any) will be offered due to low production.

Buff

- Buff is being assessed for export as malt, with international grain markets not yet exposed to Buff (and unlikely to be).
- Buff is not being assessed for the manufacture of shochu in Japan.
- Preliminary data suggests it could be malted effectively without processing additives. In the presence of declining Bass and RGT Planet supply, Buff could potentially assist the WA industry to continue supplying additive-free malt to South-East Asia and Japan.
- Grains Australia has indicated that Buff is a variety with a high fermentability profile and, consequently, would be ideally suited to adjunct brewing.
- Target production zones in 2024 are Kwinana-North (East).

Maximus CL

- Maximus CL is acceptable for export as grain and malt and is being assessed for the manufacture of shochu in Japan.
- Maximus CL malt has a high extract with a high enzyme potential and is suitable for high fermentability, starch-adjunct brewing (barleyaustralia.com.au/wp/wp-content/uploads/Tier-1-Malt-Performance-Summary-Maximus.pdf).
- Grower take-up of Maximus CL has occurred rapidly, mainly replacing the area in the rotation previously planted to Spartacus CL.
- Maximus CL has not been approved by all brewing customers, especially those in China. Even with the resumption of trade with China, grower production is still expected to exceed market demand in the short term. Malt premiums could be lower than established varieties until full brewer approval occurs, which is expected within 12 months.
- Use recommended imidazolinone herbicides and be aware of market advice regarding delivering grain from paddocks sprayed with an imidazolinone herbicide.

- Target production zones in 2024 are Geraldton, Kwinana, Albany and Esperance port zones.

RGT Planet

- RGT Planet is preferred for export as grain and as malt.
- Not suitable for the manufacture of shochu in Japan.
- RGT Planet malt has excellent extract with a moderate enzyme potential and is suitable for sugar- and starch-adjunct brewing.
- RGT Planet is a globally recognised malt variety suitable for malting without processing aids. RGT Planet is a critical malt variety to maintain our ability to supply premium malt to key customers in South-East Asia and Japan. China, having most likely used RGT Planet from non-Australian origins since 2020, are expected to be interested in Australian-grown RGT Planet.
- There is currently insufficient MALT1 grade RGT Planet supply to meet demand, resulting in premiums above Maximus CL and Spartacus CL, in some cases.
- Target production zones in 2024 are Kwinana-North (Midlands), Kwinana-South and Albany port zones, with limited segregations offered in the Esperance port zone.

Spartacus CL

- Spartacus CL is acceptable for export as grain and malt and is preferred for manufacturing shochu in Japan.
- Spartacus CL malt has a high extract with very good enzyme potential and is suitable for starch-adjunct brewing.
- Spartacus CL exhibits different malting characteristics than Maximus CL. For some customers, these differences are desirable. The rapid decline in grower production of Spartacus CL will limit our opportunity to meet some customer specifications for export malt.
- Use recommended imidazolinone herbicides and be aware of market advice regarding delivering grain from paddocks sprayed with an imidazolinone herbicide.
- Target production zones in 2024 are Kwinana, Albany and Esperance port zones.

Grain yield

Blakely Paynter (DPIRD)

National Variety Trials (NVT) are managed by the Grains Research and Development Corporation (GRDC) to assess varietal performance across Australia independently of breeders. The trial results enable growers to select the best variety for their environment. Results from the NVT are available as individual site reports or multi-environment (MET) long-term summaries. The MET analysis generates a table of performance values for each variety compared to the mean of the NVT site. Growers and consultants can select a specific state, region, location or group of locations to help choose the best variety for their environment. Both the single-site and multi-year MET analyses are available at nvtonline.com.au.

Tables 4 to 10 present data extracted from the Long-Term MET Yield Reporter, available at nvtonline.com.au. MET data (accuracy ≥ 0.8 and VAF $\geq 25\%$) are presented for each year (2018–2022) for each of the six Agzones in WA and then combined across the six Agzones to provide a statewide MET. If there are four or more observations, a five-year weighted average has been calculated from the MET data. Caution should be exercised when looking at the weighted average as it masks varietal performance over seasons within an Agzone.

Neo CL is being released solely on its performance in internal breeder trials. Neo CL has been included in WA barley NVT for the first time in 2023. Before purchasing seed, growers should consult NVT Online and assess any data published by DPIRD.

Tables 11 and 12 use single-site MET data to highlight the probability of one variety yielding either less, the same or more than another variety when grown with the same agronomy. Grain yields are compared using the least significant difference ($p=0.05$) calculated from the single-site MET analysis standard error. Only barley NVT trials where both varieties have been sown and harvested are included.

It is important to note that the single-site MET analyses only represent varietal performance under one specific set of seasonal and site conditions. Growers should not use the single-site MET analysis as their sole data source when comparing the performance of a new variety. MET analyses based on the average varietal performance of Agzones can mask variety by environment (GxE) interactions across the locations (and seasons) within the Agzone. For this reason, the relative performance of varieties in each year from 2018 to 2022 helps explain the variability in relative varietal performance across seasons. While Agzones are a simple way to group trials across environments, they might not accurately reflect a specific location in every season.

Differences in comparative grain yield performance between varieties can depend on the yield potential of the site. To help assess relative varietal performance at different site yields, NVT Online (through the Long-Term MET Yield Reporter) presents data at half-tonne yield intervals (called 'yield groups') based on trials that match the yield range. This guide presents an alternative method of viewing yield performance at different site yields and uses data extracted from the 'Statewide tables of yield and grain quality' available at nvtonline.com.au. Figures 2 to 4 use linear regression to compare varieties at different yield potentials and present varietal trends as the site-mean yield increases (the average yield of the varieties compared).

The graphs in this document were developed by calculating differences between the grain yield of a variety relative to the site-mean yield (the 'deviation'), with the deviation assessed for quadratic or linear trends. If the quadratic trend was significant, a quadratic polynomial was fitted to the data ($p<0.05$). If the linear trend (but not the quadratic trend) was significant ($p<0.05$), a linear polynomial was fitted to the data. If neither the quadratic nor the linear trend was significant, the grain yield response of a variety was deemed to run parallel to the site-mean yield at the average deviation for that variety. It is worth noting that depending on the year and location analysed, the relative performance of varieties can differ. This highlights the importance of examining more than one dataset and comparing the performance of new varieties over at least three seasons.

Table 4. Grain yield of barley varieties in AGZONE 1 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		4.27	0.61	4.98	3.43	5.05	3.67
Variety	(No. trials)	(2)	(2)	(1)	(2)	(2)	(9)
Deliverable as a malt variety							
Bass	(9)	90	83	93	89	90	89
Buff	(8)	113	135	99	109	104	113
Maximus CL	(9)	103	118	100	116	104	109
RGT Planet	(9)	99	84	107	97	104	97
Spartacus CL	(9)	99	109	98	108	99	103
Stage Two malt accreditation							
Beast	(7)	-	123	105	111	108	112
Commodus CL	(5)	-	-	100	100	101	103
Cyclops	(5)	-	-	106	113	108	112
Laperouse	(9)	107	113	103	109	105	108
Minotaur	(5)	-	-	107	108	106	102
Zena CL	(4)	-	-	-	98	104	98
Deliverable as a feed variety							
Combat	(4)	-	-	-	114	113	111
Compass	(9)	109	119	102	103	104	108
Fathom	(9)	108	121	99	103	102	107
Flinders	(5)	88	78	95	-	-	89
La Trobe	(9)	102	112	99	106	101	105
Litmus	(7)	-	112	98	93	98	100
Mundah	(5)	98	100	96	-	-	95
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(9)	107	120	106	117	109	112
Scope CL	(9)	98	105	93	93	94	97
Titan AX	(2)	-	-	-	-	106	-

Source: based on MET analysis from NVT Online, nvtonline.com.au**Table 5. Grain yield of barley varieties in AGZONE 2 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)**

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		4.33	2.23	3.20	4.24	5.41	3.88
Variety	(No. trials)	(7)	(7)	(6)	(7)	(7)	(34)
Deliverable as a malt variety							
Bass	(34)	92	92	92	91	92	92
Buff	(33)	106	110	103	105	103	105
Maximus CL	(34)	103	109	109	106	104	106
RGT Planet	(33)	100	95	99	103	104	100
Spartacus CL	(34)	100	105	105	100	100	102
Stage Two malt accreditation							
Beast	(27)	-	111	110	104	104	108
Commodus CL	(20)	-	-	102	97	99	101
Cyclops	(20)	-	-	110	110	106	108
Laperouse	(34)	106	105	107	106	103	105
Minotaur	(20)	-	-	106	107	106	104
Zena CL	(14)	-	-	-	103	105	101
Deliverable as a feed variety							
Combat	(14)	-	-	-	113	111	110
Compass	(34)	106	109	105	99	101	104
Fathom	(34)	104	108	103	100	100	103
Flinders	(20)	92	91	94	-	-	94
La Trobe	(34)	102	106	104	100	100	102
Litmus	(27)	-	106	93	89	98	97
Mundah	(18)	96	100	92	-	-	94
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(34)	106	112	110	107	108	109
Scope CL	(34)	96	100	94	93	94	95
Titan AX	(7)	-	-	-	-	103	105

Source: based on MET analysis from NVT Online, nvtonline.com.au

Table 6. Grain yield of barley varieties in AGZONE 3 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		3.71	4.30	4.71	5.57	6.02	4.86
Variety	(No. trials)	(4)	(4)	(6)	(5)	(6)	(25)
Deliverable as a malt variety							
Bass	(25)	94	92	93	91	94	93
Buff	(25)	102	100	101	104	98	101
Maximus CL	(25)	102	107	108	97	101	103
RGT Planet	(25)	104	103	101	106	107	104
Spartacus CL	(25)	98	103	103	94	97	99
Stage Two malt accreditation							
Beast	(21)	-	107	106	104	102	104
Commodus CL	(17)	-	-	99	100	98	99
Cyclops	(17)	-	-	110	109	108	109
Laperouse	(25)	104	106	107	105	104	105
Minotaur	(17)	-	-	107	103	108	106
Zena CL	(11)	-	-	-	104	106	103
Deliverable as a feed variety							
Combat	(11)	-	-	-	111	112	111
Compass	(25)	99	102	100	103	98	100
Fathom	(25)	99	100	100	101	97	99
Flinders	(25)	97	96	97	92	98	96
La Trobe	(25)	99	102	101	97	98	99
Litmus	(17)	-	-	88	92	88	90
Mundah	(12)	92	91	88	-	-	91
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(25)	103	109	107	101	103	105
Scope CL	(25)	94	92	92	94	91	92
Titan AX	(6)	-	-	-	-	103	104

Source: based on MET analysis from NVT Online, nvtonline.com.au**Table 7. Grain yield of barley varieties in AGZONE 4 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)**

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		3.36	0.79	2.57	4.18	5.47	3.27
Variety	(No. trials)	(2)	(1)	(5)	(3)	(5)	(16)
Deliverable as a malt variety							
Bass	(16)	89	85	94	94	94	93
Buff	(16)	123	149	104	100	103	108
Maximus CL	(16)	101	108	110	111	100	106
RGT Planet	(16)	100	85	96	98	104	99
Spartacus CL	(16)	96	102	107	107	97	102
Stage Two malt accreditation							
Beast	(14)	-	105	113	113	104	108
Commodus CL	(13)	-	-	107	103	100	102
Cyclops	(13)	-	-	104	113	107	106
Laperouse	(16)	100	99	103	110	104	104
Minotaur	(13)	-	-	103	107	103	102
Zena CL	(8)	-	-	-	96	103	99
Deliverable as a feed variety							
Combat	(8)	-	-	-	111	109	107
Compass	(16)	98	109	111	106	102	106
Fathom	(15)	105	119	106	103	101	105
Flinders	(8)	92	81	92	-	-	93
La Trobe	(16)	99	107	108	105	99	103
Litmus	(14)	-	148	111	83	94	103
Mundah	(8)	100	115	104	-	-	98
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(16)	107	118	116	109	102	109
Scope CL	(16)	104	119	99	91	95	98
Titan AX	(5)	-	-	-	-	106	104

Source: based on MET analysis from NVT Online, nvtonline.com.au

Table 8. Grain yield of barley varieties in AGZONE 5 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		2.90	1.97	2.45	4.23	3.97	3.10
Variety	(No. trials)	(3)	(4)	(6)	(5)	(6)	(24)
Deliverable as a malt variety							
Bass	(24)	91	90	92	91	92	91
Buff	(24)	104	104	101	103	102	103
Maximus CL	(24)	107	126	120	104	107	113
RGT Planet	(24)	103	93	91	102	101	98
Spartacus CL	(24)	101	118	114	100	102	107
Stage Two malt accreditation							
Beast	(21)	-	121	126	112	110	116
Commodus CL	(17)	-	-	112	104	102	105
Cyclops	(17)	-	-	120	112	112	113
Laperouse	(24)	106	107	116	108	108	110
Minotaur	(17)	-	-	107	105	106	107
Zena CL	(11)	-	-	-	101	100	98
Deliverable as a feed variety							
Combat	(11)	-	-	-	112	112	113
Compass	(24)	100	111	116	108	104	109
Fathom	(24)	100	106	110	104	102	105
Flinders	(13)	95	93	89	-	-	92
La Trobe	(24)	101	115	112	102	102	107
Litmus	(0)	-	-	-	-	-	-
Mundah	(13)	89	97	89	-	-	92
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(24)	109	131	116	107	107	114
Scope CL	(0)	-	-	-	-	-	-
Titan AX	(11)	-	-	-	109	106	106

Source: based on MET analysis from NVT Online, nvtonline.com.au**Table 9. Grain yield of barley varieties in AGZONE 6 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)**

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		4.91	4.14	4.07	6.05	4.91	4.82
Variety	(No. trials)	(2)	(3)	(3)	(1)	(3)	(12)
Deliverable as a malt variety							
Bass	(12)	90	90	91	93	90	91
Buff	(12)	103	103	95	101	100	100
Maximus CL	(12)	99	106	106	98	105	104
RGT Planet	(12)	111	106	108	108	108	108
Spartacus CL	(12)	94	99	100	95	99	98
Stage Two malt accreditation							
Beast	(10)	-	102	106	103	100	102
Commodus CL	(7)	-	-	98	99	92	95
Cyclops	(7)	-	-	114	105	112	111
Laperouse	(12)	101	107	109	102	107	106
Minotaur	(7)	-	-	114	106	113	112
Zena CL	(4)	-	-	-	107	107	107
Deliverable as a feed variety							
Combat	(4)	-	-	-	111	118	117
Compass	(12)	93	95	98	101	92	95
Fathom	(12)	95	96	96	99	94	96
Flinders	(12)	97	97	97	95	99	97
La Trobe	(12)	95	98	98	98	97	97
Litmus	(0)	-	-	-	-	-	-
Mundah	(8)	89	82	81	-	-	83
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(12)	105	107	106	104	106	106
Scope CL	(0)	-	-	-	-	-	-
Titan AX	(3)	-	-	-	-	101	-

Source: based on MET analysis from NVT Online, nvtonline.com.au

Table 10. Grain yield of barley varieties averaged across AGZONES 1–6 expressed as a percentage of the site mean yield for each trial year (2018–2022) and the weighted average over the five-year period (where there are four or more observations)

Year		2018	2019	2020	2021	2022	2018–2022
Site mean yield (t/ha)		3.93	2.69	3.44	4.53	5.17	3.95
Variety	(No. trials)	(20)	(21)	(27)	(23)	(29)	(120)
Deliverable as a malt variety							
Bass	(120)	91	91	93	91	92	92
Buff	(118)	107	106	101	104	101	103
Maximus CL	(120)	103	110	110	104	103	106
RGT Planet	(119)	102	99	100	103	105	102
Spartacus CL	(120)	99	105	105	100	99	102
Stage Two malt accreditation							
Beast	(100)	-	110	111	107	104	107
Commodus CL	(79)	-	-	103	100	99	100
Cyclops	(79)	-	-	111	110	108	109
Laperouse	(120)	105	106	108	107	105	106
Minotaur	(79)	-	-	107	105	107	106
Zena CL	(52)	-	-	-	102	104	101
Deliverable as a feed variety							
Combat	(52)	-	-	-	112	112	111
Compass	(120)	102	104	105	103	100	103
Fathom	(119)	102	103	102	102	99	101
Flinders	(83)	93	94	95	93	96	94
La Trobe	(120)	100	104	104	100	99	101
Litmus	(65)	-	98	90	91	91	93
Mundah	(64)	94	93	91	-	-	92
Neo CL	(0)	-	-	-	-	-	-
Rosalind	(120)	106	113	110	106	105	108
Scope CL	(84)	96	95	92	93	93	94
Titan AX	(34)	-	-	-	106	104	105

Source: based on MET analysis from NVT Online, nvtonline.com.au



Table 11. Direct comparisons between two varieties (yield difference compared using least significant difference, $p=0.05$, calculated using standard errors from single-site MET) – how many times (as a percentage) was variety A (comparator variety) lower-yielding, the same yield or higher-yielding than variety B (base variety) when sown together in WA barley NVT?

Variety A	Percentage of trials			Number of trials	Comparison years	Comparison
	Variety A is lower yielding than Variety B	Variety A and B yield the same	Variety A is higher yielding than Variety B			
Variety B: Maximus CL						
Bass	96%	3%	1%	119	2018–2022	Bass < Maximus CL
Beast	19%	37%	44%	100	2019–2022	Beast ≥ Maximus CL
Buff	50%	16%	34%	118	2018–2022	Buff = Maximus CL
Combat	8%	19%	73%	52	2021–2022	Combat > Maximus CL
Commodus CL	53%	34%	13%	79	2020–2022	Commodus CL ≤ Maximus CL
Compass	46%	27%	27%	119	2018–2022	Compass = Maximus CL
Cyclops	15%	27%	58%	79	2020–2022	Cyclops ≥ Maximus CL
Fathom	54%	28%	18%	118	2018–2022	Fathom ≤ Maximus CL
Flinders	89%	11%	0%	82	2018–2022	Flinders < Maximus CL
La Trobe	51%	46%	3%	119	2018–2022	La Trobe ≤ Maximus CL
Laperouse	26%	44%	30%	119	2018–2022	Laperouse = Maximus CL
Litmus	65%	17%	18%	65	2019–2022	Litmus ≤ Maximus CL
Minotaur	32%	27%	42%	79	2020–2022	Minotaur = Maximus CL
Mundah	88%	9%	3%	64	2018–2020	Mundah < Maximus CL
Neo CL	-	-	-	-	-	<i>No data available</i>
RGT Planet	54%	16%	30%	119	2018–2022	RGT Planet = Maximus CL
Rosalind	13%	40%	46%	119	2018–2022	Rosalind ≥ Maximus CL
Scope CL	78%	13%	8%	83	2018–2022	Scope CL < Maximus CL
Spartacus CL	76%	24%	0%	119	2018–2022	Spartacus CL < Maximus CL
Titan AX	26%	27%	47%	34	2021–2022	Titan AX = Maximus CL
Zena CL	40%	17%	42%	52	2021–2022	Zena CL = Maximus CL
Variety B: RGT Planet						
Bass	74%	21%	5%	119	2018–2022	Bass < RGT Planet
Beast	22%	16%	62%	100	2019–2022	Beast ≥ RGT Planet
Buff	33%	25%	42%	118	2018–2022	Buff = RGT Planet
Combat	0%	15%	85%	52	2021–2022	Combat > RGT Planet
Commodus CL	47%	22%	32%	79	2020–2022	Commodus CL = RGT Planet
Compass	32%	27%	41%	119	2018–2022	Compass = RGT Planet
Cyclops	15%	19%	66%	79	2020–2022	Cyclops ≥ RGT Planet
Fathom	41%	18%	42%	118	2018–2022	Fathom = RGT Planet
Flinders	62%	32%	6%	82	2018–2022	Flinders ≤ RGT Planet
La Trobe	40%	18%	42%	119	2018–2022	La Trobe = RGT Planet
Laperouse	20%	24%	55%	119	2018–2022	Laperouse ≥ RGT Planet
Litmus	63%	12%	25%	65	2019–2022	Litmus ≤ RGT Planet
Maximus CL	30%	16%	54%	119	2018–2022	Maximus CL = RGT Planet
Minotaur	13%	33%	54%	79	2020–2022	Minotaur ≥ RGT Planet
Mundah	52%	22%	27%	64	2017–2020	Mundah = RGT Planet
Neo CL	-	-	-	-	-	<i>No data available</i>
Rosalind	17%	25%	58%	119	2018–2022	Rosalind ≥ RGT Planet
Scope CL	60%	24%	16%	83	2018–2022	Scope CL ≤ RGT Planet
Spartacus CL	45%	13%	42%	119	2018–2022	Spartacus CL = RGT Planet
Titan AX	29%	47%	24%	34	2021–2022	Titan AX = RGT Planet
Zena CL	0%	100%	0%	52	2021–2022	Zena CL = RGT Planet

Source: based on single-site MET data from NVT Online, nvtonline.com.au

Table 12. Direct comparisons between two varieties (yield difference compared using least significant difference, $p=0.05$, calculated using standard errors from single-site MET) – how many times (as a percentage) was variety A (comparator variety) lower-yielding, the same yield or higher-yielding than variety B (base variety) when sown together in WA barley NVT?

Variety A	Percentage of trials			Number of trials	Comparison years	Comparison
	Variety A is lower yielding than Variety B	Variety A and B yield the same	Variety A is higher yielding than Variety B			
Variety B: Rosalind						
Bass	98%	2%	0%	119	2018–2022	Bass < Rosalind
Beast	31%	39%	30%	100	2019–2022	Beast = Rosalind
Buff	62%	18%	20%	118	2018–2022	Buff ≤ Rosalind
Combat	4%	21%	75%	52	2021–2022	Combat > Rosalind
Commodus CL	70%	27%	4%	79	2020–2022	Commodus CL < Rosalind
Compass	58%	29%	13%	119	2018–2022	Compass ≤ Rosalind
Cyclops	22%	38%	41%	79	2020–2022	Cyclops ≥ Rosalind
Fathom	69%	21%	9%	118	2018–2022	Fathom < Rosalind
Flinders	93%	7%	0%	82	2018–2022	Flinders < Rosalind
La Trobe	79%	20%	1%	119	2018–2022	La Trobe < Rosalind
Laperouse	46%	34%	20%	119	2018–2022	Laperouse ≤ Rosalind
Litmus	77%	18%	5%	65	2019–2022	Litmus < Rosalind
Maximus CL	46%	40%	13%	119	2018–2022	Maximus CL ≤ Rosalind
Minotaur	37%	41%	23%	79	2020–2022	Minotaur ≤ Rosalind
Mundah	94%	6%	0%	64	2018–2020	Mundah < Rosalind
Neo CL	-	-	-	-	-	<i>No data available</i>
RGT Planet	58%	25%	17%	119	2018–2022	RGT Planet ≤ Rosalind
Scope CL	88%	11%	1%	83	2018–2022	Scope CL < Rosalind
Spartacus CL	76%	21%	3%	119	2018–2022	Spartacus CL < Rosalind
Titan AX	44%	35%	21%	34	2021–2022	Titan AX ≤ Rosalind
Zena CL	48%	29%	23%	52	2021–2022	Zena CL ≤ Rosalind

Source: based on single-site MET data from NVT Online, nvtonline.com.au

Grain yield – comparisons

The benchmark barley varieties for grain yield in WA are now Beast and Combat, replacing Rosalind and RGT Planet. RGT Planet was the benchmark at sites with a yield potential above 5t/ha, while Rosalind was the benchmark at yield potentials below 4t/ha on non-acidic soils. Beast is now the benchmark below 2t/ha, while Combat is the benchmark above 5t/ha. (Figures 2–4, Tables 1, 2, 4–12). Between 2 and 5t/ha, Beast, Combat, Cyclops, Laperouse, Maximus CL and Rosalind are competitive, with different business cases based on farming systems on non-acidic soils and if using IMI-herbicides in the rotation. Buff is, however, the benchmark on soils with an acidic profile (pH_{Ca} below 4.8). Where early vigour and weed competitiveness are primary factors in the variety choice in sub-3t/ha environments, Beast, Commodus CL, Compass and Titan AX are considerations. Above 3.5t/ha, Laperouse is a higher-yielding and more effective

weed-suppressive option than Commodus CL and Compass. While not included in this sowing guide, Banks is worth considering for early sowing opportunities in April due to its longer duration to flowering than RGT Planet and Rosalind. Where SFNB is an issue, Combat is now the best option and outclasses Fathom for grain yield and overall agronomic performance, especially in environments that yield more than 3t/ha.

RGT Planet set a new yield benchmark for varieties segregated for malt following its release in WA in 2016. Since 2017, it has yielded higher in three-quarters of comparisons with Bass and just over two in every five comparisons with Spartacus CL (Table 11). Maximus CL is a more competitive yield option than Bass and Spartacus CL against RGT Planet, yielding higher than RGT Planet in nearly three out of every five WA barley NVT since 2018. The yield advantage of RGT Planet has not been apparent until the site yield exceeds 5.5t/ha. Maximus CL has a clear yield advantage over

RGT Planet at sites with a yield potential below 4t/ha (Figures 2–4). Buff is not competing with RGT Planet on-farm, as Buff is suited to lower rainfall areas and environments that yield less than 3t/ha. Buff is also better suited to paddocks of low soil pH.

Beast, Commodus CL, Cyclops, Laperouse, Minotaur and Zena CL are in Stage Two of the Grains Australia Malt Accreditation program, with a decision on all six varieties expected in March 2024. Each variety has a good fit in specific systems:

- **Beast** – has matched or bettered Rosalind at many WA barley NVT (Figures 2–3, Tables 4–12) and is an alternative to Rosalind, where a more vigorous early growth habit for weed suppression and/or taller straw is needed.
- **Commodus CL** – is not yield competitive with Rosalind above 2t/ha but is comparable in its yield to Compass and Spartacus CL (Tables 4–12). It offers growers a more vigorous plant type for early-season weed suppression than Spartacus CL and Maximus CL in an IMI-tolerant background. The poor straw strength of Commodus CL will limit its use in higher rainfall and early sowing opportunities; this is where Zena CL becomes an opportunity.
- **Cyclops** – since 2020, has had a yield advantage over Rosalind and most varieties (except Combat) at sites that yielded more than 3t/ha (Figures 2–4). Cyclops has the same erect growth habit as Spartacus CL and Maximus CL but with different genetics and no tolerance to IMI-herbicides.
- **Laperouse** – competes well with Rosalind (data not shown) and Maximus CL (Figure 4) at a range of yield potentials. Laperouse performs better than RGT Planet, where the site yield is less than 4t/ha.
- **Minotaur** – a semi-dwarf alternative to Bass, Flinders, RGT Planet and Zena CL. Since 2020, Minotaur has shown a clear advantage over RGT Planet at sites that yield less than 4.5t/ha (Figure 4). Minotaur, however, was outclassed by Cyclops across most of the environments in those same trials.
- **Zena CL** – effectively RGT Planet with IMI-herbicide tolerance, bred through mutation breeding from RGT Planet. Zena CL has mirrored RGT Planet for grain yield in WA (Figure 3, Tables 4–11).

More years of data are needed to confirm the yield relativity of Titan AX, but it looks comparable to Beast in the limited NVT datasets available. Beast may have an advantage below 4 t/ha, but more data is needed to confirm those observations.

Neo CL is a new variety labelled as a step change improvement in yield, with 2023 the first year it has been sown in WA barley NVT. Data from a range of seasons is now needed to confirm the yield relativity of Neo CL in WA. DPIRD internal trial data from 2022 shows a yield improvement over Maximus CL, Spartacus CL and RGT Planet (Figure 7), which supports the internal data published by InterGrain.



Barley

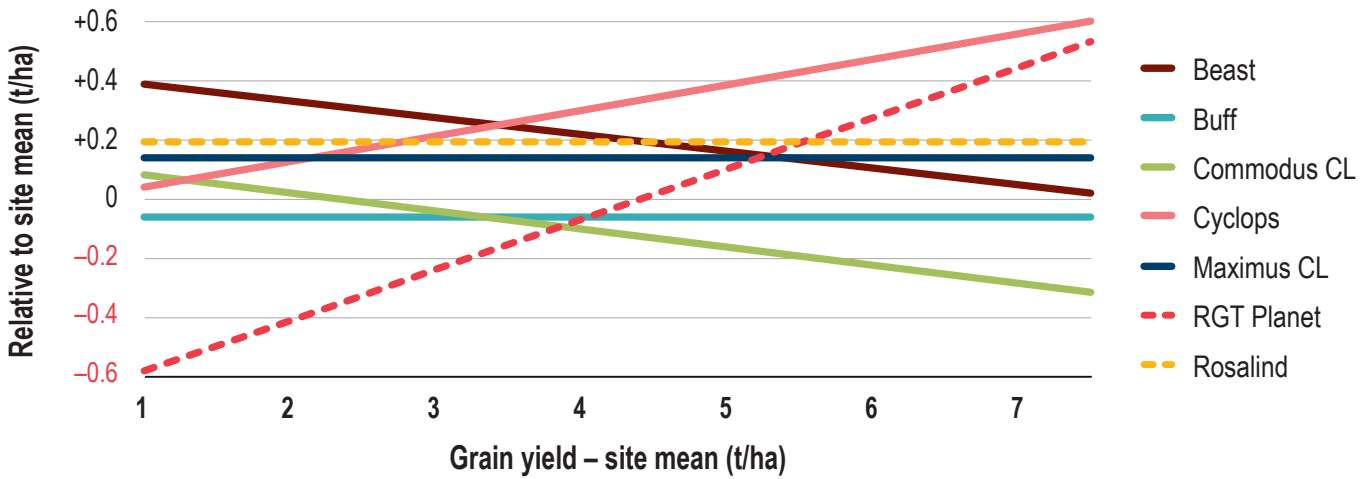


Figure 2. Fitted grain yield of Beast, Buff, Commodus CL, Cyclops, Maximus CL, RGT Planet and Rosalind at different site means.

Source: based on NVT statewide tables of yield and grain quality (2020–2022). Each variety sown in all 79 trial-years of data, NVT Online nvtonline.com.au

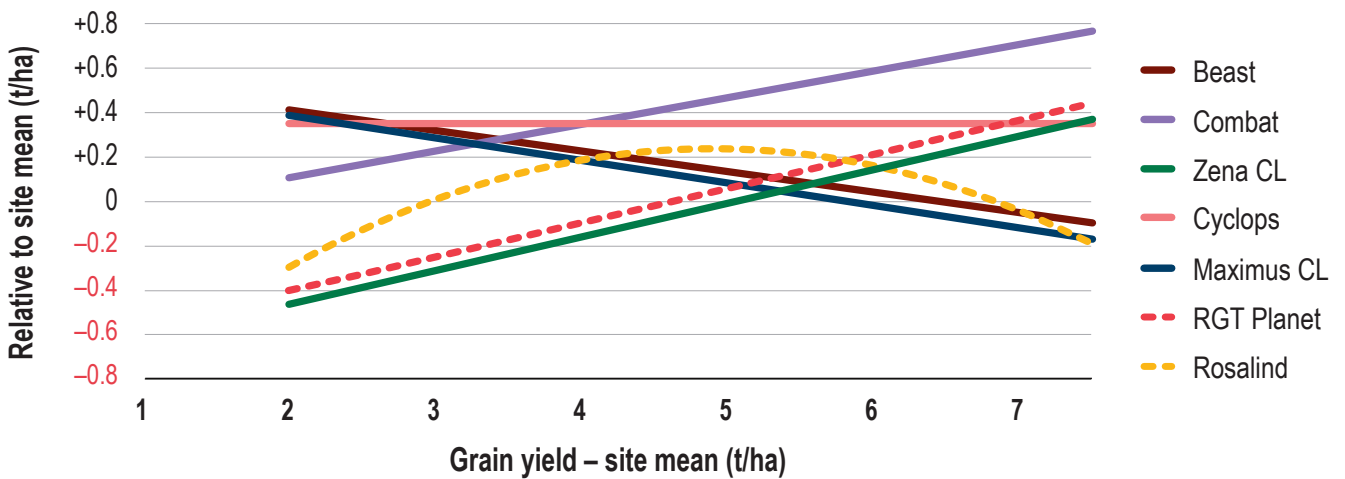


Figure 3. Fitted grain yield of Beast, Combat, Cyclops, Maximus CL, RGT Planet and Zena CL at different site means.

Source: based on NVT statewide tables of yield and grain quality (2021–2022). Each variety sown in all 59 trial-years of data, NVT Online nvtonline.com.au

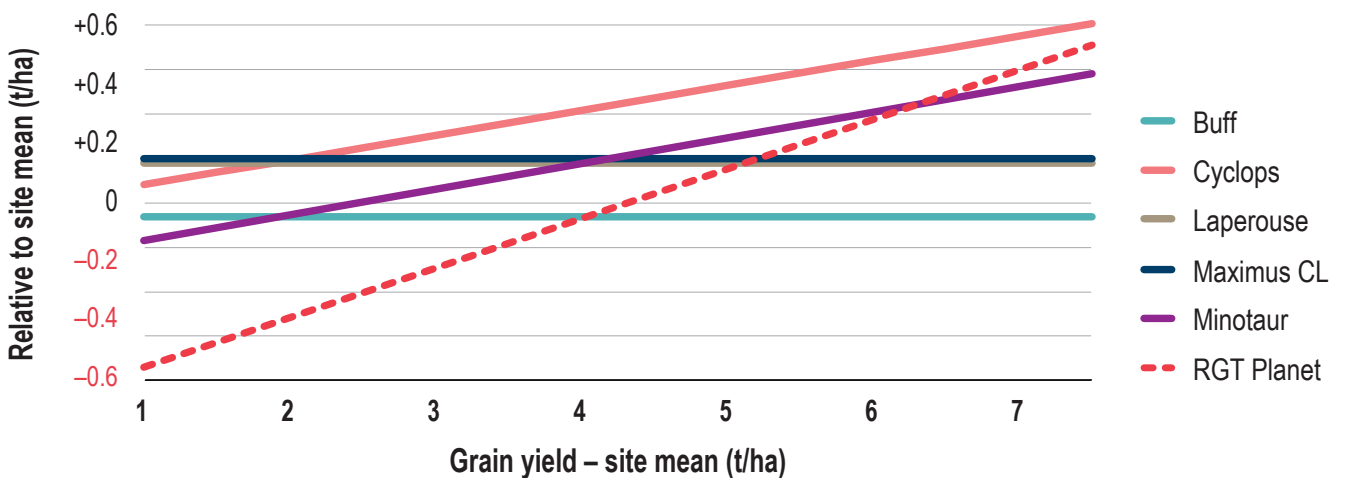


Figure 4. Fitted grain yield of Buff, Cyclops, Laperouse, Maximus CL, Minotaur and RGT Planet at different site means.

Source: based on NVT statewide tables of yield and grain quality (2020–2022). Each variety sown in all 79 trial-years of data, NVT Online nvtonline.com.au

Grain quality

Blakely Paynter (DPIRD)

When comparing feed barley varieties, it is necessary to consider grain yield potential alongside disease resistance and agronomic features like straw strength and head loss resistance. However, while grain yield is essential when comparing varieties segregated for malt, grain quality characteristics are equally important for those chasing the premium for delivery as a MALT1 barley. As the premium increases, varietal differences in grain quality increase in importance, especially in seasons with a drier finish.

As with the grain yield data presented in Figures 2 and 4, the physical grain qualities (hectolitre weight and retention above a 2.5mm slotted sieve) of a variety have been plotted relative to the site mean as the site mean increases (Figures 5–6). The deviation from the site mean was similarly assessed for quadratic and linear trends. If neither the quadratic nor the linear trend was significant, the grain quality response of a variety was deemed to run parallel to the site mean quality at the average deviation for that variety. The data used for this analysis has been extracted from the ‘NVT Statewide tables of yield and grain quality’ available at nvtonline.com.au.

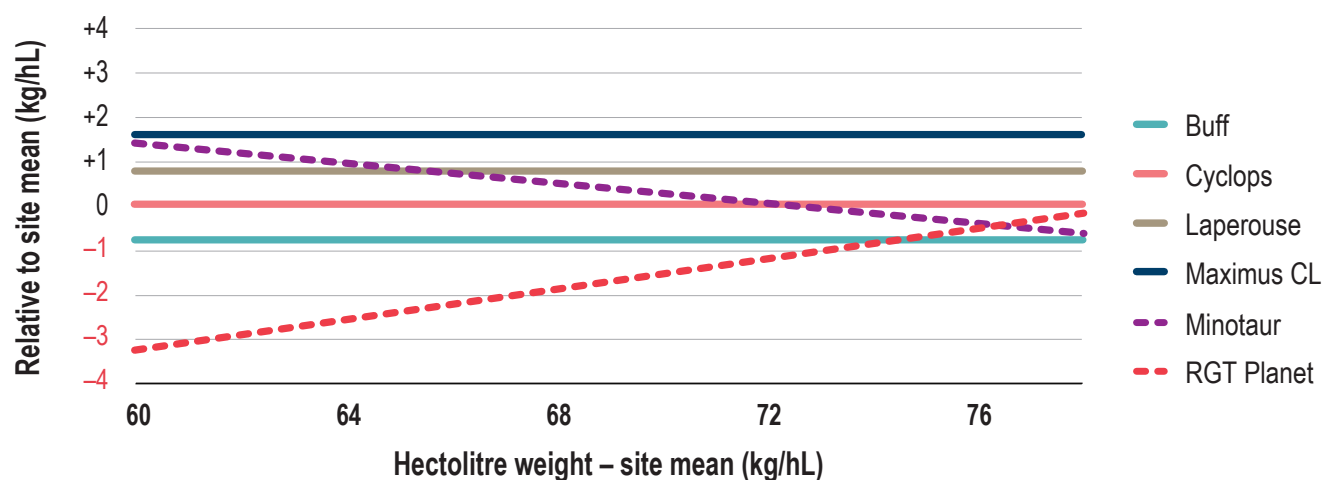


Figure 5. Fitted hectolitre weight of Buff, Cyclops, Laperouse, Maximus CL, Minotaur and RGT Planet at different site means.

Source: based on NVT statewide tables of yield and grain quality (2020–2022). Each variety sown in all 79 trial-years of data, NVT Online nvtonline.com.au

Grain quality – hectolitre weight comparisons

Figure 5 compares the hectolitre weight of three varieties in Stage Two of the Grains Australia Malt Accreditation program (Cyclops, Laperouse and Minotaur), one new malt variety (Buff), and two established malt varieties (Maximus CL and RGT Planet).

Bass has been the benchmark variety for hectolitre weight for varieties segregated for malt in WA. Maximus CL and Spartacus CL are similar to Bass. Hectolitre weight is not likely to be a limiting factor in their receival as MALT1. RGT Planet has the highest risk of not meeting MALT1 hectolitre specifications in WA. It is 3–4kg/hL lighter than Maximus CL below 68kg/hL, where the risk of dropping out of MALT1 is higher (Figure 5). Conditions favouring a low hectolitre weight in RGT Planet are often associated with high grain plumpness.

Conversely, high hectolitre is often related to low grain plumpness in RGT Planet. These observations reflect the elongated grain shape of RGT Planet. Like RGT Planet, Buff has a lower hectolitre weight than Maximus CL, about 2–2.5kg/hL lower but is an improvement over RGT Planet (Figure 5). Low hectolitre weight may be an issue for Buff in some seasons.

Three of the varieties in Figure 5, Cyclops, Laperouse and Minotaur, have a potential market fit in WA if accredited by Grains Australia. There is positive interest in them from grain marketers and malting companies. The hectolitre weight of

Cyclops, Laperouse and Minotaur, while lower than Maximus CL (Figure 5), is unlikely to cause issues for delivery as MALT1 as has occurred with RGT Planet. Zena CL, not included in Figure 5, is another variety in Stage Two accreditation with a potential market fit in WA. Zena CL has the same grain shape and hectolitre weight as RGT Planet. Zena CL will have the same risk of not meeting MALT1 hectolitre weight specifications as RGT Planet.

Neo CL is in Stage One of Grains Australia’s Malt Accreditation program. It had a similar hectolitre weight to RGT Planet in DPIRD internal trials conducted in 2022 (Figure 7) and reflects the observations and variety notes of InterGrain. Data from a more comprehensive range of seasons than that tested by InterGrain and DPIRD is now needed to confirm the hectolitre weight relativity of Neo CL in WA. If the data reflects current observations, delivery of Neo CL as MALT1 in some seasons and environments may be restricted by low hectolitre weight as has occurred with RGT Planet.

Bass is the benchmark malt variety for grain plumpness. Bass has higher retention over a range of retention levels (percentage above a 2.5mm sieve) compared with other varieties segregated for malt in WA (data not shown). Maximus CL has an improved grain shape over Spartacus CL, resulting in higher retention. Across 79 WA barley NVT (2020–2022), Maximus CL retention was 3% above Spartacus CL and 1–3% lower than Bass (data not shown). A higher selection rate for receival as MALT1 should be achievable for Maximus CL relative to Spartacus CL. RGT Planet behaves more like Baudin (data not shown) than Bass, with retention significantly lower than Spartacus CL and Maximus CL except at sites with retention above 90% (Figure 6). RGT Planet has a lower selection rate for MALT1 than Maximus CL due to its poorer grain shape. The grain plumpness of Buff is not as good as Bass (data not shown) or Maximus CL (Figure 6) and is comparable to Spartacus CL (data not shown). The grain shape of Buff (lower hectolitre weight and moderate grain plumpness) may limit a high delivery probability as MALT1.

Grain quality – grain plumpness comparisons

Figure 6 compares the retention of three varieties in Stage Two of the Grains Australia Malt Accreditation program (Cyclops, Laperouse, and Minotaur), one new malt variety (Buff) and two established malt varieties (Maximus CL and RGT Planet).

The grain plumpness of Laperouse is an improvement over Maximus CL and a significant improvement over RGT Planet (Figure 6). The grain plumpness of Laperouse is comparable to Bass (data not shown), which when combined with its good hectolitre weight, should result in a high probability of delivery as MALT1 if accredited by Grains Australia and received in WA.

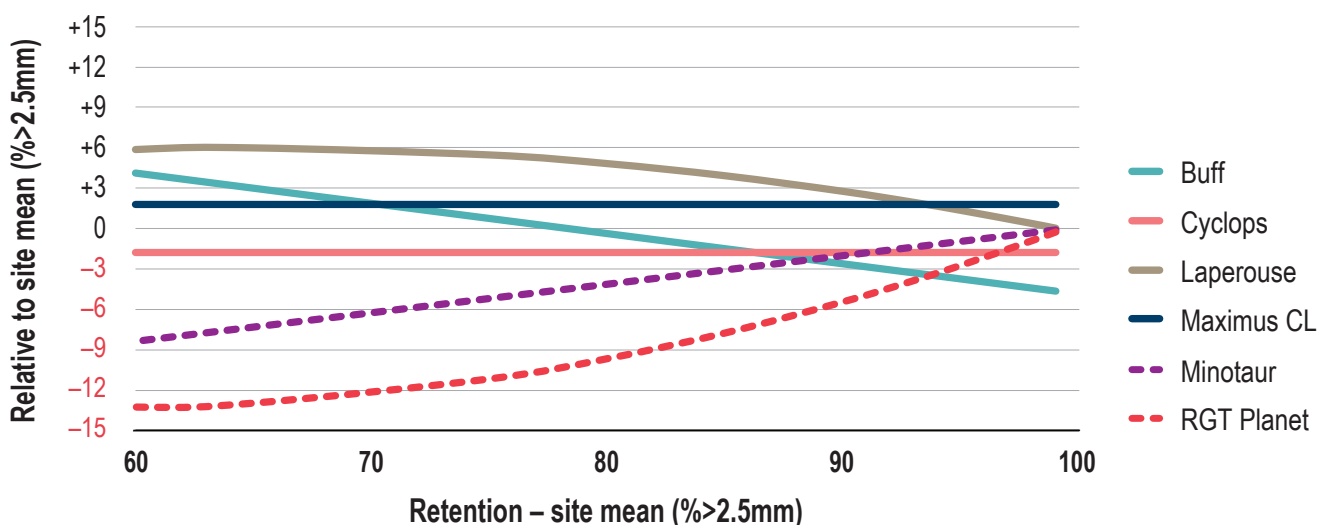


Figure 6. Fitted grain plumpness of Buff, Cyclops, Laperouse, Maximus CL, Minotaur and RGT Planet at different site means.

Source: based on NVT statewide tables of yield and grain quality (2020–2022). Each variety sown in all 79 trial-years of data, NVT Online nvtonline.com.au

The grain plumpness of Cyclops is comparable to Spartacus CL (data not shown) but not as good as Maximus CL (Figure 6). If accredited and received in WA, the receival probability of Cyclops should be similar to that achieved by Spartacus CL.

While an improvement over RGT Planet, the grain plumpness of Minotaur could limit delivery as MALT1 in some seasons (if accredited and segregated in WA) as it is poorer than Spartacus CL (data not shown) and Maximus CL (Figure 6).

Zena CL has the same grain plumpness as RGT Planet (data not shown). Growers should expect it to meet (or fail to meet) MALT1 receival specifications for grain plumpness with the same probability as RGT Planet.

In DPIRD trials in 2022, grain plumpness of Neo CL was similar to Spartacus CL, better than RGT Planet and poorer than Maximus CL (Figure 7). These results reflected InterGrain's observations and variety notes for Neo CL vs RGT Planet but not Maximus CL. Data from a wider range of seasons are now needed to confirm the relative grain plumpness of Neo CL in WA. If future results reflect current observations, grain plumpness is unlikely to be a major factor restricting the delivery of Neo CL as MALT1, unlike RGT Planet. For Neo CL, low hectolitre weight may be the issue that limits receival as MALT1 rather than grain plumpness.

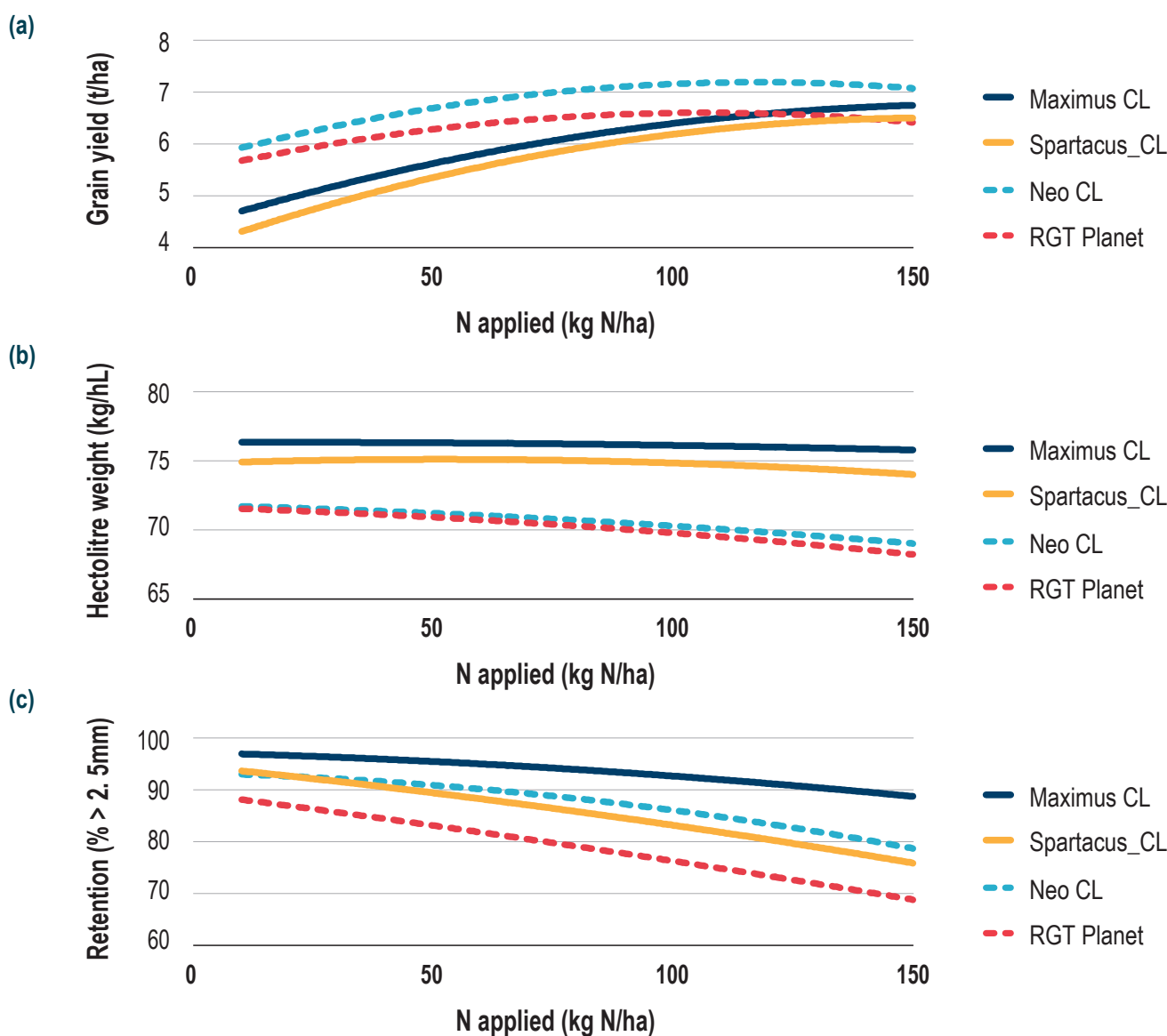


Figure 7. Fitted response of Maximus CL, Neo CL, RGT Planet and Spartacus CL to increasing N fertiliser for a) grain yield b) hectolitre weight and c) grain plumpness.

Source: Blakely Paynter, data averaged across three DPIRD sites (Wongan Hills, Yerecoin, and York) from 2022.

Disease and pest resistance

Sanjiv Gupta (Murdoch), Geoff Thomas, Carla Wilkinson, Sarah Collins, Daniel Huberli, Kithsiri Jayasena, Andrea Hills and Blakely Paynter (DPIRD)

Foliar disease abbreviations:

- **BLR** = barley leaf rust.
- **BYD/CYD** = barley yellow dwarf/cereal yellow dwarf.
- **CCN** = cereal cyst nematode.
- **CR** = crown rot.
- **NFNB** = net-form net blotch.
- **PM** = powdery mildew.
- **RLS** = ramularia leaf spot.
- **RLN** = root lesion nematode.
- **Sc** = scald.
- **SFNB** = spot-form net blotch.

Disease resistance abbreviations:

- **VS** = very susceptible.
- **SVS** = susceptible to very susceptible.
- **S** = susceptible.
- **MSS** = moderately susceptible to susceptible.
- **MS** = moderately susceptible.
- **MRMS** = moderately resistant to moderately susceptible.
- **MR** = moderately resistant.
- **RMR** = resistant to moderately resistant.
- **R** = resistant.
- **APR** = adult plant resistance.
- *p* = provisional rating.

Refer to page 4 to interpret resistance classifications.

Fungicide abbreviations:

- **DMI** = demethylation inhibitor.
- **SDHI** = succinate dehydrogenase inhibitor.
- **QoI** = Qo Inhibitor fungicides (strobilurin fungicide).

Seedling and adult resistance

Disease, virus and nematode resistance data is presented in Tables 13 to 15 and in the variety snapshots. Leaf disease ratings in this guide include seedling and adult plant stage resistance ratings for the foliar leaf diseases NFNB, SFNB, PM and BLR. There is no seedling resistance data for scald, only for adult plant stage resistance.

Seedling ratings are applicable at early growth stages (two- to three-leaf stage) and are important for deciding on seed- or fertiliser-applied fungicide treatments. They are also helpful in assessing the likely response of a variety to early disease pressure. Varieties susceptible to stubble-borne diseases such as scald, NFNB and SFNB are at high risk of initial infection if sown onto one- or two-year-old barley stubble.

Variations in seedling and adult ratings of a variety are primarily due to the differential effectiveness of resistance genes at one stage or the other. Adult plant ratings are applicable at later plant growth stages (after flag leaf emergence). However, adult ratings may be relevant as early as late tillering to stem elongation in some varieties and for some diseases.

Variety disease ratings vary over time due to seasonal changes in disease pressure, regional disease spread, climatic conditions, stubble retention and the development of new pathotypes/races. As a result, minor changes in resistance scores of varieties can occur between sowing guides. However, in this 2024 guide, there have been no significant changes in resistance scores due to a new pathotype.

New pathotype – net-form net blotch (NFNB)

Watch for increasing NFNB with a new aggressive pathotype, Oxford virulent, detected across the State. NFNB surveys indicate increasing variation in this pathogen. Future surveys will help provide information on the extent of the variation and if new virulence exists in WA. Minotaur (MS as

seedling and adult) has the best resistance to the Oxford pathotype, whereas many varieties included in this sowing guide have some tolerance as an adult (MSS) but are susceptible at a seedling stage (Tables 13 and 14).

New virulence to powdery mildew (PM)

Rosalind shows a susceptible reaction in the presence of PM with *MILa* virulence. Virulence to the *MILa* gene has been confirmed in PM isolates in WA's Albany and Esperance port zones, following detection in northern NSW and Queensland. Other potentially impacted varieties include Beast, Commodus CL, Compass and Spartacus CL. In the 2023 season, Maximus CL showed a more susceptible reaction type in a report from the Narrogin district. In eastern Australia, Maximus CL is rated as MS. Close monitoring of these varieties is recommended in mildew favourable environments. Growers should report a suspected breakdown in varietal resistance for PM in varieties rated as MRMS and above.

Pathotype surveillance and fungicide resistance

Growers and consultants observing barley varieties rated as MRMS, MR or R that carry significantly higher leaf disease levels than expected should collect infected material for pathotype identification and fungicide resistance testing. Collect leaf samples before spraying the crop with a fungicide to ensure sample viability.

Place infected Sc, NFNB, SFNB and BLR leaf material in paper envelopes marked with the location, variety, disease and date collected. Fold the leaf in half so the infected area is on the inside. Please do not wrap leaf material in plastic or send it in plastic-lined envelopes. Unlike other leaf diseases, PM-infected leaves should be placed into agar tubes to maintain a live culture for pathotyping. Sample collection kits for PM must be arranged before sampling and, therefore, before spraying.

Send Sc, NFNB and SFNB infected leaf material in paper envelopes to DPIRD, Locked Bag 4, Bentley Delivery Centre WA 6983 and marked attention, Simon Rogers. For more information, contact Simon Rogers via email at simon.rogers@dpiird.wa.gov.au or phone (08) 9368 3445.

There is currently no funding for the Centre for Crop and Disease Management (CCDM) or

DPIRD to support assessing virulence changes in PM in WA. If there is an unexpected susceptible response to PM of a resistant variety, growers and consultants should contact the CCDM or DPIRD for advice before sending any samples.

Send BLR samples in paper envelopes directly to the University of Sydney, Australian Rust Survey, Reply Paid 88076 Narellan NSW 2567. For more information on sample collection and submission, contact Matthew Williams (ACRCP Operations and Technical Officer) via email at matthew.williams@sydney.edu.au or phone (02) 9351 8808.

To manage fungicide resistance and reduce future resistance development, rotate fungicide groups or use fungicide mixtures that contain different modes of action, including DMI (e.g. prothioconazole and epoxiconazole), QoI (e.g. azoxystrobin and pyraclostrobin) and SDHI (e.g. fluxapyroxad and bixafen). Avoiding repetitive applications of single active ingredients or fungicide groups is another critical tool to reduce the risk of resistance. Isolates of NFNB, SFNB and PM expressing resistance to DMI fungicides and net blotches (NFNB and SFNB) expressing resistance to SDHI fungicides are present in WA. When disease response to fungicide control in barley crops is of concern, samples can be sent to Fran Lopez-Ruiz, CCDM, Curtin University, PO Box U1987, Perth, WA 6845. Contact the Fungicide Resistance Group at frg@curtin.edu.au for details on collecting and submitting a sample.

Plants with symptoms suspected to be RLS or those thought to be physiological leaf spotting (PLS) that respond to fungicide application should be sent for laboratory testing to DPIRD, Locked Bag 4, Bentley Delivery Centre WA 6983 and marked attention, Jason Bradley. For more information, contact Jason Bradley via email at jason.bradley@dpiird.wa.gov.au or phone (08) 9368 3982.

Scald (Sc)

Sc starts as pale grey-green, water-soaked blotches on older leaves. The blotches become elongated, often diamond-shaped and bleached with a distinctive brown margin. Lesions usually join to form necrotic areas; eventually, the entire leaf withers and dies. Sc is very damaging in barley as infection can kill leaves prematurely and reduce seed weight. Increased plantings of varieties with a susceptible rating increase Sc's prevalence, especially with an early sowing. A severe initial infection can reduce head and grain numbers.

Yield losses of up to 45% are possible in S to VS varieties with associated quality defects. Sc can survive between seasons on infested stubble and barley grass and carried through infected seeds.

Sc hot spots are apparent in WA. Varieties with the highest risk are Beast (S), Combat (S), Laperouse (S), Litmus (SVS), Minotaur (VS), Mundah (S) and Titan AX (S). A concern for the future is that the widespread adoption of susceptible varieties could see the prevalence of Sc re-emerge as a severe disease affecting barley performance in WA. Using registered seed dressings and in-crop fungicides and avoiding sowing susceptible varieties in 'barley-on-barley' situations are essential considerations for managing Sc.

Net-form net blotch (NFNB)

NFNB starts as pinpoint brown lesions that elongate and produce fine, dark brown streaks along and across the leaf blades, creating a distinctive net-like pattern. Older lesions continue to elongate along leaf veins. NFNB can reduce grain yield by 20–30% and impact grain quality. Double cropping of barley significantly increases the risk of infection.

CCDM has reported populations of NFNB with resistance to the triazole-based DMI fungicide tebuconazole and some other triazole fungicide actives such as prothioconazole and epoxiconazole. Fungicide management is often required to manage the disease in varieties with poor resistance or when the pathotype changes. Resistance has been observed in the central and southern regions of WA. Populations exist in the Esperance region



Net-form blotch net blotch

with reduced sensitivity to the DMI fungicides tebuconazole and propiconazole, and resistant populations are present across the lower great southern of the Albany Port zone. In 2022, CCDM also found NFNB with resistance and reduced sensitivity to SDHI. Presently, reports of resistance and reduced sensitivity to SDHI are only from the lower great southern of the Albany Port zone. Fungicide management of NFNB to address current resistance issues and to reduce future resistance development will increasingly require the use of fungicide mixtures containing different modes of action, including DMI (e.g. prothioconazole), Qol (e.g. azoxystrobin and pyraclostrobin) and SDHI (e.g. fluxapyroxad, benzovindiflupyr and bixafen).

Virulence of the NFNB pathogen can vary across time and regions depending on the varieties and resistance genes deployed. Historically, two distinct pathotypes of NFNB existed in WA, Beecher virulent (95NB100) and Beecher avirulent (97NB1). The Beecher avirulent is a dominant pathotype and is prevalent throughout the state. In contrast, the Beecher virulent isolate is now relatively uncommon. Another pathotype, Oxford virulent, has also become evident in the state, particularly in the Albany and Esperance port zones. NFNB surveys indicate increasing variation in the NFNB pathogen. Future surveys and pathotyping of isolates will establish if any new virulence is more widespread in the state.

As different pathotypes of NFNB exist in WA, varietal responses vary accordingly. Litmus is the most vulnerable to NFNB, susceptible to all three major NFNB pathotypes in WA. At the same time, RGT Planet and Zena CL are particularly susceptible to the Oxford pathotype. In the presence of the Oxford virulent pathotype, Buff, Combat, Minotaur, Scope CL and Titan AX have slightly better resistance (MS) as adult plants than other varieties (MSS–SVS). Fungicide, crop rotation and reducing acreage of susceptible varieties remain critical tools in reducing the annual risk of NFNB.

Spot-form net blotch (SFNB)

SFNB develops as small circular or elliptical dark brown spots that become surrounded by a chlorotic zone of varying width. These spots do not elongate to the net-like pattern characteristic of NFNB. The spots may grow to 3–6mm in diameter. SFNB can reduce grain yield by 10–50% and reduce grain quality. Double cropping of barley significantly increases the risk of infection.

The CCDM discovered SFNB populations with resistance and/or reduced sensitivity to DMI fungicides across the Albany, Esperance and Kwinana port zones (including lower and medium rainfall areas). Fungicide compounds most affected by this resistance are tebuconazole and propiconazole. Newer DMIs, such as prothioconazole, are impacted to a lesser degree.

In 2020, the CCDM reported resistance and reduced sensitivity to SDHI fungicide (e.g. fluxapyroxad) in SFNB in the Cunderdin region of WA. In 2021, another confirmed detection of reduced sensitivity to SDHI was found in the Amelup-Borden region.

Fungicide management of SFNB, to address current resistance issues in both DMI and SDHI fungicides and reduce future development regionally, will increasingly require the use of fungicide mixtures and rotation of products including effective DMI ingredients and alternate modes of action including QoI (e.g. azoxystrobin and pyraclostrobin) and SDHI (e.g. fluxapyroxad and bixafen). Where fungicide resistance is suspected, please send samples to the CCDM for assessment.

Combat and Fathom (MR as a seedling and MRMS as an adult) have the most effective combined seedling and adult resistance to SFNB. Beast, Commodus CL, Compass, Cyclops, Laperouse, Maximus CL and Titan AX have some tolerance to SFNB and are rated as MSS or better as seedlings and MSS as adult plants.

Partial tolerance at the seedling stage reduces the likelihood of severe early infection, but SFNB can still infect these varieties at the adult stage. Under high disease pressure, such as sowing into barley stubble, these varieties may still exhibit significant levels of disease at an early stage.

Powdery mildew (PM)

PM appears as fluffy white growths on the surface of the leaves. The area surrounding the spores turns yellow as the fungus depletes leaf nutrients. Older infections become grey and may develop small black fruiting bodies. Early infection can cause yield losses of up to 25%, whereas yield losses at the end of stem elongation reduce yields by about 10%.

Genetic resistance is the best management against PM, especially since a mutation of the *CYP51* gene in powdery mildew has resulted in the compromised efficacy of many DMI fungicides



Powdery mildew

(e.g. tebuconazole, triadimefon and flutriafol) in controlling powdery mildew at label rates. Higher value DMI fungicides and alternative modes of action, such as strobilurins (e.g. azoxystrobin and pyraclostrobin), SDHI (for instance, fluxapyroxad) and amines (e.g. spiroxamine) are still active against PM.

Varieties grown in WA with intermediate resistance or better (MRMS, MR and R) to PM fit into nine broad groups based on postulated or known effective genes that control their resistance. The diversity of resistance genes and the presence of multiple genes in some varieties means that not all varieties will be rendered susceptible simultaneously if mutations occur or known mutations become widespread. Only those varieties carrying the *mlo* gene, like LG Alestar and RGT Planet, have durable resistance to PM. The rest of the widely grown varieties in WA are vulnerable to mutations of the PM fungus. Field scouting indicates increasing variation in the PM pathogen with confirmation of virulence to the *MILa* gene in southern regions of WA. The variety Rosalind is significantly affected by the new virulence. Other varieties, including Beast, Commodus CL and Compass can potentially show variable responses across WA.

Barley leaf rust (BLR)

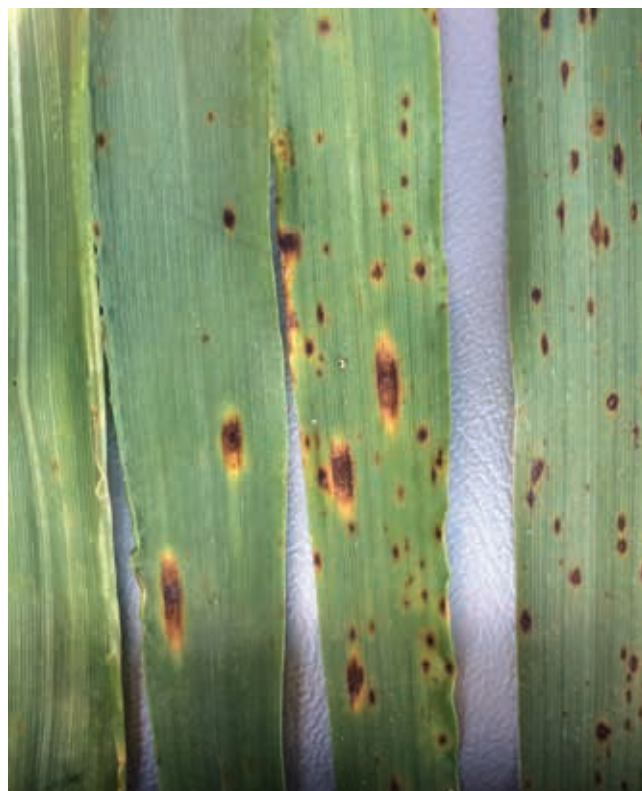
BLR appears as small, circular-to-oval pustules with light-brown powdery spores on the upper surface of leaves (rarely on the back of the leaf blade) and leaf sheaths in heavy infections. As the crop matures, pustules darken, producing black spores embedded in leaf tissue. BLR can reduce grain yield by more than 30% in severe infections.

Most of the major genes for BLR resistance present in Australian varieties are no longer effective against the dominant pathotypes in WA (5457 P- and 5656 P+). Rosalind (MR) has the best rating amongst current varieties. Several varieties, including Combat, Fathom, Flinders, RGT Planet, and Zena CL, have MRMS ratings associated with a late expression of APR. Temperature and varietal background influence the effectiveness of the APR *Rph20* gene. For example, while Flinders and RGT Planet carry two APR genes (*Rph20* and *Rph24*), their field reaction may vary depending on which allele they have and which other minor genes they carry. As they are not pathotype-specific, APR genes are unlikely to be affected by future pathotype changes. APR only develops fully at the adult plant stage, generally after flag leaf emergence, although it may be apparent from earlier growth stages in some seasons. It may still be necessary to protect those varieties with APR genes at early growth stages from the initial infection as they remain vulnerable to rust infection before heading.

Ramularia leaf spot (RLS)

Growers should watch for the leaf disease RLS caused by the fungus *Ramularia collo-cygni*. This disease was first detected in WA in 2018 in three locations across the south coast. In 2019, it was present in seed samples from the mid-west, central and southern wheatbelt, including low rainfall areas. Further testing suggests the disease is not widespread.

Where established, RLS can commonly cause yield losses of up to 25%. The fungus is primarily a disease of barley; however, it can infect many hosts, including oats, wheat and other grasses. Infected seeds are likely to be the primary source of long-distance disease spread and introduction of the disease to new areas. The more localised disease spreads via airborne spores from infected barley and grasses. However, localised spread requires prolonged periods of leaf wetness, and, as a result, a higher disease incidence is expected in medium and high-rainfall areas.



Ramularia leaf spot

Identifying the disease can be difficult as lesions are generally not evident until after flowering. RLS can be easily confused with fungal leaf spotting diseases such as SFNB or abiotic symptoms caused by physiological leaf spotting (PLS) and boron toxicity. Abiotic spots caused by PLS generally do not respond to fungicide application. Research in Europe indicates that varieties carrying the *mlo* gene for resistance to PM are often susceptible to RLS, but this is not always true. The potential impact of this disease on WA barley crops is unknown. However, following detection in 2018, significant crop infection has not been reported in WA. Varietal responses to RLS are, therefore, not available.

There are no specific management recommendations for the disease in WA. However, the fungicides currently used to manage net blotches in barley are likely to be active on RLS when applied at the booting stage. Two products are registered for RLS management, Elatus® Ace (benzovindiflupyr + propiconazole) and Maxentis® (azoxystrobin + prothioconazole). As RLS is at high risk of developing fungicide resistance, sustainable rotation of fungicides should always be practised.

Crown rot (CR)

Crown rot (CR, *Fusarium pseudograminearum*) is a fungal, stubble-borne disease most common in cereal rotations. It infects the sub-crown internode, crown and lower stems and is not usually noticed until after heading when whiteheads are visible. Symptoms can include whiteheads scattered throughout the crop but not in distinct patches as with take-all. Infected tiller bases on individual plants are honey-brown, especially under leaf sheaths. A pink discolouration often forms around or in the crown or under leaf sheaths. The browning at the base of infected tillers is the most reliable indicator of CR, as whiteheads may not occur in seasons with good spring rain. Significant yield losses can occur when high disease levels coincide with moisture stress during grain fill. Affected heads have shrivelled or no grain.

Seed dressings are registered to suppress CR. However, no fungicide options exist to control CR once the crop has been established. Including non-cereals in the rotation (such as pulses, oilseed, lupin and grass-free pasture) can reduce inoculum levels. Inter-row seeding and maintaining reasonable grass weed control in break crops and between crops are also effective measures. Varietal resistance and tolerance to CR are limited. DPIRD research in WA suggests that varietal differences in barley exist, but most barley varieties are susceptible and suffer yield loss to CR. Litmus has the lowest yield loss of the varieties tested in the presence of high CR.

Barley and cereal yellow dwarf (BYD/CYD)

Both barley yellow dwarf (BYD) and cereal yellow dwarf (CYD) viruses occur in WA. As the screening for varietal resistance to BYD and CYD occurs in the field, resistance scores reflect the rating for the presence of both viruses. However, BYD is more frequent than CYD at a ratio of about 2:1. BYD can reduce grain yield by up to 80% with seedling infection and up to 20% with later infection. Barley plants primarily become infected from infected oat (*Rhopalosiphum padi*) or corn leaf (*Rhopalosiphum maidis*) aphids.

Varietal resistance reduces the impact of the virus, but not aphid feeding, on plant growth. Therefore, even with varietal resistance to BYD and CYD, aphids must be sprayed once they reach threshold levels in the crop (50% of tillers with 15 or more aphids) to prevent yield loss from feeding damage.

Root lesion nematode (RLN)

Root lesion nematodes (RLN, *Pratylenchus species*) are microscopic, worm-like animals that feed on plant roots, causing yield loss in susceptible crops, including wheat, barley and canola. Growing susceptible crops and varieties will increase RLN population numbers and increase the risk of yield losses. RLN can be found across about 6.25 million hectares (nearly 74% of the winter cropping area of WA). *Pratylenchus neglectus* is the dominant species found in 70% of paddocks in WA, followed by *P. quasitereoides* (formerly *P. teres*), with most paddocks carrying more than one RLN species. The RLN species *P. neglectus* and *P. quasitereoides* can cause up to 18% yield loss in barley.

The key to managing RLN is identifying paddocks with yield-limiting nematode numbers and incorporating resistant crops and varieties or a fallow into the rotation to reduce numbers. RLN species often have different crop-feeding preferences, so it is important to understand which species is present to develop effective management strategies. In the barley section of this guide, *P. neglectus* and *P. quasitereoides* nematode resistance scores are from WA glasshouse and field trials. Varieties tested in fewer than five trials or where no field trial verification of a glasshouse rating exists have received provisional ratings.

Cereal cyst nematode (CCN)

Cereal cyst nematode (CCN, *Heterodea avenae*) is present in cropping regions around Geraldton, Esperance and the Avon Valley but can occur sporadically across the WA grainbelt. CCN feeds on cereals and grasses and can cause large crop losses in wheat and oats. Barley is more tolerant of CCN, and yield loss is limited even when an infection occurs. Planting CCN-resistant wheat and barley varieties and rotation with grass-free legumes or pasture retards nematode development, leading to lower nematode numbers in the soil. CCN resistance ratings in this guide have not been tested in WA and should only be used as a guide.

Table 13. Seedling (two- to three-leaf stage) leaf disease resistance profiles when grown in WA

Disease ¹	Scald	Net-form net blotch ⁴			Spot-form net blotch	Powdery mildew ⁵	Barley leaf rust
Pathotype ²	Medina	Beecher virulent (95NB100)	Beecher avirulent (97NB1)	Oxford virulent (EDRS)	(South Perth)	(South Perth)	(5457 P-)
Growth stage ³	Seedling	Seedling	Seedling	Seedling	Seedling	Seedling	Seedling
Deliverable as a malt variety							
Bass	-	MRMS	S	SVS	MRMS	S	SVS
Buff	-	MS	MRMS	S	MS	S	SVS
Maximus CL	-	MRMS	MRMS	S	MS	RMR	S
RGT Planet	-	MRMS	MS	SVS	S	R	MSS
Spartacus CL	-	MRMS	MRMS	S	S	MS	S
Stage Two malt accreditation							
Beast	-	MRMS	MS	SVS	MS	MR	S
Commodus CL	-	MRMS	MRMS	S	MRMS	MR	S
Cyclops	-	MR	MRMS	S	MSS	MR	S
Laperouse	-	MS	MRMS	S	MRMS	RMR	MS
Minotaur	-	MRMS	MRMS	MS	S	SVS	S
Zena CL	-	MRMS	MRMS	S	MSS	R	MSS
Deliverable as a feed variety							
Combat	-	S	MRMS	SVS	MR	RMR	MSS
Compass	-	MRMS	MS	SVS	MRMS	MR	S
Fathom	-	SVS	MS	S	MR	MRMS	MS
Flinders	-	MRMS	MSS	S	MS	R	MS
La Trobe	-	MRMS	MRMS	S	S	MS	MS
Litmus	-	S	MSS	S	MS	RMR	S
Mundah	-	S	MS	MSS	MSS	S	S
Neo CL	-	-	-	-	-	-	-
Rosalind	-	MR	MR	S	MS	MSS	MRMS
Scope CL	-	MRMS	MR	S	MS	MR	S
Titan AX	-	MS	MS	SVS	MS	R	MSS

¹ Resistance rating: VS = very susceptible, SVS = susceptible to very susceptible, S = susceptible, MSS = moderately susceptible to susceptible, MS = moderately susceptible, MRMS = moderately resistant to moderately susceptible, MR = moderately resistant, RMR = resistant to moderately resistant, R = resistant. Refer to page 4 for interpreting resistance classification. p = provisional rating. No score '-' = no rating is currently available.

² Pathotype: the strain of the pathogen used in evaluating the disease reaction of the different barley varieties, which represents the most common pathotype present in WA. Therefore, on-farm reactions of varieties may differ if the pathotype present differs from the pathotype used in testing.

³ Growth stage: the seedling resistance score reflects resistance at the two to the three-leaf stage (use data cautiously after the four-leaf stage). Varieties with a VS or S rating at the seedling stage are at a higher risk of early infection.

⁴ Net-form net blotch: three pathotypes (95NB100, 97NB1 and Oxford) of NFNB are present in WA. Beecher avirulent (97NB1) pathotype is dominant, while the Oxford virulent pathotype is also prevalent in the state. Beecher virulent (95NB100) can be present but occurs less frequently. New NFNB pathotypes have been detected and their impact on varietal resistance is being surveyed.

⁵ Powdery mildew: varieties with a VS or S rating at the seedling stage (i.e. Bass, Buff and Minotaur) should be treated with a seed dressing active against powdery mildew to prevent early infection during the tillering phase. Resistant varieties (non-*mlo*) may show a variable reaction to strains of PM present in the southern regions of WA. Maximus CL should be monitored for reaction to PM following a report of increased virulence in the Narrogin region.

Table 14. Adult (after flag leaf emergence) leaf disease resistance profiles when grown in WA

Disease ¹	Scald	Net-form net blotch ⁴			Spot-form net blotch	Powdery mildew ⁵	Barley leaf rust
Pathotype ²	Medina	Beecher virulent (95NB100)	Beecher avirulent (97NB1)	Oxford virulent (EDRS)	(South Perth)	(South Perth)	(5457 P-)
Growth stage ³	Adult	Adult	Adult	Adult	Adult	Adult	Adult
Deliverable as a malt variety							
Bass	MRMS	MS	MSS	S	S	MSS	VS
Buff	MS	MS	MRMS	MS	S	S	S
Maximus CL	MR	MRMS	MRMS	S	MSS	RMR	MSS
RGT Planet	MR	S	MS	SVS	S	R	MRMS (late APR)
Spartacus CL	MR	MS	MS	S	SVS	MS	MSS
Stage Two malt accreditation							
Beast	S	MRMS	MS	MSS	MSS	MR	MSS
Commodus CL	MSS	MRMS	MRMS	MSS	MSS	MR	MSS
Cyclops	MRMS	MRMS	MRMS	MSS	MSS	MR	S
Laperouse	S	MRMS	MRMS	MSS	MSS	MR	MSS
Minotaur	VS	MRMS	MRMS	MS	S	S	S
Zena CL	MR	MS	MRMS	SVS	SVS	R	MRMS (late APR)
Deliverable as a feed variety							
Combat	S	MSS	MSS	MS	MRMS	R	MRMS _p (late APR)
Compass	MS	MRMS	MS	S	MSS	MR	S
Fathom	MR	S	MS	S	MRMS	MRMS	MRMS (late APR)
Flinders	MSS	MRMS	MS	S	S	RMR	MRMS (late APR)
La Trobe	MR	MRMS	MS	MSS	S	MSS	MSS
Litmus	SVS	S	S	S	S	MR	S
Mundah	S	S	MS	MSS	S	MSS	S
Neo CL	-	-	-	-	-	-	-
Rosalind	MSS	MS	MR	MSS	S	MSS	MR
Scope CL	MS	MRMS	MRMS	MS	S	MR	MSS
Titan AX	S	MRMS	MRMS	MS	MSS	RMR	S

¹ Resistance rating: VS = very susceptible, SVS = susceptible to very susceptible, S = susceptible, MSS = moderately susceptible to susceptible, MS = moderately susceptible, MRMS = moderately resistant to moderately susceptible, MR = moderately resistant, RMR = resistant to moderately resistant, R = resistant. Refer to page 4 for interpreting resistance classification. p = provisional rating. No score '-' = no rating is currently available.

² Pathotype: the strain of the pathogen used in evaluating the disease reaction of the different barley varieties, which represents the most common pathotype present in WA. Therefore, on-farm reactions of varieties may differ if the pathotype present differs from the pathotype used in testing.

³ Growth stage: the seedling resistance score reflects resistance at the two to the three-leaf stage (use data cautiously after the four-leaf stage). Varieties with a VS or S rating at the seedling stage are at a higher risk of early infection.

⁴ Net-form net blotch: three pathotypes (95NB100, 97NB1 and Oxford) of NFNB are present in WA. Beecher avirulent (97NB1) pathotype is dominant, while the Oxford virulent pathotype is also prevalent in the state. Beecher virulent (95NB100) can be present but occurs less frequently. New NFNB pathotypes have been detected and their impact on varietal resistance is being surveyed.

⁵ Powdery mildew: varieties with a VS or S rating at the seedling stage (i.e. Bass, Buff and Minotaur) should be treated with a seed dressing active against powdery mildew to prevent early infection during the tillering phase. Resistant varieties (non-*mlo*) may show a variable reaction to strains of PM present in the southern regions of WA. Maximus CL should be monitored for reaction to PM following a report of increased virulence in the Narrogin region.

Table 15. Crown rot yield loss and virus and nematode seedling and adult resistance profiles when grown in WA

Disease ¹	Crown rot yield loss	Barley and cereal yellow dwarf ³	Root lesion nematode ⁴	Root lesion nematode ⁴	Cereal cyst nematode ⁵
Pathotype	<i>Fusarium pseudograminearum</i>	-	<i>Pratylenchus neglectus</i>	<i>Pratylenchus quasitereoides</i>	<i>Heterodera avenae</i>
Growth stage ²	Seedling and adult	Seedling and adult	Seedling and adult	Seedling and adult	Seedling and adult
Deliverable as a malt variety					
Bass	High	MRMS	MSS	MSS	S
Buff	-	MRMS	-	S	Sp
Maximus CL	-	MRMS	-	S	R
RGT Planet	-	MRMS	MSS	MS	Rp
Spartacus CL	Moderate	MS	MSS	MSS	R
Stage Two malt accreditation					
Beast	-	MS	-	MSp	MR
Commodus CL	-	MRMS	-	MSp	R
Cyclops	-	S	-	MSSp	S
Laperouse	-	MRMS	-	MSp	S
Minotaur	-	MSS	-	MSp	R
Zena CL	-	MRMS	-	-	R
Deliverable as a feed variety					
Combat	-	MRMS	-	-	MRMS
Compass	High	MS	MSS	S	R
Fathom	Moderate	MRMS	MSp	MSS	R
Flinders	High	MRMS	MSp	MSSp	S
La Trobe	Moderate	MSS	MS	S	R
Litmus	Low	S	-	MSSp	MS
Mundah	Moderate	MS	-	MSp	S
Neo CL	-	-	-	-	Rp
Rosalind	Moderate	MRMS	-	MSS	R
Scope CL	High	MRMS	MSS	MRMS	S
Titan AX	-	MS	-	-	MRp

¹ Resistance rating: VS = very susceptible, SVS = susceptible to very susceptible, S = susceptible, MSS = moderately susceptible to susceptible, MS = moderately susceptible, MRMS = moderately resistant to moderately susceptible, MR = moderately resistant, RMR = resistant to moderately resistant, R = resistant. Refer to page 4 for interpreting resistance classification. p = provisional rating. No score '-' = no rating is currently available.

² Growth stage: the resistance to barley and cereal yellow dwarf virus and the varietal impacts on nematode numbers do not differ between growth stages. It applies equally throughout the life of the plant.

³ Barley and cereal yellow dwarf: plants become infected from infected oat and corn leaf aphids. Varietal resistance reduces the effect of the virus on plant growth but does not reduce the impact of aphid feeding on plant growth.

⁴ Root lesion nematode: barley varieties vary in the impact of root-lesion nematode on their growth. A resistant variety retards nematode development, leading to lower nematode levels in the soil for subsequent crops. Ratings are based on data collected in WA.

⁵ Cereal cyst nematode: all barley varieties are tolerant of cereal cyst nematode, but a resistant variety retards nematode development, leading to lower nematode levels in the soil for subsequent crops. CCN resistance data is based on variety responses in SA.

Variety snapshots

Blakely Paynter (DPIRD)

Variety snapshots are presented for:

- five varieties (Bass, Buff, Maximus CL, RGT Planet and Spartacus CL) that can be delivered into malt segregations in WA at the 2024–25 harvest (as per the GIWA Western Australian malt barley variety receival recommendations for the 2024–25 harvest).
- six varieties undergoing Stage Two malt accreditation with Grains Australia (Beast, Commodus CL, Cyclops, Laperouse, Minotaur and Zena CL).
- twelve varieties that can only be delivered into bulk handling feed segregations (Beast, Combat, Compass, Fathom, Flinders, La Trobe, Litmus, Mundah, Neo CL, Rosalind, Scope CL and Titan AX).

The comment section in each snapshot describes essential varietal characteristics, including yield relative to another variety, key weaknesses and strengths (including, where appropriate, disease resistance, straw strength and head loss) and relevant market information for varieties that are segregated as malt.

Grain yield data extracted from the Long Term MET Yield Reporter (available at NVT online, nvtonline.com.au) are presented relative to a control variety (typically Maximus CL) rather than the site mean yield (as shown in Tables 4 to 10) for each year in the period 2018 to 2022. Single-site MET data has been used in the comments section to highlight the probability of one variety yielding less, the same, or more than another variety when grown using the same agronomy (in the same trial).

Disease and nematode resistance ratings are sourced from Tables 13 to 15 and presented for seedling and adult plant growth stages (if known).

Phenology information is an output of the new flowering date predictive program, “FlowerPower” barley (available at fp.dpird.app/), developed by

DPIRD. “FlowerPower” barley is a statistical model that predicts the date of awn emergence (Z49) for barley across multiple WA environments. Model predictions use historical temperature data from 2011, sourced from the SILO database hosted by the Queensland Department of Environment and Science (longpaddock.qld.gov.au/silo/point-data/). The phenology data presented in the snapshots are the median predicted date to Z49 (date expected for 50% of seasons) based on “FlowerPower” barley version v7.1.0.10. Data are presented relative to a control variety (typically Spartacus CL) for four model environments (Carnamah, Cunderdin, Katanning and Grass Patch) for four sowing dates (15-April, 05-May, 25-May and 15-June). The prediction data for Carnamah is less precise than the other three locations due to no available research site in that part of WA.

Agronomic traits are tabulated based on published data, data collected by DPIRD, data generated from the DPIRD-GRDC co-funded projects DAW00190 and DAW00224 and, in some cases, from the breeder. The data presented includes:

- Maturity (days to Z49) relative to Stirling when sown on 25 May at Northam based on “FlowerPower” barley version v7.1.0.10 (normal season, 50% years). Very early = -15 to -4 days, early = -3 to +3 days, medium = +4 to +10 days and late = +11 to +17 days. The maturity ranking with a late May sowing differs from that when sown in April or after mid-June. Where DPIRD collected data is not yet available in “FlowerPower”, unpublished or breeder information is used.
- Coleoptile length as measured by DPIRD, after germinating seeds in rolled, moistened filter paper for 15 days at 15°C in the dark. Short = 40–60mm, medium = 60–80mm, long = 80–100mm and * = limited data available to rank the variety.
- Plant height to the base of the ear (cm) at maturity at sites where the straw of control varieties (Stirling, Buloke and Scope CL) was 65–75cm long. Very short = <45cm, short = 45–55cm, medium = 55–65cm and tall = 65–75cm. Data from DPIRD-GRDC and DPIRD internal agronomy trials.
- Straw strength is based on lodging scores taken at maturity and ranked relative to control varieties. Data from DPIRD-GRDC and DPIRD internal agronomy trials.

- Head loss risk was assessed in small plot trials and ranked based on counting heads post-harvest at sites where high levels of head loss were recorded in high-risk varieties (i.e. Scope CL). Data from DPIRD-GRDC and DPIRD internal agronomy trials.
- Grain protein deviation (relative to average) as calculated and ranked using NVT trials (2005–2022) and DPIRD-GRDC funded barley agronomy trials (2006–2020). Lower = <-0.3%, slightly lower = -0.3 to -0.1%, average = -0.1 to +0.1%, slightly higher = +0.1 to +0.3% and higher = > +0.3%. Grain protein deviation analyses the relationship between grain yield and grain protein concentration in barley varieties grown under similar management and environmental conditions in WA. A

typical relationship exists in which grain yield increases and grain protein concentration decreases (yield dilution). Deviations from this relationship between grain yield and grain protein were used to classify varieties for their grain protein deviation and determine relative levels of inherent grain protein concentration.

Variety information, including the seed licensee, seed trading restrictions and the EPR payable, sourced from breeding companies, Variety Central (varietycentral.com.au/) and IP Australia Plant Breeders Rights database (pericles.ipaustralia.gov.au/pbr_db/search.cfm).



Bass[Ⓛ]

Deliverable as a malt variety

Comments

Bass (tested as WABAR2315) is a short-height, medium-spring malt barley. Bass is a 'market leader' for malt quality, with demand for domestic processing and exporting as malt. It is acceptable for export as grain, but production volumes do not support segregation. Bass has strong market demand for malting without processing aids in Japan and Southeast Asia, often resulting in a price premium. Bass is outclassed for grain yield but has a better grain quality package than Maximus CL, RGT Planet, and Spartacus CL, often resulting in a higher strike rate into MALT1 segregations. Best suited to environments with a yield potential above 3t/ha. Fungicides may be required to manage NFNB (Oxford virulent), SFNB, PM and BLR. Weed competitiveness is similar to other semi-dwarf varieties. The acreage of Bass has continued to decline despite solid market demand, and it accounted for less than 1% of the state's barley acreage in 2022 and is almost exclusively planted in the Kwinana Port Zone. Target production zones in 2024 are Kwinana-North (Midlands) and Kwinana-South. Limited segregation opportunities (if any) will be offered due to low production. The 2024–25 harvest will be the last harvest for Bass segregations.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	87	70	93	77	87
Agzone 2	89	84	84	86	88
Agzone 3	92	86	86	94	93
Agzone 4	88	79	85	85	94
Agzone 5	85	71	77	88	86
Agzone 6	91	85	86	95	86
Statewide	88	83	85	88	89
Disease resistance	Seedling		Adult		
Sc	-		MRMS		
NFNB (Beecher virulent)	MRMS		MS		
NFNB (Beecher avirulent)	S		MSS		
NFNB (Oxford virulent)	SVS		S		
SFNB	MRMS		S		
PM	S		MSS		
BLR (5457P-)	SVS		VS		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	MSS		MSS		
RLN (<i>P. quasitereoides</i>)	MSS		MSS		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Camamah	-	-	-	-	
Cunderdin	+2	+3	+4	+3	
Katanning	+4	+5	+6	+4	
Grass Patch	+1	+3	+3	+2	
Agronomic traits					
Early growth habit	Prostrate				
Coleoptile length	Medium				
Plant height	Short				
Straw strength	Very good				
Head loss risk	Medium				
Grain protein deviation	Higher				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.50				

Refer to page 4 for interpreting resistance classification.

Buff[Ⓛ]

Deliverable as a malt variety

Comments

Buff (tested as IGB1506) is a medium-height, medium-spring, malt barley. Buff has AI tolerance genetics similar to Litmus. Buff has a white aleurone, unlike Litmus. Buff is competitive with feed and malt varieties on non-acidic soils, except where IMI chemistry is used. Across 65 WA barley NVT trials (2019–2022), Buff has yielded less than Litmus in 9%, the same in 25% and higher in 66%. Across 119 WA barley NVT trials (2018–2022), Buff has yielded less than Maximus CL in 50%, the same in 16% and higher in 34%. The grain quality package of Buff is okay, but not great, having a lower hectolitre weight, with a similar retention risk as Spartacus CL. Fungicides may be required to manage SFNB, PM and BLR. Its weed competitiveness has not been tested. Buff may be at a medium risk of head loss and has a short coleoptile. Buff was the fifth most popular barley variety in 2022, accounting for 3.5% of the state's barley acreage, predominantly in the Geraldton and Kwinana Port Zone. Target production zones in 2024 are Kwinana-North (East).

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	110	114	99	94	100
Agzone 2	103	101	94	99	99
Agzone 3	100	93	94	107	97
Agzone 4	122	138	95	90	103
Agzone 5	97	83	84	99	95
Agzone 6	104	97	90	103	95
Statewide	104	96	92	100	98
Disease resistance	Seedling		Adult		
Sc	-		MS		
NFNB (Beecher virulent)	MS		MS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	S		MS		
SFNB	MS		S		
PM	S		S		
BLR (5457P-)	SVS		S		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	S		S		
CCN	Sp		Sp		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Camamah	-10	-2	+1	-2	
Cunderdin	-8	+0	+2	+0	
Katanning	-7	+0	+2	+0	
Grass Patch	-9	-1	+1	-1	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Short				
Plant height	Medium				
Straw strength	Moderately good				
Head loss risk	Medium				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	AgVic Services / InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.50				

Refer to page 4 for interpreting resistance classification.

p = provisional rating

Maximus CL^(b)

Deliverable as a malt variety

Comments

Maximus CL (tested as IGB1705T) is an IMI-tolerant, medium-height, early-spring, malt barley. Maximus CL is acceptable for export as grain and malt and is being assessed for the manufacture of shochu in Japan. Maximus CL has not been approved by all brewing customers, especially those in China. Full approval is expected within 12 months. Maximus CL has a short coleoptile and should not be sown deep. Across 119 WA barley NVT (2018–2022), Maximus CL yielded less than RGT Planet in 30% of trials, the same in 16% and higher in 54%, performing better in environments that yield less than 4t/ha. Maximus CL grain is plumper than Spartacus CL grain with a similar hectolitre weight resulting in a higher probability of receival as MALT1. Use recommended IMI-herbicides and be aware of market advice regarding delivering grain from paddocks sprayed with an IMI- herbicide. Maximus CL is a general improvement over Spartacus CL for NFNB (except Oxford virulent) as an adult, SFNB and PM (even in the presence of *MILa* virulence). Fungicides may be required to manage smut, NFNB (Oxford virulent) and BLR. Maximus CL appears to have a low risk of head loss. Maximus CL was the most popular variety in 2022, sown on 32% of the barley acreage, just pipping Spartacus CL at 30%. Target production zones in 2024 are Geraldton, Kwinana, Albany, and Esperance Port Zones.

Yield (% Spartacus CL)	2018	2019	2020	2021	2022
Agzone 1	104	108	102	107	105
Agzone 2	103	104	104	106	104
Agzone 3	104	104	105	103	104
Agzone 4	105	106	103	104	103
Agzone 5	106	107	105	104	105
Agzone 6	105	107	106	103	106
Statewide	104	105	105	104	104

Disease resistance	Seedling	Adult
Sc	-	MR
NFNB (Beecher virulent)	MRMS	MRMS
NFNB (Beecher avirulent)	MRMS	MRMS
NFNB (Oxford virulent)	S	S
SFNB	MS	MSS
PM	RMR	RMR
BLR (5457P-)	S	MSS
BYD and CYD	MRMS	MRMS
RLN (<i>P. neglectus</i>)	-	-
RLN (<i>P. quasitereoides</i>)	S	S
CCN	R	R

'FlowerPower' predicted flowering date (days to Z49)	Relative to Spartacus CL			
	15-Apr	05-May	25-May	15-Jun
Carnamah	+9	+3	+2	+4
Cunderdin	+6	+1	+0	+2
Katanning	+7	+2	+1	+3
Grass Patch	+7	+2	+1	+3

Agronomic traits	
Early growth habit	Erect
Coleoptile length	Short
Plant height	Medium
Straw strength	Good
Head loss risk	Low
Grain protein deviation	Slightly higher

Variety information	
Breeder / Seed licensee	InterGrain
Access to seed	Seedclub members and resellers
EPR (\$/t, excl. GST)	\$4.25

Refer to page 4 for interpreting resistance classification.

RGT Planet^(b)

Deliverable as a malt variety

Comments

RGT Planet (tested as SFR85-104) is a medium-height, medium-spring, malt barley preferred for export as grain and as malt but not for shochu. Suited to environments with a yield potential above 5t/ha and mixed farms practising grain and graze due to its early vigour. Across 119 WA barley NVT (2018–2022), RGT Planet yielded less than Rosalind in 58% of trials, the same in 25% and higher in 17%. The physical grain quality package of RGT Planet is inferior to Bass, Maximus CL, and Spartacus CL, often resulting in a lower frequency of delivery as MALT1. Excellent resistance in WA to PM (due to the *mlo* gene). Fungicides may be required to manage NFNB, SFNB and BLR (under high pressure). It appears to have a similar level of weed competitiveness (tested against oats) to Compass and Fathom. The popularity of RGT Planet, the third most popular barley variety in 2022 at 13% of the state's barley acreage, is declining. There is currently insufficient MALT1 grade RGT Planet supply to meet the demand for malting without processing aids, resulting in premiums above Maximus CL and Spartacus CL in some cases. Target production zones in 2024 are Kwinana-North (Midlands), Kwinana-South, and Albany Port Zones, with limited segregations offered in the Esperance Port Zone.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	96	71	107	84	100
Agzone 2	97	87	91	97	100
Agzone 3	102	96	94	109	106
Agzone 4	99	79	87	88	104
Agzone 5	96	74	76	98	94
Agzone 6	112	100	102	110	103
Statewide	99	90	91	99	102

Disease resistance	Seedling	Adult
Sc	-	MR
NFNB (Beecher virulent)	MRMS	S
NFNB (Beecher avirulent)	MS	MS
NFNB (Oxford virulent)	SVS	SVS
SFNB	S	S
PM	R	R
BLR (5457P-)	MSS	MRMS (late APR)
BYD and CYD	MRMS	MRMS
RLN (<i>P. neglectus</i>)	MSS	MSS
RLN (<i>P. quasitereoides</i>)	MS	MS
CCN	R _p	R _p

'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL			
	15-Apr	05-May	25-May	15-Jun
Carnamah	-	-	-	-
Cunderdin	-1	+3	+5	+5
Katanning	+0	+3	+5	+5
Grass Patch	-2	+2	+4	+5

Agronomic traits	
Early growth habit	Prostrate
Coleoptile length	Medium
Plant height	Medium
Straw strength	Good
Head loss risk	Low
Grain protein deviation	Slightly lower

Variety information	
Breeder / Seed licensee	RAGT Semences / Seed Force
Access to seed	RAGT Broadacre partners
EPR (\$/t, excl. GST)	\$4.00

Refer to page 4 for interpreting resistance classification.

p = provisional rating.

Spartacus CL^(b)

Deliverable as a malt variety

Comments

Spartacus CL (tested as IGB1334T) is an IMI-tolerant, medium-height, early-spring, malt barley that is acceptable for export as grain and malt and is preferred for manufacturing shochu in Japan. Spartacus CL has a short coleoptile and should not be sown deep. Across 119 WA barley NVT (2018–2022), Spartacus CL yielded less than Maximus CL in 76% of trials, the same in 24% and higher in 0%. Use recommended IMI-herbicides and be aware of market advice regarding delivering grain from paddocks sprayed with an IMI-herbicide. Fungicides may be required to manage smut, NFNB (Oxford virulent), SFNB and BLR. Spartacus CL appears to be a weak competitor with weeds (based on data from eastern Australia). The popularity of Spartacus CL is declining, being swapped out for Maximus CL. It was the second most popular barley variety in 2022, accounting for 30% of the state's barley acreage. Spartacus CL exhibits different malting characteristics than Maximus CL. These differences are desirable for some customers and will limit our opportunity to meet some customer specifications for export malt. Target production zones in 2024 are Kwinana, Albany, and Esperance Port Zones.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	96	92	98	93	95
Agzone 2	97	96	96	94	96
Agzone 3	96	96	95	97	96
Agzone 4	95	94	97	96	97
Agzone 5	94	94	95	96	95
Agzone 6	95	93	94	97	94
Statewide	96	95	95	96	96
Disease resistance	Seedling		Adult		
Sc	-		MR		
NFNB (Beecher virulent)	MRMS		MS		
NFNB (Beecher avirulent)	MRMS		MS		
NFNB (Oxford virulent)	S		S		
SFNB	S		SVS		
PM	MS		MS		
BLR (5457P-)	S		MSS		
BYD and CYD	MS		MS		
RLN (<i>P. neglectus</i>)	MSS		MSS		
RLN (<i>P. quasitereoides</i>)	MSS		MSS		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-9	-3	-2	-4	
Cunderdin	-6	-1	+0	-2	
Katanning	-7	-2	-1	-3	
Grass Patch	-7	-2	-1	-3	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Short				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Seedclub members and resellers				
EPR (\$/t, excl. GST)	\$4.25				

Refer to page 4 for interpreting resistance classification.

Beast^(b)

Stage Two malt accreditation

Comments

Beast (tested as AGTB0113) is a tall-height, early-spring barley under Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Beast suits low- to medium-rainfall environments and has good early vigour to assist with weed suppression, with a similar plant type to Compass. It combines the genetics of Compass and Hindmarsh. Across 100 WA barley NVT (2019–2022), Beast yielded less than Rosalind in 31% of trials, the same in 39% and higher in 30%. The primary advantage over Rosalind is in the sub-2t/ha environments where taller straw at harvest and a longer coleoptile at seeding are beneficial. Beast appears to have helpful resistance to NFNB (except Oxford virulent as a seedling), SFNB and PM but may need management for scald and BLR. Beast grain has good plumpness (better than Maximus CL) but with a lower hectolitre weight than Maximus CL. Lodging risk is similar to Compass. Beast has been released as a feed variety pending malting and brewing evaluation (expected in March 2024). Given its malt profile (low fermentability), Beast is not expected to be segregated in WA even if it meets the Grains Australia malting and brewing accreditation requirements.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	104	105	96	104
Agzone 2	-	102	101	98	100
Agzone 3	-	100	98	107	101
Agzone 4	-	97	103	102	104
Agzone 5	-	96	105	108	103
Agzone 6	-	96	100	105	95
Statewide	-	100	101	103	101
Disease resistance	Seedling		Adult		
Sc	-		S		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MS		MS		
NFNB (Oxford virulent)	SVS		MSS		
SFNB	MS		MSS		
PM	MR		MR		
BLR (5457P-)	S		MSS		
BYD and CYD	MS		MS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSP		MSP		
CCN	MR		MR		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-2	-1	-1	-2	
Katanning	+0	+1	+1	-1	
Grass Patch	-3	-2	-2	-3	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	Medium				
Grain protein deviation	Slightly higher				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	AGT Affiliates and Seed Sharing™				
EPR (\$/t, excl. GST)	\$4.00				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Commodus CL[Ⓛ]

Stage Two malt accreditation

Comments

Commodus CL (tested as IGB1908T) is an IMI-tolerant, tall-height, early-spring barley modelled off Compass barley. Commodus CL is undergoing Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Commodus CL is suited to low- to medium-rainfall areas and lighter soils. It has good early canopy size and ground coverage for weed suppression, high grain plumpness but poor hectolitre weight and is of a similar plant height to Compass. Has a medium coleoptile length. Commodus CL has the same IMI herbicide tolerance as Maximus CL but with greater early vigour. Across 79 WA barley NVT (2020–2022), Commodus CL yielded less than Maximus CL in 53% of trials, the same in 34% and higher in 13%. Relative to Compass in those same trials, Commodus CL yielded less than Compass in 29% of trials, the same in 71% and higher in 0%. Commodus CL appears to have useful resistance to NFNB, SFNB and PM but may need management for scald and BLR. Lodging risk is similar to Compass. Commodus CL has been released as a feed variety pending malting and brewing evaluation (expected in March 2024). Given its malt profile (low fermentability), Commodus CL is not expected to be segregated in WA even if it meets the Grains Australia malting and brewing accreditation requirements.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	100	86	97
Agzone 2	-	-	94	92	95
Agzone 3	-	-	92	103	97
Agzone 4	-	-	97	93	100
Agzone 5	-	-	93	100	95
Agzone 6	-	-	92	101	88
Statewide	-	-	94	96	96
Disease resistance	Seedling		Adult		
Sc	-		MSS		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	S		MSS		
SFNB	MRMS		MSS		
PM	MR		MR		
BLR (5457P-)	S		MSS		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	M _{Sp}		M _{Sp}		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-1	+0	+0	+1	
Katanning	+0	+0	+1	+1	
Grass Patch	-2	-2	-1	+0	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	Medium				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Seedclub members and resellers				
EPR (\$/t, excl. GST)	\$4.25				

Refer to page 4 for interpreting resistance classification.
 ρ = provisional rating.

Cyclops[Ⓛ]

Stage Two malt accreditation

Comments

Cyclops (tested as AGTB0200) is a medium-height, early-spring barley under Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Cyclops has a short coleoptile and should not be sown deep. Cyclops has the same erect growing habit as Maximus CL but with different genetics and no tolerance to IMI chemistry. Across 79 WA barley NVT (2020–2022), Cyclops yielded less than Maximus CL in 15% of trials, the same in 27% and higher in 58%, being a higher-yielding option in environments that yield more than 3t/ha. Cyclops appears to have useful resistance to scald, NFNB, SFNB, and PM but may need BLR management. Grain plumpness and hectolitre weight are lower than Maximus CL, with plumpness similar to Spartacus CL. Cyclops appears to have a low lodging and head loss risk. The breeder of Cyclops has engaged with grain marketers and malt companies operating in WA, and there is positive interest in Cyclops subject to accreditation and sufficient scale of production. The earliest accreditation date is March 2024.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	106	97	104
Agzone 2	-	-	101	104	102
Agzone 3	-	-	102	112	107
Agzone 4	-	-	95	102	107
Agzone 5	-	-	100	108	105
Agzone 6	-	-	108	107	107
Statewide	-	-	101	106	105
Disease resistance	Seedling		Adult		
Sc	-		MRMS		
NFNB (Beecher virulent)	MR		MRMS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	S		MSS		
SFNB	MSS		MSS		
PM	MR		MR		
BLR (5457P-)	S		S		
BYD and CYD	S		S		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	M _{Sp}		M _{Sp}		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-	-	-	-	
Katanning	-	-	-	-	
Grass Patch	-	-	-	-	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Short				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Grain protein deviation	Slightly higher				
Variety information					
Breeder / Seed licensee	AGT				
Access to seed	AGT Affiliates and Seed Sharing™				
EPR (\$/t, excl. GST)	\$4.00				

Refer to page 4 for interpreting resistance classification.
 ρ = provisional rating.

Laperouse[Ⓛ]

Stage Two malt accreditation

Comments

Laperouse (tested as WI4952) is a medium-height, medium-spring barley under Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Across 119 WA barley NVT (2018–2022), Laperouse yielded less than RGT Planet in 20% of trials, the same in 24% and higher in 56%. Performs better than RGT Planet when the site yield is below 4.5t/ha. It has a better grain quality package than RGT Planet, with a higher hectolitre weight and plumper grain (similar to Bass), lending to a high probability of being received as MALT1 if received in WA. Laperouse has helpful resistance to NTNB, STNB and PM, but fungicides may be required to manage scald and BLR. Its weed competitiveness has not been evaluated. It appears to have good straw strength and a low head loss risk. Farmer production of Laperouse is more advanced than that of Cyclops, Minotaur, and Zena CL. The greatest grower production is found in the western to central areas of the Albany Port Zone. The breeder of Laperouse has engaged with malt companies operating in WA and overseas companies, and there is positive interest in Laperouse subject to accreditation and sufficient scale of production. The earliest accreditation date is March 2024.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	104	96	103	94	101
Agzone 2	103	96	98	100	99
Agzone 3	102	99	99	108	103
Agzone 4	99	92	94	99	104
Agzone 5	99	85	97	104	101
Agzone 6	102	101	103	104	102
Statewide	102	96	98	103	102
Disease resistance	Seedling		Adult		
Sc	-		S		
NFNB (Beecher virulent)	MS		MRMS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	S		MSS		
SFNB	MRMS		MSS		
PM	RMR		MR		
BLR (5457P-)	MS		MSS		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSp		MSp		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	+2	+4	+4	+2	
Katanning	+5	+6	+6	+4	
Grass Patch	+2	+3	+3	+2	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Short				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	SECOBRA Recherches / Seednet				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.80				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Minotaur[Ⓛ]

Stage Two malt accreditation

Comments

Minotaur (tested as AGTB0213) is a medium-height, medium-spring barley with no IMI tolerance produced by crossing European and Australian genetics. Minotaur is under Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Across 79 WA barley NVT (2020–2022), Minotaur yielded less than RGT Planet in 13% of trials, the same in 33% and higher in 54%. Performs better than RGT Planet when the site yield is below 4.5t/ha. Relative to Cyclops, Minotaur yielded less in 47% of trials, the same in 42% and higher in 11%. Hectolitre weight and grain plumpness are an improvement over RGT Planet but not as good as Bass, Maximus CL or Spartacus CL. Minotaur has useful resistance to NFNB but may need management for SFNB, PM, and BLR and is very sensitive to scald. Minotaur appears to have a low lodging and head loss risk. The breeder of Minotaur has engaged with grain marketers and malt companies operating in WA, and there is positive interest in Minotaur subject to accreditation and sufficient scale of production. The earliest accreditation date is March 2024.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	107	93	102
Agzone 2	-	-	97	101	102
Agzone 3	-	-	99	106	107
Agzone 4	-	-	94	96	103
Agzone 5	-	-	89	101	99
Agzone 6	-	-	108	108	108
Statewide	-	-	97	101	104
Disease resistance	Seedling		Adult		
Sc	-		VS		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	MS		MS		
SFNB	S		S		
PM	SVS		S		
BLR (5457P-)	S		S		
BYD and CYD	MSS		MSS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSp		MSp		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-	-	-	-	
Katanning	-	-	-	-	
Grass Patch	-	-	-	-	
Agronomic traits					
Early growth habit	Prostrate				
Coleoptile length	Medium				
Plant height	Short				
Straw strength	Good				
Head loss risk	-				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	AGT				
Access to seed	AGT Affiliates and Seed Sharing™				
EPR (\$/t, excl. GST)	\$4.00				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Zena CL^(b)

Stage Two malt accreditation

Comments

Zena CL (tested as IGB20125T) is an IMI-tolerant, medium-height, medium-spring barley modelled on RGT Planet. Zena CL is under Stage Two evaluation in 2023 by Grains Australia for its malting and brewing potential. Across 52 WA barley NVT (2021–2022), Zena CL yielded the same as RGT Planet in all 52 trials. Zena CL has a similar agronomic fit (i.e., coleoptile length, phenology, straw strength, and head loss risk) and grain quality profile as RGT Planet, except it is tolerant of IMI herbicides. Disease screening data suggest a slight improvement over RGT Planet for NFNB (Beecher virulent and avirulent), similar for scald, NFNB (Oxford virulent), PM, and BLR, and slightly worse for SFNB. The breeder of Zena CL has engaged with malt companies operating in WA, and there is positive interest in Zena CL subject to accreditation and sufficient scale of production. The breeder expects the variety to have a similar market fit to RGT Planet. The earliest accreditation date is March 2024.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	84	100
Agzone 2	-	-	-	97	101
Agzone 3	-	-	-	107	105
Agzone 4	-	-	-	86	103
Agzone 5	-	-	-	97	93
Agzone 6	-	-	-	109	102
Statewide	-	-	-	98	101
Disease resistance	Seedling		Adult		
Sc	-		MR		
NFNB (Beecher virulent)	MRMS		MS		
NFNB (Beecher avirulent)	MRMS		MRMS		
NFNB (Oxford virulent)	S		SVS		
SFNB	MSS		SVS		
PM	R		R		
BLR (5457P-)	MSS		MRMS (late APR)		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	-		-		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-1	+3	+5	+5	
Katanning	+0	+3	+5	+5	
Grass Patch	-2	+2	+4	+5	
Agronomic traits					
Early growth habit	Prostrate				
Coleoptile length	Medium				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Grain protein deviation	Slightly lower				
Variety information					
Breeder / Seed licensee	GIA / Intergrain				
Access to seed	Seedclub members and resellers				
EPR (\$/t, excl. GST)	\$4.25				

Refer to page 4 for interpreting resistance classification.

Combat^(b)

Deliverable as a feed variety

Comments

Combat (IGB1944) is a medium-height, medium-spring, feed variety. Combat has a semi-prostrate growth habit expected to provide a more weed-competitive behaviour than Rosalind. Combat is moderately susceptible to lodging and head loss. Across 52 WA barley NVT (2021–2022), Combat yielded lower than Rosalind in 4%, the same in 21% and higher in 75% of trials. Combat had a yield advantage over other varieties when the site yielded more than 4.5t/ha. Combat has useful resistance to NFNB and BLR (APR) and excellent resistance to SFNB and PM but may need management for scald. Combat is not being submitted for malting and brewing evaluation and has been released as a feed-only variety.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	98	109
Agzone 2	-	-	-	107	107
Agzone 3	-	-	-	114	111
Agzone 4	-	-	-	100	109
Agzone 5	-	-	-	108	105
Agzone 6	-	-	-	113	112
Statewide	-	-	-	108	109
Disease resistance	Seedling		Adult		
Sc	-		S		
NFNB (Beecher virulent)	S		MSS		
NFNB (Beecher avirulent)	MRMS		MSS		
NFNB (Oxford virulent)	SVS		MS		
SFNB	MR		MRMS		
PM	RMR		R		
BLR (5457P-)	MSS		MRMS _p (late APR)		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	-		-		
CCN	MRMS		MRMS		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-	-	-	-	
Katanning	-	-	-	-	
Grass Patch	-	-	-	-	
Agronomic traits					
Early growth habit	Semi-prostrate				
Coleoptile length	-				
Plant height	-				
Straw strength	-				
Head loss risk	-				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Seedclub members and resellers				
EPR (\$/t, excl. GST)	\$3.50				

Refer to page 4 for interpreting resistance classification.

Compass[Ⓛ]

Deliverable as a feed variety

Comments

Compass (tested as WI4593) is a tall-height, early-spring barley, only deliverable into feed stacks in WA. Best suited to environments with a yield potential below 4t/ha and where weed-competitive barley is required. Compass has a similar grain yield potential to Spartacus CL in WA and can out-yield RGT Planet, where the yield potential is below 3t/ha. Across 119 WA barley NVT (2018–2022), Compass yielded less than Rosalind in 58% of trials, the same in 29% and higher in 13%. Compass is susceptible to lodging, particularly in high-yielding situations. It has good tolerance to NFNB (Beecher virulent and avirulent) and PM (except in the presence of *MILa* virulence). Fungicides may be required to control NFNB (Oxford virulent) and BLR. While it was accredited as a malt variety by Grains Australia in March 2018, no malt segregations are available in WA. Therefore, Compass is received as a feed variety in WA. Compass was the twelfth most popular barley variety in 2022 but only accounted for just over 0.5% of the state's barley acreage. Compass is superseded by new varieties, including Beast, Combat, Commodus CL, Cyclops, Maximus CL, Laperouse, Minotaur, and Titan AX — depending on the farming system.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	106	101	102	89	100
Agzone 2	103	100	96	93	97
Agzone 3	97	95	93	106	97
Agzone 4	97	101	101	95	102
Agzone 5	93	88	97	104	97
Agzone 6	94	90	92	103	88
Statewide	99	95	95	99	97
Disease resistance	Seedling		Adult		
Sc	-		MS		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MS		MS		
NFNB (Oxford virulent)	SVS		S		
SFNB	MRMS		MSS		
PM	MR		MR		
BLR (5457P-)	S		S		
BYD and CYD	MS		MS		
RLN (<i>P. neglectus</i>)	MSS		MSS		
RLN (<i>P. quasitereoides</i>)	S		S		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-4	-1	+0	+1	
Katanning	-3	-1	+1	+1	
Grass Patch	-5	-2	+0	+0	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	Medium				
Variety information					
Breeder / Seed licensee	University of Adelaide / Seednet				
Access to seed	Seednet Partners				
EPR (\$/t, excl. GST)	\$3.80				

Refer to page 4 for interpreting resistance classification.

Fathom[Ⓛ]

Deliverable as a feed variety

Comments

Fathom (tested as WI4483) is a medium-height, medium-spring, feed barley. Fathom has good early vigour for weed suppression and a long coleoptile, allowing deeper sowing when required. Best suited to environments with a yield potential below 3t/ha and where there is a high risk of SFNB. Across 118 WA barley NVT (2018–2022), Fathom yielded less than Rosalind in 69% of trials, the same in 21% and higher in 9%. Combat supersedes Fathom. Across 52 WA barley NVT (2020–2022), Fathom yielded less than Combat in 88% of trials, the same in 12% and higher in 0%. It has excellent tolerance to scald and SFNB and practical tolerance to PM but may require management for NFNB (Beecher virulent and Oxford virulent) and BLR (late APR). It is mixed for its head colour, having green and waxy green heads. Fathom was the fifteenth most popular barley variety in 2022, accounting for just under 0.5% of the state's barley acreage.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	105	103	99	89	98
Agzone 2	101	99	94	94	96
Agzone 3	97	93	93	104	96
Agzone 4	104	110	96	93	101
Agzone 5	93	84	92	100	95
Agzone 6	96	91	91	101	90
Statewide	99	94	93	98	96
Disease resistance	Seedling		Adult		
Sc	-		MR		
NFNB (Beecher virulent)	SVS		S		
NFNB (Beecher avirulent)	MS		MS		
NFNB (Oxford virulent)	S		S		
SFNB	MR		MRMS		
PM	MRMS		MRMS		
BLR (5457P-)	MS		MRMS (late APR)		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	MS _p		MS _p		
RLN (<i>P. quasitereoides</i>)	MSS		MSS		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	+8	+6	+4	+2	
Cunderdin	+8	+6	+4	+2	
Katanning	+8	+5	+3	+1	
Grass Patch	+8	+5	+3	+2	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Long				
Plant height	Medium				
Straw strength	Fair				
Head loss risk	Low				
Variety information					
Breeder / Seed licensee	University of Adelaide / Seednet				
Access to seed	Seednet Partners				
EPR (\$/t, excl. GST)	\$2.00				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Flinders^(b)

Deliverable as a feed variety

Comments

Flinders (tested as WABAR2537) is a short-height, medium-spring barley no longer deliverable to malt barley segregations after the 2023–24 harvest due to the low production volumes. Best suited to environments with a yield potential above 3t/ha and environments where short, stiff straw and good head retention are essential. Across 82 WA barley NVT (2018–2022), Flinders yielded less than RGT Planet in 62% of trials, the same in 32% and higher in 6%. Across 82 WA barley NVT (2018–2022), Flinders yielded less than Rosalind in 93% of trials, the same in 7% and higher in 0%. Flinders is resistant to PM (non-*mlo*). Fungicides may be required to manage NFNB (Oxford virulent), SFNB and BLR (despite having APR). Weed competitiveness is similar to other semi-dwarf varieties. The acreage of Flinders is declining, and it accounted for 0.6% of the state's barley acreage in 2022, with production predominantly in the Albany and Esperance Port Zones.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	85	66	95	-	-
Agzone 2	89	83	86	-	-
Agzone 3	95	90	90	95	97
Agzone 4	91	75	84	-	-
Agzone 5	89	74	74	-	-
Agzone 6	98	92	92	97	94
Statewide	90	85	86	89	93
Disease resistance	Seedling		Adult		
Sc	-		MSS		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MSS		MS		
NFNB (Oxford virulent)	S		S		
SFNB	MS		S		
PM	R		RMR		
BLR (5457P-)	MS		MRMS (late APR)		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	MSp		MSp		
RLN (<i>P. quasitereoides</i>)	MSSp		MSSp		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	+1	+5	+6	+5	
Cunderdin	+3	+6	+7	+7	
Katanning	+5	+7	+8	+8	
Grass Patch	+3	+6	+7	+6	
Agronomic traits					
Early growth habit	Prostrate				
Coleoptile length	Short				
Plant height	Short				
Straw strength	Very good				
Head loss risk	Low				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.80				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

La Trobe^(b)

Deliverable as a feed variety

Comments

La Trobe (tested as IGB1101) is a medium-height, early-spring barley no longer deliverable to malt barley segregations in WA after the 2022–23 harvest. Best suited to environments with a yield potential below 4t/ha. Across 119 WA barley NVT (2018–2022), La Trobe yielded less than Rosalind in 79% of trials, the same in 20% and higher in 1%. Has practical tolerance to scald and NFNB (Beecher virulent and avirulent), but fungicides may be required to manage smut, NFNB (Oxford virulent), SFNB and BLR. La Trobe was the eighth most popular barley variety in 2022, accounting for 2% of the state's barley acreage. La Trobe is superseded by Maximus CL, where malt is a target, and Beast, Combat, Cyclops, Laperouse, Minotaur, and Titan AX when growing barley for a feed outcome.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	99	95	99	91	97
Agzone 2	99	97	95	94	96
Agzone 3	97	95	94	100	97
Agzone 4	98	99	98	95	99
Agzone 5	94	91	93	98	95
Agzone 6	96	92	92	100	92
Statewide	97	95	95	96	96
Disease resistance	Seedling		Adult		
Sc	-		MR		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MRMS		MS		
NFNB (Oxford virulent)	S		MSS		
SFNB	S		S		
PM	MS		MSS		
BLR (5457P-)	MS		MSS		
BYD and CYD	MSS		MSS		
RLN (<i>P. neglectus</i>)	MS		MS		
RLN (<i>P. quasitereoides</i>)	S		S		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-5	+0	+1	-1	
Cunderdin	-6	-2	-1	-2	
Katanning	-5	-2	-1	-3	
Grass Patch	-6	-2	-1	-3	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Medium				
Plant height	Medium				
Straw strength	Moderately good				
Head loss risk	Medium				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$4.00				

Refer to page 4 for interpreting resistance classification.

Litmus^(b)

Deliverable as a feed variety

Comments

Litmus (tested as WABAR2625) is a tall-height, early-spring, feed barley with improved tolerance to low pH and high soil Al that Buff supersedes. It is best suited to environments where the soil at 10–30cm has a pH_{Ca} below 4.8. Across 65 WA barley NVT (2019–2022), Litmus yielded less than Buff in 66% of trials, the same in 25% and higher in 9%. Litmus has fair straw strength and is susceptible to all leaf diseases but has the lowest yield loss in the presence of crown rot. Fungicides may be required to manage all leaf diseases except PM. Its reaction to weed competition is unknown. Due to the presence of blue aleurone in its grain, it is only deliverable to sites where active management of blue aleurone in feed barley stacks is available. Litmus was the tenth most popular barley variety in 2022, accounting for just over 1% of the state's barley acreage, with production restricted to the Geraldton and Kwinana Port Zones. Growers are switching to Buff in preference to Litmus.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	95	98	80	94
Agzone 2	-	97	85	84	94
Agzone 3	-	-	81	95	87
Agzone 4	-	137	101	75	94
Agzone 5	-	-	-	-	-
Agzone 6	-	-	-	-	-
Statewide	-	89	82	88	88
Disease resistance	Seedling		Adult		
Sc	-		SVS		
NFNB (Beecher virulent)	S		S		
NFNB (Beecher avirulent)	MSS		S		
NFNB (Oxford virulent)	S		S		
SFNB	MS		S		
PM	RMR		MR		
BLR (5457P-)	S		S		
BYD and CYD	S		S		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSSp		MSSp		
CCN	MS		MS		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-18	-9	-6	-7	
Cunderdin	-15	-7	-4	-4	
Katanning	-14	-7	-3	-4	
Grass Patch	-16	-8	-4	-5	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	Medium				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.80				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Mundah

Deliverable as a feed variety

Comments

Mundah (tested as 85S:514) is a medium-height, very early-spring, feed barley. Best suited to environments with a yield potential below 2t/ha and later sowing systems (i.e. June and July) where early season weed control is necessary. Across 64 WA barley NVT (2018–2020), Mundah yielded less than Rosalind in 94% of trials, the same in 6% and higher in 0%. Mundah can suffer from head loss and lodging. Fungicides may be required to manage scald, NFNB (Beecher virulent and Oxford virulent), SFNB, PM and BLR. Mundah appears to have similar weed competitiveness to Compass and Fathom, although it has not been tested side by side in the same trials. Mundah was the eleventh most popular barley variety in 2022, accounting for 0.6% of the state's barley acreage. Mundah is no longer sown in WA barley NVT. Mundah is superseded by new varieties, including Beast, Buff, Combat, Commodus CL, Cyclops, Laperouse, Litmus, and Titan AX — depending on the farming system.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	95	85	96	-	-
Agzone 2	93	92	84	-	-
Agzone 3	90	85	81	-	-
Agzone 4	99	106	95	-	-
Agzone 5	83	77	74	-	-
Agzone 6	90	77	76	-	-
Statewide	91	85	83	-	-
Disease resistance	Seedling		Adult		
Sc	-		S		
NFNB (Beecher virulent)	S		S		
NFNB (Beecher avirulent)	MS		MS		
NFNB (Oxford virulent)	MSS		MSS		
SFNB	MSS		S		
PM	S		MSS		
BLR (5457P-)	S		S		
BYD and CYD	MS		MS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSSp		MSSp		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-20	-13	-11	-10	
Cunderdin	-15	-10	-7	-6	
Katanning	-13	-8	-5	-5	
Grass Patch	-16	-11	-8	-7	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Medium				
Plant height	Medium				
Straw strength	Fair				
Head loss risk	Medium				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	No EPR payable				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

Neo CL[Ⓟ]

Deliverable as a feed variety

Comments

Neo CL (tested as IGB22102T) is an IMI-tolerant, medium-height, medium-spring, two-row barley. Neo CL is a cross between Australian genetics carrying tolerance to IMI-herbicides and RGT Planet, with RGT Planet representing 25% of the pedigree. DPIRD phenology data from 2022 suggest that Neo CL is later flowering than RGT Planet when sown in mid-April, but similar in May. Above 4t/ha, Neo CL has shown a high yield potential in DPIRD testing (2022 season only) and InterGrain testing, with little data available for environments that yield less than 3t/ha. Neo CL has been entered into WA barley NVT for the first time in 2023, so independent data from a broader spread of environments will be available in 2024. Neo CL grain appears to have a similar hectolitre weight to RGT Planet but with improved grain plumpness (potentially similar to Spartacus CL). According to the breeder, Neo CL appears to have useful resistance to scald, NTN, SFNB, and PM, but notably improved resistance to NFNB and SFNB over RGT Planet. Neo CL is in Stage One of the Grains Australia Malt Accreditation program in 2023, with the earliest accreditation being in March 2025.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	-	-	-	-	-
Agzone 3	-	-	-	-	-
Agzone 4	-	-	-	-	-
Agzone 5	-	-	-	-	-
Agzone 6	-	-	-	-	-
Statewide	-	-	-	-	-
Disease resistance	Seedling		Adult		
Sc	-		-		
NFNB (Beecher virulent)	-		-		
NFNB (Beecher avirulent)	-		-		
NFNB (Oxford virulent)	-		-		
SFNB	-		-		
PM	-		-		
BLR (5457P-)	-		-		
BYD and CYD	-		-		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	-		-		
CCN	Rp		Rp		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-	-	-	-	
Katanning	-	-	-	-	
Grass Patch	-	-	-	-	
Agronomic traits					
Early growth habit	Semi-prostrate				
Coleoptile length	-				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Seedclub members and resellers				
EPR (\$/t, excl. GST)	\$4.25				

Refer to page 4 for interpreting resistance classification.
ρ = provisional rating.

Rosalind[Ⓟ]

Deliverable as a feed variety

Comments

Rosalind (tested as IGB1302) is a medium-height, early-spring, feed barley. It suits all environments with a low probability of delivering malt-grade barley. Rosalind has been the yield benchmark for barley in WA but is now challenged by Combat and Cyclops. Across 52 WA barley NVT (2021–2022), Rosalind yielded less than Combat in 75% of trials, the same in 21% and higher in 4%, with Combat having a yield advantage at all levels of yield potential. Across 79 WA barley NVT (2020–2022), Rosalind yielded less than Cyclops in 41% of trials, the same in 38% and higher in 22%, with Cyclops showing an advantage above 4t/ha. Good straw strength and head retention. Fungicides may be required to manage scald, NFNB (Oxford virulent), SFNB, and where MILa virulent PM is present. Its weed competitiveness is unknown. Rosalind was the fourth most popular barley variety in 2022, accounting for 7% of the state's barley acreage, being more prevalent in southern cropping areas than northern cropping areas.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	104	102	106	101	105
Agzone 2	103	103	101	101	104
Agzone 3	101	102	99	104	102
Agzone 4	106	109	105	98	102
Agzone 5	102	104	97	103	100
Agzone 6	106	101	100	106	101
Statewide	103	103	100	102	102
Disease resistance	Seedling		Adult		
Sc	-		MSS		
NFNB (Beecher virulent)	MR		MS		
NFNB (Beecher avirulent)	MR		MR		
NFNB (Oxford virulent)	S		MSS		
SFNB	MS		S		
PM	MSS		MSS		
BLR (5457P-)	MRMS		MR		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	MSS		MSS		
CCN	R		R		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-8	-1	+1	+0	
Cunderdin	-9	-3	-1	-2	
Katanning	-8	-3	-1	-2	
Grass Patch	-9	-4	-1	-2	
Agronomic traits					
Early growth habit	Erect				
Coleoptile length	Short				
Plant height	Medium				
Straw strength	Good				
Head loss risk	Low				
Variety information					
Breeder / Seed licensee	InterGrain				
Access to seed	Free to trade				
EPR (\$/t, excl. GST)	\$3.50				

Refer to page 4 for interpreting resistance classification.

Scope CL^(b)

Deliverable as a feed variety

Comments

Scope CL (tested as VBHT0805) is an IMI-tolerant, tall-height, medium-spring barley no longer segregated as a malt variety in WA and deliverable only into feed stacks. Better adapted than Commodus CL, Maximus CL, and Spartacus CL to April sowing opportunities when sowing into non-Clearfield® wheat stubble (allowing control of in-crop wheat volunteers). Across 83 WA barley NVT (2018–2022), Scope CL yielded less than Maximus CL in 78% of trials, the same in 13% and higher in 8%. Fungicides may be required to manage NFNB (Oxford virulent), SFNB and BLR. It should be harvested when ripe due to a high head loss risk. While it was accredited as a malt variety by Barley Australia in March 2013, malt segregations are no longer offered in WA. Scope CL is still very popular in the Geraldton and Kwinana Port Zone and was the sixth most popular barley variety across WA in 2022, accounting for just over 2% of the state's barley acreage.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	95	89	93	80	90
Agzone 2	93	92	86	88	90
Agzone 3	92	86	85	97	90
Agzone 4	103	110	90	82	95
Agzone 5	-	-	-	-	-
Agzone 6	-	-	-	-	-
Statewide	93	86	84	89	90
Disease resistance	Seedling		Adult		
Sc	-		MS		
NFNB (Beecher virulent)	MRMS		MRMS		
NFNB (Beecher avirulent)	MR		MRMS		
NFNB (Oxford virulent)	S		MS		
SFNB	MS		S		
PM	MR		MR		
BLR (5457P-)	S		MSS		
BYD and CYD	MRMS		MRMS		
RLN (<i>P. neglectus</i>)	MSS		MSS		
RLN (<i>P. quasitereoides</i>)	MRMS		MRMS		
CCN	S		S		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	+6	+7	+6	+5	
Cunderdin	+5	+5	+5	+3	
Katanning	+7	+6	+6	+4	
Grass Patch	+5	+4	+4	+3	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	High				
Variety information					
Breeder / Seed licensee	AgVic Services / Seednet				
Access to seed	Seednet Partners				
EPR (\$/t, excl. GST)	\$3.50				

Refer to page 4 for interpreting resistance classification.

Titan AX^(b)

Deliverable as a feed variety

Comments

Titan AX (tested as AGTB0325) is a herbicide-tolerant, tall-height, medium-spring barley. Titan AX tolerates the Aggressor herbicide (Group 1, quizalofop-P-ethyl), allowing in-crop control of grass weeds, including barley grass, brome grass, and wild oats. The plant type of Titan AX is similar to that of Compass with good early vigour, similar lodging and head loss risk, a medium coleoptile, and a maturity slightly later than Compass or similar to RGT Planet. Titan AX is suggested for low- to medium-rainfall environments. Growers should be cautious in their expectations due to the lack of public field trial data. In 34 WA barley NVT (2021–2022), Titan AX yielded less than Rosalind in 44% of trials, the same in 35%, and higher in 21%. In the same trials, Titan AX yielded less than Maximus CL in 26% of trials, the same in 26%, and higher in 46%. Titan AX has useful resistance to NFNB, STNB, and PM but may need management for scald and BLR. Titan AX is in Stage One of the Grains Australia Malt Accreditation program in 2023, with the earliest accreditation being in March 2025.

Yield (% Maximus CL)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	102
Agzone 2	-	-	-	-	99
Agzone 3	-	-	-	-	102
Agzone 4	-	-	-	-	106
Agzone 5	-	-	-	105	99
Agzone 6	-	-	-	-	96
Statewide	-	-	-	102	101
Disease resistance	Seedling		Adult		
Sc	-		S		
NFNB (Beecher virulent)	MS		MRMS		
NFNB (Beecher avirulent)	MS		MRMS		
NFNB (Oxford virulent)	SVS		MS		
SFNB	MS		MSS		
PM	R		RMR		
BLR (5457P-)	MSS		S		
BYD and CYD	MS		MS		
RLN (<i>P. neglectus</i>)	-		-		
RLN (<i>P. quasitereoides</i>)	-		-		
CCN	MR _p		MR _p		
'FlowerPower' predicted flowering date (days to Z49)	Relative to Maximus CL				
	15-Apr	05-May	25-May	15-Jun	
Carnamah	-	-	-	-	
Cunderdin	-	-	-	-	
Katanning	-	-	-	-	
Grass Patch	-	-	-	-	
Agronomic traits					
Early growth habit	Semi-erect				
Coleoptile length	Medium				
Plant height	Tall				
Straw strength	Fair				
Head loss risk	Medium				
Variety information					
Breeder / Seed licensee	AGT				
Access to seed	AGT Affiliates and Seed Sharing™				
EPR (\$/t, excl. GST)	\$4.55				

Refer to page 4 for interpreting resistance classification.
p = provisional rating.

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Barley