Oats

Introduction

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This oat guide is designed to help growers determine which milling oat or export hay variety to grow. The guide provides variety characteristics, disease ratings and agronomic information for oat varieties that offer the best opportunity to meet market requirements (Tables 1–13; Figures 1–7).

Until the end of 2020, the National Oat Breeding Program (NOBP), led by the South Australian Research and Development Institute (SARDI) with support from the AgriFutures Export Fodder Program and the Australian Exporters Company (AEXCO) was responsible for developing and evaluating oat varieties for milling and export hay. In 2021, the breeding program at the NOBP transitioned to the commercial cereal breeding company InterGrain. InterGrain is now responsible for the national development of milling oat grain and export oaten hay varieties.

Many oat grain varieties are available for delivery into the Co-Operative Bulk Handling (CBH) system. At CBH sites accepting oats, the Grains Industry of Western Australia (GIWA) oat delivery grades available are OAT1 and OAT2, while OWAN is an exclusive segregation for Wandering oats. Each variety has its strengths and weaknesses across different growing regions. Most successful oat growers choose to grow more than one variety because no single oat variety is likely to provide optimum agronomic traits, disease resistance, yield and quality in any one year. Some grain oat varieties are suitable for export hay, but hay-only varieties may provide a better option for dedicated export hay growers. This guide summarises the suitability of oat varieties for grain (OAT1, OAT2, OWAN) and hay (Table 1). It also outlines the characteristics of seven of the most widely sown grain oat varieties (Table 2). The variety ‘snapshots’ at the end of this section summarises the strengths and weaknesses of key grain and hay varieties documented in this bulletin.

The decision on whether to grow an OAT1, OAT2 or OWAN grain oat depends on five main factors:

1. The premium paid for different OAT1, OAT2 and OWAN varieties.
2. Relative grain yield of oat varieties.
3. Differences in input costs required due to agronomic and disease characteristics.
4. Likelihood of meeting oat receival specifications.
5. Location of receival segregations for OAT1 and OAT2 varieties.

Grain oat variety choice in 2024 — what should I grow?

While there are currently no new variety options that are accredited by Grains Australia for milling oat production in 2024, new variety options with strong performance are on the horizon. These include the advanced breeding line 13008-18, which appears to be suited to lower yielding environments (<4t/ha) and Koala, which appears suited to higher yielding environments (>4t/ha).

Bannister is recommended if targeting the OAT1 market and risk of oat septoria is low-moderate. Bilby and Williams are recommended in higher rainfall areas with a low risk of drought stress during grain filling. Wandering is recommended if targeting the OWAN or OAT2 market, while Durack is a good OAT2 option with a June sowing.

Hay oat variety choice in 2024 – what should I grow?

If targeting export hay, the hay-only varieties Brusher and Forester are suitable for the far southwest of WA. Mulgara and Wintaroo are hay-only options for medium to high-yielding regions statewide. The recently released hay-only variety Koorabup and the dual-purpose variety Williams are suggested for high disease-risk areas. In other areas, the dual-purpose varieties Carrolup, Yallara and Bannister are also suitable for export hay production.

Table 1. Suitability of oat varieties for grain (OAT1, OAT2, OWAN) and hay

Variety	OAT1	OAT2	OWAN	Hay
Archer	-	-	-	✓
Bannister	✓	✓	-	✓
Bilby	✓	✓	-	-
Brusher	-	-	-	✓
Carrolup	✓	✓	-	✓
Durack	-	✓	-	✓
Forester	-	-	-	✓
Kangaroo	-	-	-	✓
Kingbale	-	-	-	✓
Koala	*	*	-	*
Kojonup	✓	✓	-	✓
Koorabup	-	-	-	✓
Kowari	✓	✓	-	-
Kultarr	-	-	-	✓
Mitika	✓	✓	-	-
Mulgara	-	-	-	✓
Swan	-	-	-	✓
Tammar	-	-	-	✓
Tungoo	-	-	-	✓
Wallaby	-	-	-	✓
Wandering	-	✓	✓	-
Williams	✓	✓	-	✓
Winjardie	-	-	-	✓
Wintaroo	-	-	-	✓
Yallara	✓	✓	-	✓

Source: GIWA and AEXCO
*Koala has not yet been considered suitable for milling or export hay.

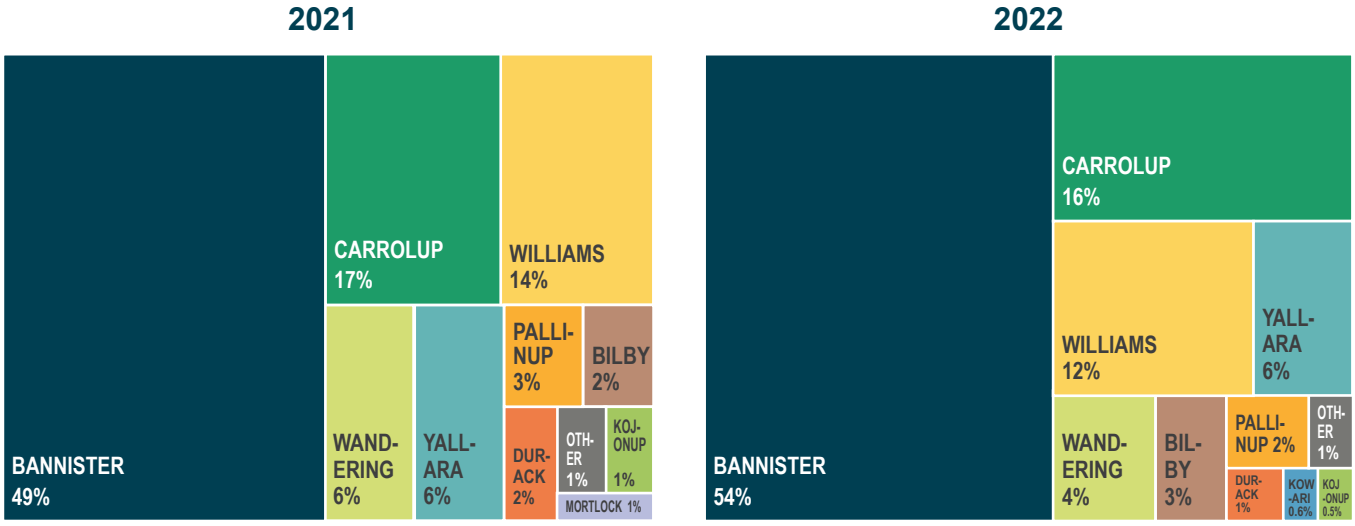

Figure 1. Relative popularity (percentage of oat area) of the top ten oat varieties plus the combined area sown to the remaining seven varieties delivered in WA in 2021 and 2022. The top ten varieties occupied 99% of the area planted to oats in both seasons, while the top five varieties occupied 92%.

Source: Grower estimates as provided to CBH for 2021 and 2022.

The hay-only varieties Archer and Kingbale may have a fit for rotations where imidazolinone (IMI) residues exist or where 'incorporated before sowing' (IBS) use of Sentry® (imazapic + imazapyr) is being considered to manage barley and brome grass, wild oats and other weeds on the label. Sentry® herbicide is now approved for IBS application in Archer and Kingbale hay, forage, seed and grain crops (domestic feed market only) (cdn.nufarm.com/wp-content/uploads/sites/22/2018/06/30133447/0512-Nufarm-Sentry-Herbicide-v2.pdf). Excess grain, seed and screenings produced from the single-gene IMI oaten hay varieties Archer and Kingbale, can now be used for domestic livestock feed. However, grain of these two varieties cannot be delivered into the Bunge and CBH bulk handling systems.

What is new in 2024?

No new milling or hay oat varieties were released in 2023. The following are notes on five varieties that might be of interest to oat growers: 13008-18, Archer, Koala, Kultarr and Wallaby.

13008-18

Key points:

- Potential milling oat with very good grain quality.
- Bannister type with improved panicle emergence.
- Medium spring maturity (3–6 days earlier to flower than Bannister).
- Very high yielding in <4t/ha environments.
- Undergoing milling evaluation post 2023 harvest.

13008-18 is a medium spring variety suited to all milling oat-growing regions in WA. 13008-18 is derived from Bannister and has the following pedigree – 02095-9/Bannister. It has been accepted for milling evaluation by Grains Australia.

13008-18 was first tested in WA oat NVT in 2021. It appears to be a yield improvement over Bannister above 2t/ha (Figure 3) with a stronger grain quality package (Figures 5 and 7). The critical quality strength of 13008-18 is its improved grain plumpness over Bannister. The disease resistance profile of 13008-18 is similar to Bannister.

Table 2. Summary of oat variety traits comparing seven grain-oat varieties

Trait	Bannister	Bilby	Carrolup	Durack	Wandering	Williams	Yallara
First year in variety trials in WA	2006	2013	1993	2010	1997	2006	2003
Statewide MET yield (% site mean)[1]	107%	102%	87%	86%	106%	103%	86%
Maturity relative to Carrolup (sown in late May)[2]	+3 days	-2 days	-	-7 days	+1 days	+2 days	-2 days
GIWA grade	OAT1	OAT1	OAT1	OAT2	OAT2	OAT1	OAT1
Suitable for export hay	Yes	No	Yes	Yes	No	Yes	Yes
Oat septoria	MSS	S	MSS	S	MSS	MSS	MSS
Oat leaf rust	MR	MRMS	VS	MRMS	VS	MR	MR
Oat stem rust	MS	SVS	S	SVS	SVS	MSS	MSS
Barley and cereal yellow dwarf	MS	S	SVS	S	S	MSS	MSS

Source: DPIRD and NVT Online nvtonline.com.au

[1] Regional differences in grain yield are masked when using a statewide average of the WA oat NVT MET data (2018–2022). Growers are directed to Tables 3 to 8 for a more precise estimate of variety performance in their region and Figures 2 and 3 to indicate relative variety performance at different site yields.

[2] Days to watery ripe from a 20 May sowing at Northam based on output from DPIRD FlowerPower v7, fp.dpird.app/

No score '-' = no rating is currently available. *Refer to page 4 for interpreting resistance classification.*

13008-18 shows promise as a hay variety. DPIRD data from 2022 suggests it has improved hay quality over Carrolup at a similar yield and Brusher at a lower hay yield.

DPIRD is evaluating 13008-18 in grain and hay trials to gather additional performance information season to InterGrain and that being generated by the WA oat NVT system before the 2024 cropping.

The NOBP bred 13008-18, and InterGrain are commercialising it. InterGrain has indicated they will release the variety if it passes milling evaluation.

Archer

Key points:

- Single gene, IMI-tolerant oat suitable for export hay.
- While modelled on Yallara oats, it has a different plant architecture and agronomic package and requires different management to optimise its performance as a hay-only variety.
- Targeted for sowing into soil with IMI residues from previous crops and for IBS use with Sentry® herbicide.
- Sentry® is approved for IBS application in crops of Archer hay, forage, seed and grain (domestic feed market only).
- Cannot be sprayed post-emergent with an IMI herbicide.
- Grain cannot be delivered to the Bunge and CBH bulk handling system but can be used in domestic feed markets for oaten grain and/or consumed on-farm.

Archer (tested as GIA1803-040) was released as a hay-only variety by InterGrain in August 2022. It was developed through mutation breeding by InterGrain's partner, GIA. According to InterGrain, Archer is a medium-maturity, medium-height and hay-only variety. In a recent DPIRD study, Archer was comparable to Yallara for yield and hay quality traits with a later cutting date (~1 week). Preliminary data from InterGrain indicates Archer produces high hay yields with suitable quality for export hay and has a useful disease profile. However, cereal cyst nematode (CCN) may require rotational management (Table 13). Archer appears to have a comparable grain yield to Carrolup, allowing for easier seed bulk-up for the following year's hay crop.

Archer seed is available from InterGrain's network of Seedclub members and resellers. As with other IMI-tolerant wheat and barley varieties, farmer-to-farmer trading of Archer seed is not allowed.

Koala

Key points:

- Currently undergoing milling evaluation.
- Suitability for export hay has not been established.
- Targeted for sowing in medium to high rainfall areas and for April planting.
- Widely tested in WA oat NVT since 2016.
- Has shown a slight yield advantage over Bannister in environments that yield more than 4.5t/ha.

Koala (tested as SV09143-35) is a late spring and tall grain-oat derived from Bannister, currently undergoing milling evaluation. Koala has the following pedigree – 02088-70/Bannister. It has similar tolerance to oat septoria and oat leaf rust (OLR) as Bannister but is improved for oat stem rust (OSR i.e. MRMS versus MS) (Table 12). Bannister and Koala have similar grain quality packages (hectolitre weight and screenings through a 2.0mm sieve) shown in Figures 4–7.

DPIRD is evaluating Koala in response to nitrogen (N) rates to gather additional agronomic, grain yield and quality information before the 2024 cropping season and complement information generated by NVT.

Koala seed will be bulked in WA in 2023 with the intent of being available for sale from Seednet partners in 2024.

Kultarr

Key points:

- Being evaluated for potential as an export hay variety.
- Suited to low to medium rainfall environments.
- Taller plant height, a benefit in more challenging years.
- Limited agronomic performance data exists for WA conditions.

According to the commercialising agent InterGrain, Kultarr (tested as 07423-18) is a quick to mid-maturing oaten hay with a tall plant height that offers excellent hay yields (Table 10). Kultarr has a higher yield potential than Brusher and Mulgara. It is slightly later to flower than Brusher and has similar flowering to Mulgara. Preliminary hay quality data indicates the variety has a suitable quality profile for export hay (Table 10). Kultarr has valuable resistance to oat septoria (MSS*p*), OLR (MR*p*) and OSR (MSS*p*) (Table 12).

Kultarr is being evaluated by DPIRD to gather additional hay yield and quality information before the 2024 cropping season and complement performance data being generated by InterGrain.

Kultarr was bred by the NOBP with support from the AgriFutures Export Fodder Program and AEXCO and is being commercialised by InterGrain. Kultarr seed will be available from InterGrain's network of Seedclub members and resellers for planting in 2024. Seed is free to trade from farmer to farmer by complying with the InterGrain seed sales declaration agreement (intergrain.com/source-seeds/ftf-trading/).

Wallaby

Key points:

- Being evaluated for potential as an export hay variety.
- Suited to medium to high rainfall environments.
- Wallaby is a dwarf type with a medium to tall plant height.
- Limited agronomic performance data exists for WA conditions.

According to the commercialising agent InterGrain, Wallaby (tested as 07079-9) is a mid-slow maturing oaten hay variety with similar hay yields to Brusher and Mulgara (Table 10). The variety has good digestibility and high water-soluble carbohydrate (WSC) levels. Provisional disease ratings suggest Wallaby has valuable resistance to oat septoria (MSS*p*), OLR (MR*p*), OSR (MS*p*) and is resistant to CCN (R) (Tables 12 and 13). Wallaby appears to have comparable grain yield to Carrolup, allowing for easier seed bulk-up for the following year's hay crop.

Wallaby is being evaluated by DPIRD to gather additional hay yield and quality information before the 2024 cropping season and complement production data being generated by InterGrain.

Wallaby was bred by the NOBP with support from the AgriFutures Export Fodder Program and AEXCO and is being commercialised by InterGrain. Wallaby seed will be available from InterGrain's network of Seedclub members and resellers for planting in 2024. Seed is free to trade from farmer to farmer by complying with the InterGrain seed sales declaration agreement (intergrain.com/source-seeds/ftf-trading/).

Other considerations for oat growers

Changes in disease pathogens

Oat growers are encouraged to look out for the red leather leaf (RLL) plant disease, which was confirmed in WA for the first time in 2021. The disease, which has been present in south-eastern Australia for many years, can cause yield and quality impacts in oaten hay and grain crops. DPIRD detected the disease in samples collected from Narrogin, Piesseville and Pingelly as part of its general crop surveillance program. The geographic spread suggests the disease has likely been present for more than one season.

In eastern Australia, RLL is commonly found in areas with high rainfall, mild weather and high humidity. Epidemiology of the disease is not well understood and no detailed study of the pathogen's life cycle has been done. RLL survives on crop residue and infection will likely arise from spores produced in the infested residue and secondary spread from infected plants. If you suspect you have RLL in your crops, please get in touch with Geoff Thomas via email at geoff.j.thomas@dpird.wa.gov.au or by phone at (08) 9368 3262 or Kylie Chambers at kylie.chambers@dpird.wa.gov.au or by phone (08) 9690 2151.

Early sowing reduces the risk of screenings in milling oats

A screening limit introduced in 2019–2020 for the receival of milling oat in the OAT2 grade has increased delivery risk for milling oat growers in WA. The new limit means grain with more than 15% screenings through a 2.0mm slotted sieve is not deliverable into the bulk handling system.

Research conducted by DPIRD with GRDC support (project DAW1901-002RTX) over two seasons (2019 and 2020) demonstrated that growers of milling oats could reduce screenings risk by sowing earlier. Oats sown in early April had a higher hectolitre weight (up 3kg/hL) and lower screenings (down 9% through a 2.0mm sieve) while yielding 0.65t/ha more than when sown after the first week of May. Grain staining, if present, was below the reportable levels for downgrading and did not influence the risk from earlier sowing in the trials. Early sowing and choosing the best variety reduced screenings more than reducing high rates of applied N. Early April sowing and variety selection are critical to meeting the recently introduced OAT2 delivery standards for milling oats.

Tips for nitrogen fertiliser – grain and hay

Nitrogen strategies differ for grain and hay oats, but high rates of applied N can be detrimental to both grain and hay quality.

If growing oats to deliver milling oat grain, the recommended N strategy is to apply one-third of the total required N fertiliser at seeding and two-thirds at six to ten weeks after seeding. While there is some flexibility around this recommended strategy, applying all N upfront carries the most risk.

The grain quality of Carrolup and Williams is more sensitive to increasing N than Bannister. The risk of high screenings and low hectolitre weight increases as more N is applied to grain crops. The dangers of higher N rates can be offset by sowing in April and planting varieties with high grain plumpness and high hectolitre weight.

If growing oats for hay delivery, the recommended N strategy is to apply two-thirds at seeding and one-third at six to ten weeks after seeding. To maximise quality, late N should be applied before stem elongation.

Research in the National Hay Agronomy (NHA) project, a four-year study supported by AgriFutures (project number PRJ-011029) with trials sites in WA, SA, Vic and NSW found that:

- Nitrogen application results in more biomass and taller and greener plants with an increased risk of lodging (especially in susceptible varieties). Peak hay yield was achieved with 90kg N/ha when averaged across varieties and locations. In some locations, target N was lower due to below-average rainfall during critical periods of the season.
- Nitrogen was not a major driver of hay quality defects such as thick stem diameter, high acid detergent fibre (ADF), high neutral detergent fibre (NDF) and high lignin, but did increase crude protein and decrease WSC.
- Applying more than 90kg N/ha increased the risk of not meeting the industry WSC limit of 22% for premium hay.
- Hay quality traits of varieties responded similarly to increasing N. When seeking high levels of WSC, more N can be applied to varieties with higher genetic levels of WSC before dropping a quality grade, with potentially more hay grown at the same quality grade. For example, more N can be applied to Yallara hay crops than Koorabup hay crops due to their inherent genetic differences in WSC, with Yallara one of the higher WSC varieties evaluated.
- Planting date was not a significant driver of N response when averaged across varieties and locations. While there were differences between planting dates in agronomic traits such as hay yield and hay quality parameters (except hay greenness, ADF and NDF), for most traits the response to N was similar across planting dates, albeit at a different level.
- Across the three years of research (2019–2021), season and variety had a greater influence on hay quality than rate of applied N.

Target plant density

Target plant density for oats depends on end-use (grain or hay) and rainfall zone.

When determining seeding rate, it is essential to consider target plant density (plants per square metre) rather than using a set machinery seeding rate (kg/ha). Using a fixed seeding rate can result in variable plant density across seasons due to variations in seed size (variety and seed source), seed viability and establishment conditions.

A target density of 160 plants/m^2 is appropriate for grain oats in lower rainfall areas, while 240 plants/m^2 is recommended in higher rainfall areas.

For hay oats, a target density of 240 plants/m^2 is appropriate in lower rainfall areas, while 320 plants/m^2 is recommended in higher rainfall areas.

The target density in plants/m^2 determines the seeding rate in kg/ha and is calculated using the following formula:

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

For example, if sowing Bannister oats with a kernel weight of 35g per 1000 kernels at a target density of 240 plants/m^2 with a germination of 96% and an expected establishment of 80%, then the seed rate in kg/ha required to establish 240 plants/m^2 is:

$$\text{seed rate in kg/ha} = 109 \text{ kg/ha} = \frac{35 \text{ x } 240}{0.96 \text{ x } 0.80 \text{ x } 100}$$

Lodging management in hay oats

Lodging poses a logistical issue for producers of export fodder, especially in high rainfall environments and when high soil nutrition results in big canopies early in the season. Crop lodging costs hay yield, causes uneven crop ripening, makes it difficult to cut the crop at a consistent height and affects curing time.

One way to reduce lodging in hay crops is to use the gibberellin biosynthesis inhibitor Moddus® Evo (250g/L trinexypac-ethyl), which increases stem strength and reduces plant height while potentially delaying flowering. The label rate for Moddus® Evo use in oats is 300–400mL/ha, with application restricted to Z30–Z32 (beginning of stem elongation). Another option is to graze the paddock before stem elongation.

Spraying a label rate application of Moddus® Evo at stem elongation (Z31–Z32) affected yield of hay oats in a four-year NHA project supported by AgriFutures (project number PRJ-011029). While Moddus® Evo improved straw strength and reduced lodging risk, 400mL/ha of Moddus® Evo also caused a yield decline in some seasons. The yield decline was not associated with any adverse change in hay quality. As the likelihood of lodging cannot be predicted when spraying the crop at the beginning of stem elongation, careful consideration should be given before applying Moddus® Evo at the label rate for export hay.

Research has shown that applying Moddus® Evo at 200mL/ha (below the label rate) is safer for hay oat crops, resulting in less risk of yield loss while improving straw strength and lowering lodging risk. The hay industry should consider applying for a label extension to allow a lower application rate of Moddus® Evo to reduce application cost and risk of yield loss.

Gibberellic acid and stuck panicles in export hay

In dry seasons, with specific varieties and generally in low rainfall environments, oat panicles can be slow to emerge from the leaf sheath, often only partially emerging before the watery ripe growth stage of the top florets. This results in growers either delaying hay cutting until the panicles have fully emerged or cutting at the correct growth stage but enduring a longer curing time. Both these scenarios can result in reduced hay quality due to a decline in WSC, increased fibre due to the later growth stages and increased environmental exposure as the hay cures. By increasing curing time, stuck panicles also increase the risk of saprophytic colonisation.

In the four-year NHA project supported by AgriFutures (project number PRJ-011029), gibberellic acid as ProGibb® SG was evaluated at four locations when sprayed at either stem elongation (Z31–32), flag leaf emergence (Z37–39) or both growth stages. While the gibberellic acid elongated the nodes, it elongated all nodes, not just the peduncle, and resulted in taller plants. While there was no adverse effect of applying gibberellic acid as ProGibb® SG on hay yield or quality, later applications (i.e. after flag leaf emergence) may be required so that the effect is only seen on the peduncle. The risk of stuck panicles is best managed through breeding of varieties capable of peduncle elongation, which in turn allows panicle emergence under most conditions. Further work is required to better understand the best time to apply gibberellic acid and other growth regulators so that only the peduncle is elongated and the risk of stuck panicles is reduced.

Using fungicides to protect hay quality in the swath

Rainfall during windrow curing encourages growth of saprophytic fungi, which usually consist of cosmopolitan fungi such as *Alternaria* spp. and *Cladosporium* spp. that colonise senescing or dead tissue and cause dark discolouration or spots. Curing hay provides an ideal environment for colonisation, especially when it coincides with or follows rainfall. Hay discolouration due to

growth of weather-induced saprophytic fungi is a significant issue for producers of export oaten hay as it reduces visual quality, suitability for export markets and economic returns.

Late-season fungicide options to minimise saprophytic colonisation of curing hay were evaluated by DPIRD and Agriculture Victoria plant pathologists in a NHA project supported by AgriFutures (project number PRJ011029). The research found foliar fungicides should be applied as needed for in-crop disease control and that effective disease control could improve hay quality through retained green leaf area.

While fungicides, specifically strobilurin-based products, can reduce saprophytic fungal growth and improve visual hay quality, exceeding fungicide MRLs is a potential risk, particularly with late-season strobilurin applications. However, oaten hay downgraded from biological damage and saprophyte staining can cost the grower about $150/t.

The NHA project established the weather conditions that favour saprophytic fungi development on windrows. As the research was preliminary, concrete recommendations to industry on the use of strobilurin fungicides could not be provided. The recommendation to date is that fungicides should be applied to manage in-crop disease with any additional saprophyte suppression an off-target bonus rather than the sole purpose of the application. Applying late-season fungicide can reduce the impact of fungal staining on visual quality. Applying fungicides (strobilurin and demethylation inhibitor, DMI based products) can have an off-target effect of reducing saprophytic fungal colonisation of bleached (senescent) leaf material in the windrow. However, these fungicides had no impact on green leaf retention or the nutritional quality of hay post-weathering. Strobilurin chemistries had a greater and more consistent effect on reducing saprophytic growth than DMIs.

Growers applying late-season fungicides to reduce fungal staining on visual quality should apply them well before the withholding period (i.e. 28 rather than 21 days before cutting). Applying fungicides before the withholding period is just as effective at reducing saprophytic growth and provides growers with a wider cutting window while reducing chemical residue levels. Further work is required to provide growers and industry with fungicide and non-fungicide options to reduce or avoid saprophytic fungal growth while maintaining and protecting export markets.

Please note: to avoid exceeding chemical MRLs in hay and jeapordising export hay markets, it is vital that unnecessary fungicide applications are avoided and that label recommendations for rates and withholding periods are followed precisely.

Management of grain staining in grain oats

Fungicide strategies can reduce but not eliminate the risk of grain staining in oats. Variety selection is the key in high-risk environments. DPIRD research found that the level of septoria-stained grain in untreated varieties with partial septoria resistance was lower than highly susceptible varieties with multiple fungicide applications.

Bannister is the most widely sown oat variety in WA for grain due to its yield advantage over Carrolup and its higher grain quality than Williams. However, despite sharing the same septoria resistance rating with Carrolup and Williams, Bannister is more susceptible to septoria grain staining. There is a greater risk of grain staining and subsequent receival downgrading for Bannister in higher rainfall areas than for Carrolup and Williams.

In situations of high disease pressure, such as growing a susceptible variety, oat-on-oat rotations and regions of high rainfall, Consult Ag and DPIRD research suggests that if oat septoria becomes evident at stem elongation (>5% of leaf area affected), a two-spray regime at stem elongation and again at flag emergence will achieve the greatest control and reduce the risk of grain staining at harvest. When disease pressure is lower, or if the disease enters the canopy later in the season, a single application at flag leaf emergence is the best strategy. Rainfall between grain-fill and harvest can also result in grain staining of Bannister but applying late fungicides (applied at Z55–59) is an unreliable control measure.

Harvest timing for grain oats

Harvest timing is critical to maximising oat yield.

To reduce shedding, oats must be harvested as soon as the crop is ripe. Non-dwarf and other varieties likely to shed or lodge should be harvested earlier than varieties less likely to shed or lodge. Grain can be directly harvested at a moisture content above 12% and then placed under aeration or through a grain dryer to reduce harvesting delays. Direct harvesting is the most economical way to harvest oats for grain if the

crop ripens and dries evenly (to less than 12% moisture). If the oat crop has an uneven maturity or the climate does not allow for rapid grain drying, swathing should be considered as it is illegal to desiccate oat crops in Australia for delivery.

DPIRD research in 2019 examined the effect of delayed harvesting on 12 milling oat varieties. Grain yield and quality of all 12 varieties responded similarly to delayed harvest. Delaying harvest by three weeks reduced grain yield by 10%. Delaying harvest by six weeks reduced grain yield by 25%.

Grain – yield and quality

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Grain yield

National Variety Trials (NVT) are managed by the Grains Research and Development Corporation (GRDC) to provide a nationally independent means of assessing varietal performance and enable growers to select the best variety for their environment. The results of NVT trials 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 the specific state, region, location, or group of locations of their choice to choose the best variety for their environment. Both the single-site and multi-year MET analyses are available at nvtonline.com.au.

Tables 3 to 8 present data extracted from the Long-Term MET Yield Reporter available at nvtonline.com.au. MET data (accuracy ≥0.8 and VAF ≥25%) are presented for each year (2018–2022) for each of the Agzones in WA except Agzone 1 and then combined across 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 examining the weighted average as it masks varietal performance over seasons within an Agzone.

Table 9 uses single-site MET data to highlight the probability of one variety yielding less, the same or more than another variety when grown in the same trial 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 oat NVT trials where both varieties have been sown and harvested are compared.

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 may 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 using data extracted from the 'Statewide tables of yield and grain quality' available at nvtonline.com.au. Figures 2 and 3 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 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 is significant ($p<0.05$), a quadratic polynomial has been fitted to the data. If the linear trend (but not the quadratic trend) is significant ($p<0.05$), a linear polynomial has been fitted to the data. If neither the quadratic nor the linear trend is significant, the grain yield response of a variety has been deemed to run parallel to the site mean yield at the average deviation for that variety. It is worth noting that relative performance may differ depending on the years and locations analysed. This highlights the importance of examining more than one dataset and comparing the performance of new varieties over at least three seasons.

Table 3. Grain yield of oat 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)		4.38	2.90	2.82	4.01	4.21	3.63
Variety	(No. trials)	(3)	(4)	(4)	(4)	(4)	(19)
Deliverable as OAT1							
Bannister	(19)	110	103	101	106	105	**105**
Bilby	(19)	100	102	104	103	102	**102**
Carrolup	(19)	84	93	84	84	85	**86**
Kojonup	(19)	89	84	85	101	100	**92**
Kowari	(19)	94	99	102	98	98	**98**
Mitika	(11)	90	97	97	-	-	**95**
Williams	(19)	107	105	96	100	99	**101**
Yallara	(19)	89	98	88	80	82	**87**
Deliverable as OAT2							
Durack	(19)	83	96	94	84	85	**89**
Wandering	(19)	108	105	101	105	104	**104**
Not yet evaluated for milling							
13008-18	(8)	-	-	-	110	109	**111**
Koala	(19)	112	97	93	106	107	**103**

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

Table 4. Grain yield of oat 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)		4.27	3.41	3.07	4.55	4.92	4.12
Variety	(No. trials)	(2)	(2)	(2)	(2)	(3)	(11)
Deliverable as OAT1							
Bannister	(11)	108	111	105	104	110	**108**
Bilby	(11)	102	97	101	102	100	**100**
Carrolup	(11)	91	95	84	87	92	**90**
Kojonup	(11)	101	110	88	97	106	**101**
Kowari	(11)	96	92	97	99	94	**95**
Mitika	(6)	94	91	94	-	-	**93**
Williams	(11)	107	109	100	99	109	**105**
Yallara	(11)	86	92	90	86	87	**88**
Deliverable as OAT2							
Durack	(11)	85	83	89	89	83	**86**
Wandering	(11)	109	108	102	103	110	**107**
Not yet evaluated for milling							
13008-18	(5)	-	-	-	108	108	**108**
Koala	(11)	109	122	105	104	115	**111**

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

Table 5. Grain yield of oat 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)		2.11	1.11	1.30	3.63	4.62	2.55
Variety	(No. trials)	(1)	(1)	(1)	(1)	(1)	(5)
Deliverable as OAT1							
Bannister	(5)	105	106	83	107	109	**102**
Bilby	(5)	105	102	123	97	105	**106**
Carrolup	(5)	90	96	69	82	74	**82**
Kojonup	(5)	83	73	56	91	103	**81**
Kowari	(5)	99	97	123	94	98	**102**
Mitika	(3)	96	96	110	-	-	**97**
Williams	(5)	109	117	80	97	97	**100**
Yallara	(5)	89	104	62	94	66	**83**
Deliverable as OAT2							
Durack	(5)	90	96	105	87	75	**91**
Wandering	(5)	111	113	101	98	107	**106**
Not yet evaluated for milling							
13008-18	(2)	-	-	-	108	115	**-**
Koala	(5)	95	96	35	114	110	**90**

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

Table 6. Grain yield of oat 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)		3.08	1.81	2.16	2.48	4.49	2.77
Variety	(No. trials)	(1)	(2)	(2)	(2)	(2)	(9)
Deliverable as OAT1							
Bannister	(9)	108	99	108	108	107	**106**
Bilby	(9)	101	103	103	99	102	**102**
Carrolup	(9)	91	89	86	90	88	**89**
Kojonup	(9)	90	78	92	98	104	**93**
Kowari	(9)	96	102	97	94	97	**97**
Mitika	(5)	93	99	93	-	-	**94**
Williams	(9)	109	98	106	104	103	**103**
Yallara	(9)	93	97	86	93	82	**90**
Deliverable as OAT2							
Durack	(9)	88	100	85	87	84	**89**
Wandering	(9)	109	100	109	104	107	**105**
Not yet evaluated for milling							
13008-18	(4)	-	-	-	107	109	**110**
Koala	(9)	107	89	106	114	109	**105**

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

Table 7. Grain yield of oat 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)		4.82	4.52	3.63	4.91	5.42	4.66
Variety	(No. trials)	(1)	(1)	(1)	(1)	(1)	(5)
Deliverable as OAT1							
Bannister	(5)	117	109	115	107	109	**111**
Bilby	(5)	95	102	105	102	100	**101**
Carrolup	(5)	92	91	85	84	88	**88**
Kojonup	(5)	112	107	118	110	107	**111**
Kowari	(5)	87	96	94	97	95	**94**
Mitika	(3)	86	93	88	-	-	**90**
Williams	(5)	114	106	111	98	104	**107**
Yallara	(5)	91	83	64	76	83	**79**
Deliverable as OAT2							
Durack	(5)	76	83	68	81	81	**78**
Wandering	(5)	111	109	119	105	107	**110**
Not yet evaluated for milling							
13008-18	(2)	-	-	-	107	108	**-**
Koala	(5)	135	112	120	112	116	**119**

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

Table 8. Grain yield of oat varieties averaged across AGZONES 2–6 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)		3.96	2.77	2.67	3.87	4.60	3.58
Variety	(No. trials)	(8)	(10)	(10)	(10)	(11)	(49)
Deliverable as OAT1							
Bannister	(49)	110	106	104	106	108	**107**
Bilby	(49)	100	101	104	102	102	**102**
Carrolup	(49)	88	93	84	85	87	**87**
Kojonup	(49)	96	93	90	100	104	**97**
Kowari	(49)	94	97	100	97	96	**97**
Mitika	(28)	91	95	95	-	-	**94**
Williams	(49)	108	106	100	100	103	**103**
Yallara	(49)	89	94	84	84	82	**86**
Deliverable as OAT2							
Durack	(49)	83	91	88	86	83	**86**
Wandering	(49)	109	106	105	104	107	**106**
Not yet evaluated for milling							
13008-18	(21)	-	-	-	108	109	**110**
Koala	(49)	113	105	98	108	111	**107**

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

Table 9. 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 per cent) was variety A (comparator variety) lower-yielding, the same yield or higher-yielding than variety B (base variety) when sown together in WA oat 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: Bannister						
13008-18	14%	59%	27%	22	2021–2022	13008-18 = Bannister
Bilby	46%	40%	14%	50	2018–2022	Bilby ≤ Bannister
Carrolup	94%	6%	0%	50	2018–2022	Carrolup < Bannister
Durack	90%	4%	6%	50	2018–2022	Durack < Bannister
Koala	30%	44%	26%	50	2018–2022	Koala = Bannister
Kojonup	60%	38%	2%	50	2018–2022	Kojonup ≤ Bannister
Kowari	70%	22%	8%	50	2018–2022	Kowari < Bannister
Mitika	75%	18%	7%	28	2018–2020	Mitika < Bannister
Wandering	12%	80%	8%	50	2018–2022	Wandering = Bannister
Williams	32%	60%	8%	50	2018–2022	Williams = Bannister
Yallara	88%	8%	4%	50	2018–2022	Yallara < Bannister
Variety B: Carrolup						
13008-18	0%	9%	91%	22	2021–2022	13008-18 > Carrolup
Bannister	0%	6%	94%	50	2018–2022	Bannister > Carrolup
Bilby	2%	16%	82%	50	2018–2022	Bilby > Carrolup
Durack	28%	44%	28%	50	2018–2022	Durack = Carrolup
Koala	6%	16%	78%	50	2018–2022	Koala > Carrolup
Kojonup	18%	22%	60%	50	2018–2022	Kojonup ≥ Carrolup
Kowari	8%	18%	74%	50	2018–2022	Kowari > Carrolup
Mitika	11%	36%	54%	28	2018–2020	Mitika ≥ Carrolup
Wandering	0%	6%	94%	50	2018–2022	Wandering > Carrolup
Williams	0%	8%	92%	50	2018–2022	Williams > Carrolup
Yallara	26%	52%	22%	50	2018–2022	Yallara = Carrolup

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

The highest yielding oat varieties sown in WA oat NVT are Bannister, Koala, Wandering and Williams, with the advanced breeding line 13008-18 also one of the highest performers in those Agzones where MET data was available (Tables 3 to 8). However, Wandering cannot be delivered into the OAT1 grade and Koala is not yet accredited as a milling oat variety nor deliverable into the Bunge or CBH bulk handling system. Bannister and Williams have an advantage over Wandering above 3.5t/ha, while Wandering has an advantage below 1.5t/ha (data not shown). Since 2017, Bannister has outperformed Williams in environments above 3t/ha but performed the same in environments below 3t/ha (Figure 2).

Carrolup (Figures 2–3), Durack (data not shown) and Yallara (Figures 2–3) are inferior to Bannister, Wandering and Williams at most levels of yield potential. However, Durack (data not shown) becomes competitive with Bannister and Williams in environments with a yield potential below 1.5t/ha, particularly with a June sowing. Bilby is as good or better than Bannister below 2t/ha but inferior above 3t/ha and has matched Williams since 2018 (Figure 2).

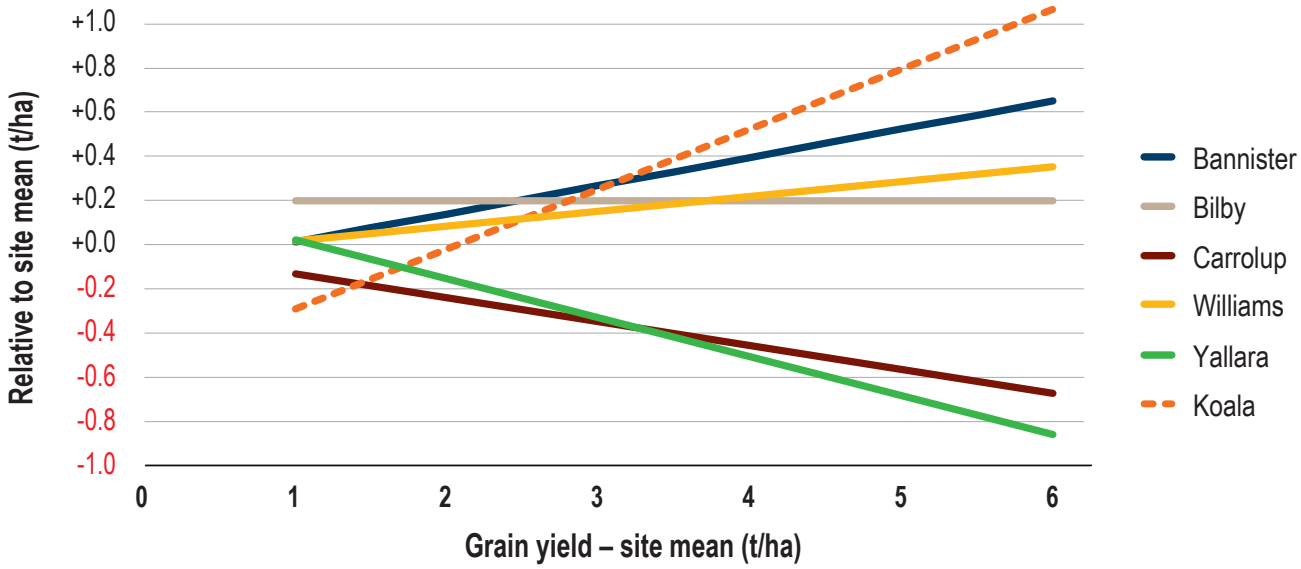

Figure 2. Fitted grain yield of Bannister, Bilby, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2017–2022). Each variety sown in all 62 trial-years of data, NVT Online nvtonline.com.au

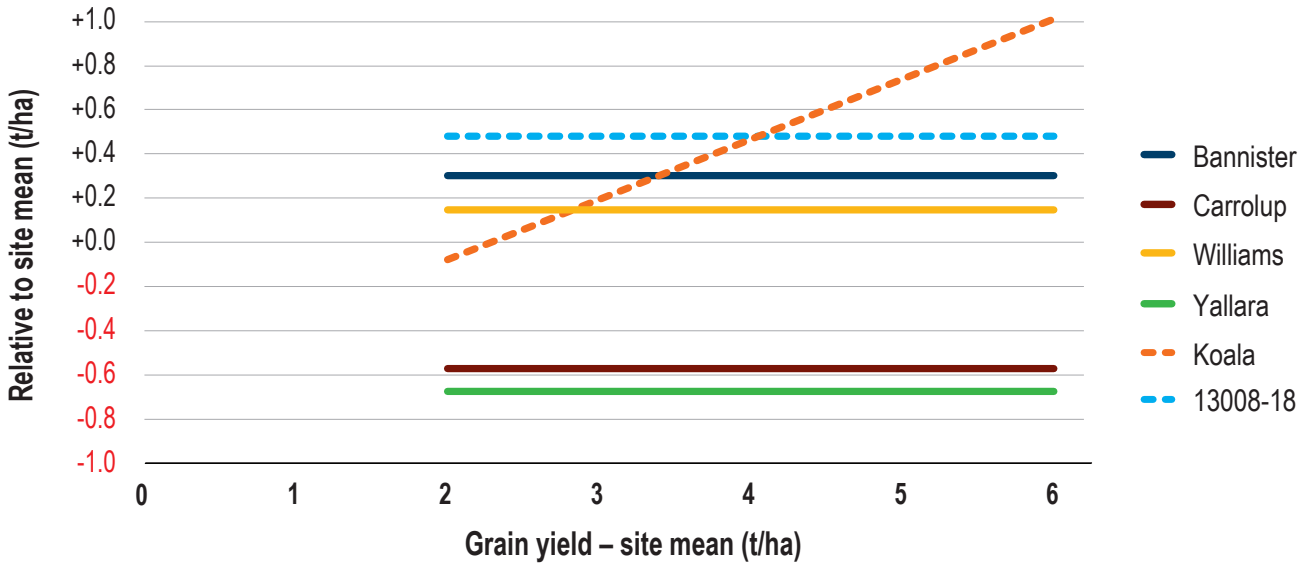

Figure 3. Fitted grain yield of 13008-18, Bannister, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2021–2022). Each variety sown in all 22 trial-years of data, NVT Online nvtonline.com.au

Grain quality

Grain quality is an essential trait of milling oat varieties. In Figures 4 to 7 physical grain quality (hectolitre weight and screenings through a 2.0mm slotted sieve) of popular milling oat varieties has been plotted relative to the site mean. The deviation from the site mean has then been assessed for quadratic and linear trends. If neither the quadratic nor the linear trend is significant, the grain quality response of a variety has been deemed to run parallel to the site mean quality at the average deviation for that variety. Data for this analysis was extracted from the NVT' Statewide yield and grain quality' tables available at nvtonline.com.au.

None of the current milling oat varieties combine a high hectolitre weight with high grain plumpness (low screenings). The closest is Yallara, but this variety is not competitive with Bannister for grain yield (Figure 2). In WA oat NVT, the yield of Yallara was below Bannister in 88% of trials (Table 9).

Carrolup is the benchmark variety for hectolitre weight among milling oat varieties, followed by Durack (not shown) and Yallara (Figure 4 and 5). Hectolitre weight is a receival weakness of Bannister, Wandering and Williams, although Bannister is slightly better than Williams (Figures 4 and 5). Like Bannister, Bilby has inferior hectolitre

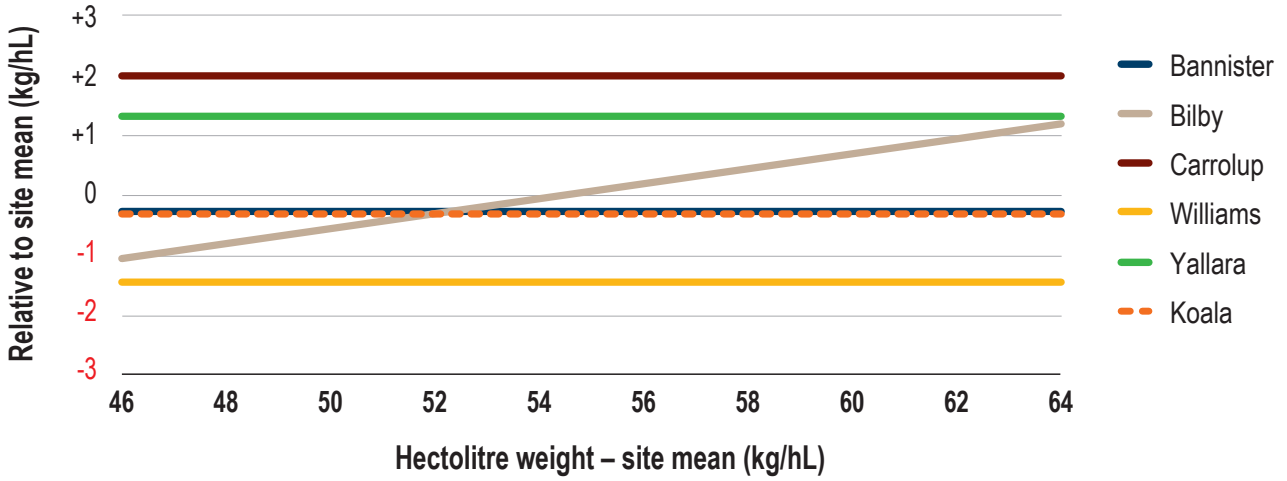

Figure 4. Fitted hectolitre weight of Bannister, Bilby, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2017–2022). Each variety sown in all 62 trial-years of data, NVT Online nvtonline.com.au

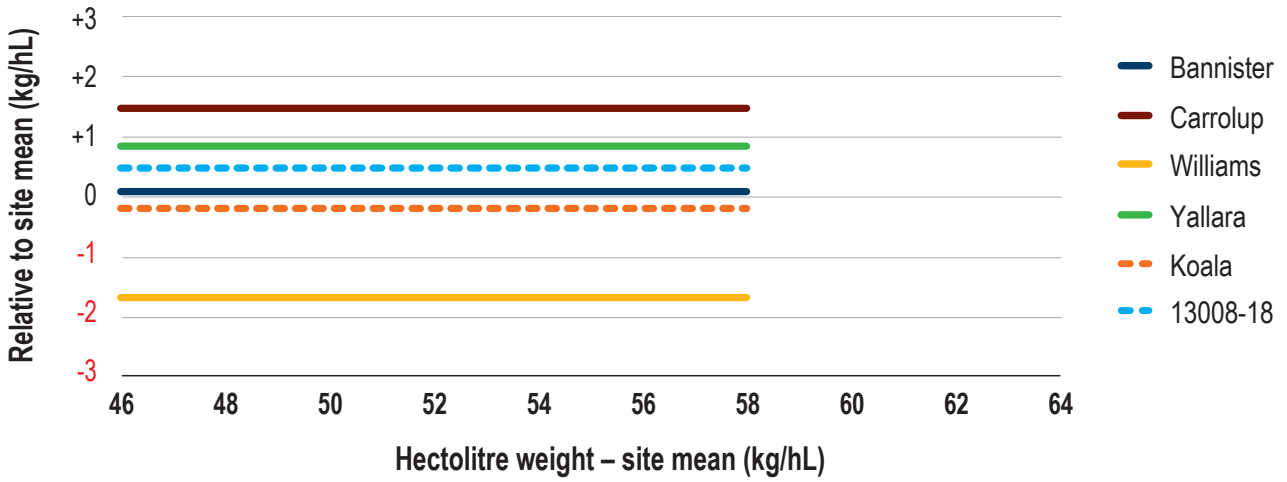

Figure 5. Fitted hectolitre weight of 13008-18, Bannister, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2021–2021). Each variety sown in all 22 trial-years of data, NVT Online nvtonline.com.au

weight relative to Carrolup (Figures 4 and 5). The hectolitre weight of Koala is the same as Bannister and a general improvement over Williams. The hectolitre weight of 13008-18 appears to be a slight improvement over Bannister.

The benchmark varieties for grain plumpness are Kowari (data not shown), Mitika (data not shown) and possibly Yallara (Figures 6 and 7). Grain plumpness is a weakness of Carrolup and Williams, with these two varieties having the lowest grain plumpness (highest screenings) and the greatest risk of not meeting the receival standards of current milling varieties. Bannister is an improvement over Williams but is not as plump as Kowari (data not shown), Mitika (data not shown) or Yallara. Koala has grain plumpness like Bannister and is an improvement over Williams. Bilby, Durack and Wandering have a slight plumpness advantage over Bannister and an advantage over Williams (data not shown). 13008-18 has superior grain plumpness to Bannister and may be a general improvement over Yallara, one of the plumper milling varieties.

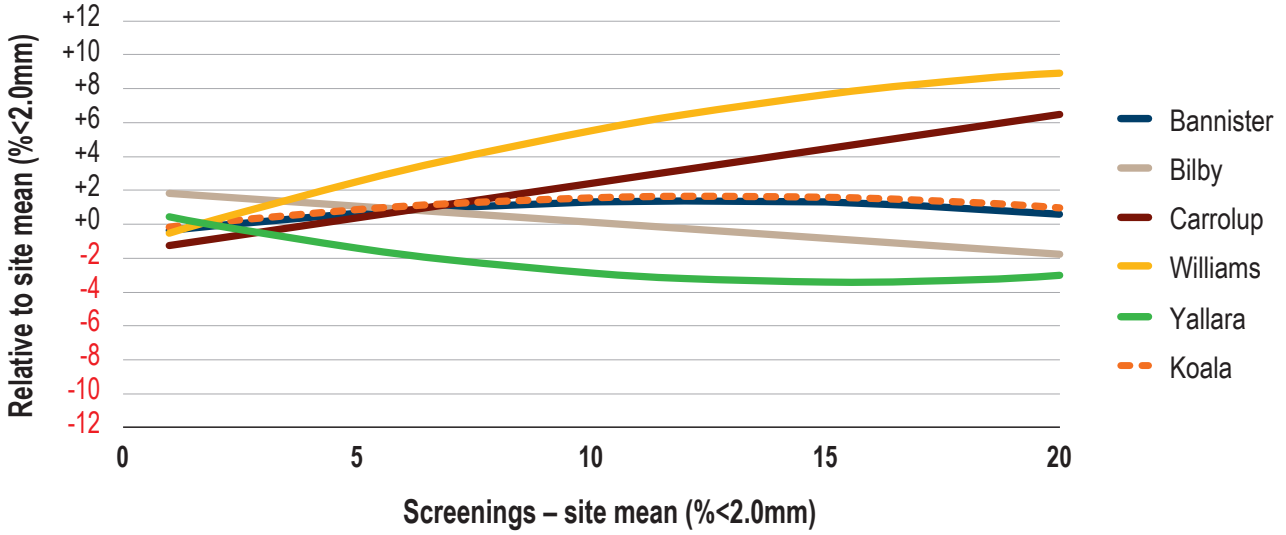

Figure 6. Fitted grain plumpness of Bannister, Bilby, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2017–2022). Each variety sown in all 59 trial-years of data, NVT Online nvtonline.com.au

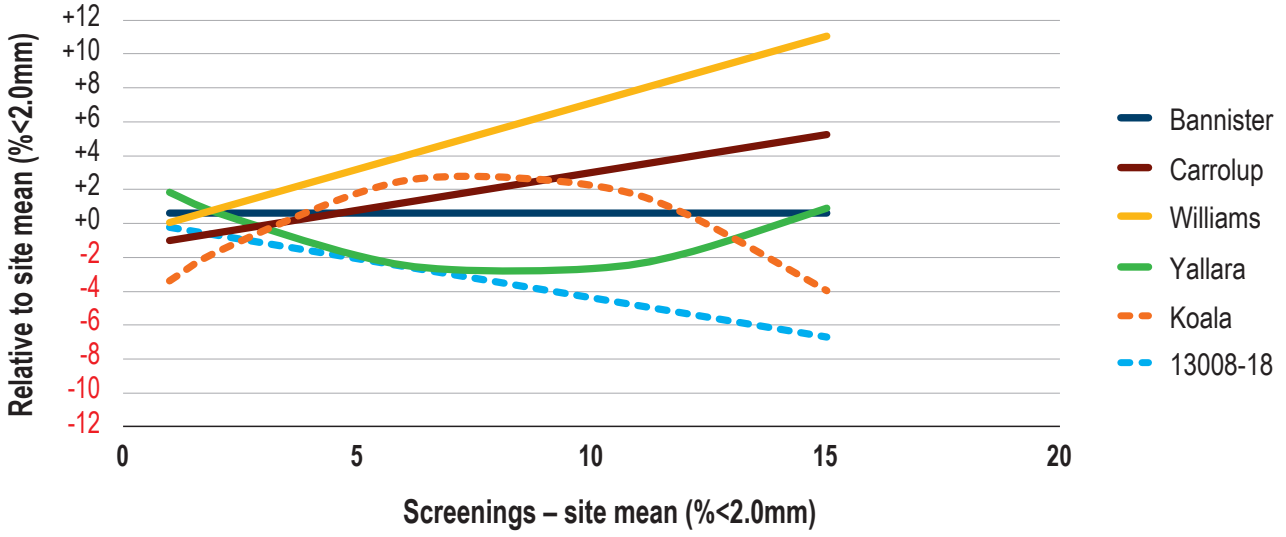

Figure 7. Fitted grain plumpness of 13008-18, Bannister, Carrolup, Koala, Williams and Yallara at different site means.

Source: based on NVT statewide tables of yields and grain quality (2021–2022). Each variety sown in all 22 trial-years of data, NVT Online nvtonline.com.au

Hay – yield and quality

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Variety performance in breeder hay variety trials

Breeder hay variety trials are conducted nationally, with several sites in WA annually. Table 10 compares hay yield and quality of dual-purpose and hay-only varieties from the WA sites. Quality measures present in Table 10, as predicted by near-infrared analysis (NIR), include digestibility, crude protein (CP), water-soluble carbohydrates (WSC), acid detergent fibre (ADF) and neutral detergent fibre (NDF).

The difference in hay yield between varieties was 1t/ha, with Brusher at the higher end and Koorabup and Winjardie at the lower end of the hay yield range (Table 10). In datasets tabulated by the NOBP and included in previous sowing guides, Forester achieved good hay quality however it is not widely sown in WA due to its very late maturity, and there is no data available in the current dataset. Of the varieties listed in Table 10 with hay yield and quality data, Wallaby has the best overall hay quality (high digestibility, high WSC, low fibre and moderate rates of rumen digestibility), and Koorabup has the poorest quality (low digestibility, low WSC, higher fibre levels and moderate rumen digestibility).

Table 10. Average hay yield and quality (predicted by NIR) in NOBP and InterGrain trials in WA from 2017 to 2022

Variety	Hay yield (t/ha)	Digestibility (% dm)	WSC (% dm)	ADF (% dm)	NDF (% dm)	CP (% dm)
(No. trials)	(46)	(46)	(46)	(46)	(46)	(46)
Deliverable as OAT1						
Bannister	10.4	65.5	26.8	32.5	52.6	5.9
Bilby	-	-	-	-	-	-
Carrolup	10.3	63.2	27.1	33.3	52.2	5.9
Kojonup	-	-	-	-	-	-
Kowari	-	-	-	-	-	-
Mitika	-	-	-	-	-	-
Williams	-	-	-	-	-	-
Yallara	10.6	63.2	26.9	32.9	51.6	5.8
Deliverable as OAT2						
Durack	10.5	62.7	25.9	33.2	52.1	5.7
Wandering	-	-	-	-	-	-
Not yet evaluated for milling						
13008-18	-	-	-	-	-	-
Koala	-	-	-	-	-	-
Hay-only variety						
Archer	10.8	63.3	25.4	33.1	52.4	6.1
Brusher	11.1	64.5	26.9	32.9	52.1	6.0
Kingbale	10.8	63.5	27.0	34.5	52.8	5.6
Koorabup	10.1	63.3	26.5	33.9	52.7	5.8
Kultarr	10.8	63.7	26.5	33.6	52.4	5.6
Mulgara	10.6	64.7	27.6	33.3	52.4	5.7
Wallaby	10.7	66.0	28.5	32.6	52.5	5.7
Winjardie	10.1	63.3	25.9	33.2	52.5	5.8
Wintaroo	10.7	63.3	26.7	34.8	52.8	5.7

Source: InterGrain

CP = crude protein, WSC = water soluble carbohydrates, ADF = acid detergent fibre, NDF = neutral detergent fibre. No score '-' = no rating is currently available.

Bannister was the best of the dual-purpose hay varieties, with improved digestibility, moderate levels of WSC, moderate fibre levels and higher rumen digestibility than Carrolup, Durack and Yallara. The susceptibility of Bannister to oat septoria may affect the visual grading of its hay more than other dual-purpose varieties, where the disease in not adequately controlled. Of the dual-purpose varieties, Carrolup, Williams and Yallara are the preferred varieties for export hay.

Hay quality trait performance

The following comments relate to hay quality traits in the breeder hay variety trials (Table 10):

- **Digestibility** – Bannister and Wallaby were more digestible than other varieties tested.
- **Crude protein** – little difference was noted between varieties, with the range only 0.5%. Archer and Brusher were at the higher end, with Kingbale and Kultarr at the lower end of the range.
- **Water soluble carbohydrates** – Brusher, Carrolup, Mulgara, Wallaby and Yallara had higher WSC.
- **Acid detergent fibre** – Bannister, Brusher, Wallaby and Yallara had lower ADF levels.
- **Neutral detergent fibre** – Yallara had the lowest NDF.

Variety performance in NHA agronomy trials

NHA research supported by AgriFutures (project number PRJ-011029) assessed hay yield and quality of four dual-purpose (Carrolup, Durack, Williams and Yallara) and four hay-only varieties (Brusher, Koorabup, Mulgara and Wintaroo) over three consecutive years in WA, SA, Vic and NSW. The varieties were assessed at two seeding dates, typically three to four weeks apart. Data were averaged over three rates of applied N due to the lack of a variety by N interaction for the twelve datasets.

The NHA hay yields ranged from 2 to 18t/ha, with 50% of the hay cuts yielding between 4.5 to 10.5t/ha. The difference in mean hay yield between the highest (Wintaroo) and lowest (Durack) yielding varieties averaged over sowing dates was 0.7t/ha, which was similar to the range observed in the breeder hay trials (Table 10).

Brusher and Wintaroo were the leading varieties for hay yield at the first sowing date, while Wintaroo had the highest yield of the second sowing date. Varietal differences (lowest to highest) at the first sowing date were 1.0t/ha and 0.6t/ha at the second sowing date. Brusher lost the most yield with delayed sowing (1.8t/ha), while Carrolup and Durack were the least affected with only a 1.0t/ha reduction in yield.

Brusher and Wintaroo had the poorest overall straw strength, followed by Mulgara. Varieties differed in stem diameter, with Carrolup, Durack and Koorabup averaging 0.5mm narrower stems than Mulgara, Williams and Wintaroo. Mulgara, Williams and Wintaroo were the most likely to produce hay with a stem diameter wider than 6mm, the upper limit for premium hay.

Brusher was more variable in its hay greenness than the other seven varieties as measured by a Soil Plant Analysis Development (SPAD) chlorophyll meter. Durack hay was the greenest, averaging 5 SPAD units darker than Carrolup, Mulgara and Wintaroo, which were the lightest green. Williams varied the least in the greenness of all the varieties.

The following comments relate to hay quality traits of varieties in the NHA trials (data not shown):

- **Digestibility** – Brusher, Mulgara and Yallara were more digestible than Durack.
- **Crude protein** – Williams had the highest CP and Wintaroo the lowest.
- **Water soluble carbohydrates** – Yallara had the highest WSC and Koorabup and Williams the lowest.
- **Acid detergent fibre** – Koorabup and Wintaroo had the highest average ADF, with Brusher and Yallara the lowest.
- **Neutral detergent fibre** – Koorabup and Wintaroo had the highest average NDF and Yallara had the lowest.
- **NDFDom30** – Brusher, Mulgara and Yallara hay had higher levels of rumen digestibility after 30 hours than Carrolup and Durack hay.

Of the eight varieties evaluated, Yallara had the best overall hay quality nationally, with the highest WSC and lowest fibre levels (ADF and NDF) combined with thin stems (data not shown). Yallara hay yield was comparable to the specialist hay varieties Brusher and Wintaroo, with a lower lodging risk and similar hay colour.

The new hay variety Koorabup was uninspiring with hay yield 0.5t/ha behind Brusher, a higher ADF and NDF risk, lower WSC and a similar hay greenness and stem diameter. These poor results for Koorabup in NHA trials mimic the observations of this variety in the breeder hay trials (Table 10). Koorabup was the only variety that did not store WSC when sown early compared to late.

While the hay variety Mulgara yielded 0.5t/ha more than Carrolup, it had lower WSC and thicker stems. Hay colour and fibre (ADF, NDF and lignin) were similar.

Variety response to sowing date varied and was not easily predicted before the season or when the crop was planted. While earlier sowing increased the opportunity to maximise hay yield, it did not do so consistently. Further evaluation of variety responses to seeding date is warranted, especially with the suite of new oaten hay options currently being evaluated by the industry and the breeding company InterGrain.

General comments on hay quality

Before growing oats for export hay, arranging a contract with an exporter is essential. Cutting at or just before watery ripe (Z71) will achieve optimum yield and quality. Cutting the crop before Z71 can maximise hay quality if the panicles are not stuck in the boot. However, there is a window of five to seven days after Z71 before hay quality falls. This window provides room to cut hay on time. Rainfall events of 10mm or more post-cutting can drastically reduce quality.

Good colour, aroma, sweet taste and fine texture are essential to export hay buyers. Hay processing companies in WA also grade based on nutritional value. Number of grades (and even grading systems) differ between hay processors. Some companies have five grades, others have four and some grade hay based on a 100-point system. Unlike grain, there is no common standard on which hay is received. Hay should have a maximum bale moisture of 14% at delivery to ensure that it does not degrade or spoil during storage. Some export standards are as low as 12% moisture. High moisture hay (>18%) is at risk of self-combustion during storage and spoilage from mould.

Typical quality standards to meet WA export hay requirements are outlined in Table 11. Premium Grade-1 hay will generally have more than 4% crude protein, be more than 60% digestible with WSC above 22%, ADF less than 32%, NDF below 55% and a stem thickness below 6mm. Most processors have a limit of 1% by weight of broadleaf plants and 5% of other cereals/ryegrass/wild oats. Zero-tolerance exists for the presence of toxic plants, doublegee and foreign material such as dirt, stones, sticks, insects, wool, wire and carcases.

Most processors allow a maximum of 10% disease-affected leaves. Check withholding periods on labels of all fungicides before use and do not apply fungicide if the likely cutting date is within the withholding period. For best control, plant disease-resistant varieties. Export markets expect a clean and green product from Australia and are checking for breaches of MRLs for a range of herbicide, insecticide and fungicide products. Growers should follow label registrations for any product applied.

Livestock deaths caused by annual ryegrass toxicity poisoning from Australian hay or straw exports into an importing country could devastate the Australian hay and straw export industry. All export hay must be sampled and tested for the bacterium (*Rathayibacter toxicus*), the cause of annual ryegrass toxicity. If contamination by this bacterium is a potential problem, it is important to implement an annual ryegrass toxicity management program.

Table 11. Quality standards to meet export hay requirements

Parameter	Grade 1	Grade 2	Grade 3	Grade 4
Crude protein (% dm)	4–10	<4	<4	<4
Est. metabolisable energy (MJ/kg DM)	>9.5	<9.5	<9.5	<9.5
In-vitro digestibility (% dm)	>60	>58	>56	>53
Water soluble carbohydrates (% dm)	>22	>18	>14	>14
Acid detergent fibre (% dm)	<30–32	>32–35	>35–37	>37–40
Neutral detergent fibre (% dm)	≤55	≤55–59	≤57–60	≤60–64
Stem thickness (mm)	<6	<8	<9	>9

Source: DPIRD

Disease and pest resistance

Manisha Shankar, Kylie Chambers, Geoff Thomas, Blakely Paynter, Carla Wilkinson and Daniel Huberli (DPIRD)

Foliar disease abbreviations:

- **BB** = bacterial blight
- **OCR** = oat crown (leaf) rust.
- **OSR** = oat stem rust.
- **RLL** = red leather leaf.

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.
- *p* = provisional rating.

Refer to page 4 for interpreting resistance classification.

Adult resistance

Information about disease and virus resistance of oat and hay varieties are presented in Tables 12 and 13 and the variety snapshots. Leaf disease ratings in this guide are for the adult-stage. While adult-stage ratings are applicable after flag leaf emergence, they can be relevant as early as late tillering to stem elongation in some varieties and for some diseases. DPIRD is now screening oat varieties under contract for NVT. The foliar resistance data for milling oat varieties in Table 12 is from disease screening trials in WA. Koorabup was the only hay variety screened by DPIRD in 2020 and 2021; limited data is available for the other hay-only varieties. In 2021, DPIRD began screening several hay-only varieties for NVT, including Brusher, Kingbale, Mulgara, Tungoo and Wintaroo. Some of the data presented has been sourced from InterGrain.

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. In this 2024 guide, there have been no significant changes in resistance scores due to a new pathotype.

Pathotype surveillance and fungicide resistance

Any oat varieties rated as MRMS, MR or R carrying significantly higher levels of disease than expected should be sent for pathotype identification and fungicide resistance testing. Collect leaf samples before spraying the crop with a fungicide to ensure sample viability.

Place infected septoria, oat crown (leaf) rust (OCR) and oat stem rust (OSR) 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.

Send septoria-infected leaf material in paper envelopes to DPIRD, Locked Bag 4, Bentley Delivery Centre WA 6983 and marked attention, Manisha Shankar. For more information, contact Manisha Shankar via email at manisha.shankar@dpird.wa.gov.au or by phone (08) 9368 3533.

Send OCR and OSR 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 by phone (02) 9351 8808.

Samples suspected of infection with RLL can be sent to DPIRD Diagnostic Laboratory Services (DDLS) to be included in the DPIRD surveillance project supported by GRDC (project number DAW2104-003RTX). For more information about plant disease testing, sample submission forms and sampling techniques, contact DDLS via email at DDLS@dpird.wa.gov.au or by phone at (08) 9368 3533.

Oat Septoria

Septoria (*Phaeosphaeria avenaria* f.sp. *avenaria* (asexual stage: *Stagonospora* (formerly *septoria*) *avenae* f.sp. *avenaria*), also known as *Septoria avenae* blotch, is the most common oat disease in WA. Oat septoria was found in 90% of paddocks surveyed through the AgriFutures-supported NHA project (project number PRJ-011029) and GRDC disease surveillance projects (project numbers DAW1907-002RTX and DAW2104-003RTX). The disease severity of oat septoria was generally low, with the percentage of leaf area affected under 10%. Oat septoria does not infect wheat and wheat septoria does not infect oats.

Septoria occurs throughout the cereal growing areas and is most severe in the high rainfall areas. It begins as small dark brown-to-purple, oval or elongated spots on leaves. Spots grow into larger light or dark-brown blotches with a lighter yellow/brown border that can cover and kill the entire leaf. Dark-brown blotches can also occur on the panicle. Infection can spread to leaf sheaths and through these to stems, where greyish-brown or shiny black lesions can cause lodging. In some varieties, the fungus can sometimes cause a dark discolouration of the grain when unseasonably late rain occurs.

In extreme cases, septoria can cause up to 20% grain yield loss and crop lodging but losses of about 10% are more common in high rainfall areas. The disease can also affect grain quality by reducing grain weight and increasing screenings. Tall or slow-maturing oats are less likely to be affected by the disease than short (dwarf) or fast-maturing varieties. Septoria can also reduce hay yield, quality and appearance and is a significant constraint to hay production.

Most oat varieties are rated as MSS or below to septoria. Mitika and Winjardie are particularly susceptible and rated as SVS. No milling variety has acceptable resistance to oat septoria, while the hay-only varieties Koorabup (MRMS) and Tungoo (MRMS) have good resistance.

Oat crown (leaf) rust (OCR)

Oat crown rust (OCR, *Puccinia coronata* var. *avenae*), also known as leaf rust, appears on leaves as small, circular-to-oval pustules containing orange to yellow powdery spores. The word ‘crown’ refers to the shape of spores produced by the fungus, not the disease symptoms. Pustules are found predominantly on the leaf tissue, but pustules can also occur on stems and panicles under heavy infection. As the crop matures, the pustules darken and produce black spores embedded in leaf tissue. The spore masses in the pustules are readily dislodged. Leaf rust develops most rapidly at 15–22°C under moist conditions. OCR does not infect wheat and wheat leaf rust does not infect oats.

OCR can cause losses of up to 50% in forage, hay and grain yield. It can also reduce forage and hay quality (both physical and nutritional) and palatability. OCR can also reduce grain quality, impacting grain weight and screenings.

Most milling oat varieties have good resistance to OCR except Carrolup (VS), Kojonup (SVS) and Wandering (VS). Winjardie (SVS), Kingbale (S) and Wintaroo (S) have the weakest resistance of the hay-only varieties.

Oat stem rust (OSR)

Oat stem rust (OSR, *Puccinia graminis* f.sp. *avenae*) is a fungal foliar disease of oats. It appears as elongated pustules containing reddish-brown powdery spores, mainly on stems and potentially on the leaves and head in heavy infections. Spore masses in the pustules can dislodge readily. Stem rust development and spread are favoured by warm (18–30°C) humid conditions and an epidemic is more likely if the spring is suitably wet. The latent period (the approximate time taken for an infection to result in new spores) of OSR is 7–10 days under these optimal temperature conditions. Disease severity can increase extremely rapidly once a crop is uniformly infected. OSR does not infect wheat and wheat stem rust does not infect oats.

OSR can cause up to 90% yield loss and reduce grain quality in susceptible varieties. It also reduces hay yield, quality and appearance. Widespread outbreaks are rare but very damaging. Regional outbreaks are more common, causing losses over limited areas.

Milling oat and most hay-only varieties are rated as MS or below to OSR, with Bilby, Durack and Wandering the most sensitive (SVS). The unclassified variety Koala has good resistance to OSR being rated as MRMS, while the hay-only variety Mulgara is rated as MR.

Red leather leaf (RLL)

Red leather leaf (RLL, *Neospermospora avenae*) typically occurs during the tillering stages and first appears as small light (grey-pale blue) coloured lesions with a red/red-brown edge. During the stem elongation to head emergence stages, symptoms appear as red, irregular-shaped lesions spread across leaves. Later in the season, affected leaves take on a 'leathery' appearance, turning red, brown and maybe slightly rolled.

RLL was first detected in WA oat crops in 2021, although it has likely been present for more than one season. The impact of RLL on the yield and quality of hay and grain in WA is currently unknown. In the eastern states, RLL has caused at least 10% yield loss in hay and grain in susceptible varieties in favourable seasons.

How and where this disease will impact WA oat production is speculative. However, it is most likely to be a concern for oat growers in the cooler high-medium rainfall zones of the Great Southern region, where oats are more common and seasonal conditions, particularly in winter, are more favourable.

If you suspect you have RLL in your crops, please get in touch with Geoff Thomas via email at geoff.j.thomas@dpird.wa.gov.au or by phone at (08) 9368 3262 or Kylie Chambers at kylie.chambers@dpird.wa.gov.au or by phone (08) 9690 2151.

Crown rot

Crown rot (*Fusarium pseudograminearum*) is a fungal, stubble-borne disease most common in continuous cereal rotations. It affects the sub-crown internode, crown and lower stems and is not usually noticed until after heading when whiteheads are visible in wheat and sometimes barley. The browning at the base of infected tillers is the most reliable indicator of crown rot in oats. Whiteheads are not observed in oats.

Varietal resistance and tolerance to crown rot are limited. Seed dressings are registered to suppress crown rot. However, no fungicide options exist to control crown rot once the crop has been established. Inoculum levels can be reduced by including non-cereals in the rotation (such as pulses, oilseed, lupin and grass-free pasture). Inter-row seeding and maintaining reasonable grass weed control in break crops and between crops are also effective measures.

Research in WA suggests that oats are more resistant to crown rot than wheat and barley. Research at Merredin and Wongan Hills has demonstrated that high levels of crown rot can cause average yield losses of 19% in wheat and 18% in barley. Trials with milling oats observed an average yield loss to crown rot of 4%. No differences in tolerance were observed among the oat varieties evaluated.

Bacterial blight (BB)

In the AgriFutures-supported NHA project (project number PRJ-011029), BB was present in 41% of paddocks surveyed over the three years, generally at low severity. BB development is moisture driven. Periods of low rainfall or reduced canopy humidity limit disease impact, while increased temperature and reduced humidity in spring lessen disease development in the upper canopy. The dominance of BB-susceptible variety Bannister and the general practice of sowing oats over oats increases the risk of BB. Despite this, BB was rarely observed at damaging levels at any location.

Stripe blight (*Pseudomonas syringae* pv. *striafaciens*) is the predominant form of BB observed in WA. While common, it only reached damaging levels in a few paddocks when conditions were favourable. Halo blight (*Pseudomonas syringae* pv. *corofaciens*) is less common but has been observed more frequently in WA throughout the 2023 growing season.

Stripe blight symptoms are found predominantly on leaves. They resemble water-soaked spots without the presence of a halo. The spots lengthen and form patches that can then form red-brown stripes, which distort leaf growth in young leaves. Stripes can develop yellow and red margins. The lesions can merge, forming irregular blotches that cause the leaf to senesce prematurely. Florets inside can appear rotten and stained if the stripe blight occurs on the boot. Emerged florets appear mottled brown-to-white and can be sterile.

Halo blight causes oval water-soaked spots that are pale green or yellow. The centre of the spots becomes yellow-brown, surrounded by a yellow-green halo. As the disease develops, the lesions turn brown and join to form irregular blotches. Severe infection can lead to premature senescence of leaves.

There are no registered products available for the control of BB.

Barley and cereal yellow dwarf (BYD/CYD)

Both BYD and CYD viruses occur in WA. As 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. Oat 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 the effect of aphid feeding on plant growth. Therefore, varietal resistance to BYD and CYD does not reduce the need to spray for aphids to prevent yield loss from feeding damage once aphids reach threshold levels in the crop (50% of tillers with 15 or more aphids).

Most oat varieties are rated as MS or below to BYD and CYD.

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, followed by *Pratylenchus quasitereoides* (formerly *P. teres*). Nematode populations potentially limit the yield of barley and wheat in more than 50% of infested paddocks. Yield loss in oat crops has not been investigated in WA.

The key to managing RLN is identifying paddocks with high nematode numbers and incorporating resistant crops and varieties or a fallow to reduce nematodes. Wheat, barley, canola and oats are all susceptible crops and can increase nematode levels. Resistance is the ability of the crop to prevent nematode multiplication and tolerance is the ability of the crop to yield in the presence of nematodes. Oats are generally more resistant than wheat to *P. neglectus* and more susceptible than wheat to *P. quasitereoides*. Lupins, field peas, faba beans and serradella are resistant and should lower the numbers of the two RLN species.

The *P. neglectus* and *P. quasitereoides* resistance scores in this guide are from WA-based glasshouse and field trials. Varieties with fewer than five observations, or where there has been no field trial verification of the glasshouse rating, receive provisional ratings. All oat varieties tested caused RLN nematodes to increase over the growing season, with Williams the most resistant milling variety and Mulgara the most resistant hay-only variety to both *P. neglectus* and *P. quasitereoides*.

Cereal cyst nematode (CCN)

Cereal cyst nematode (CCN, *Heterodea avenae*) is present in cropping regions around Geraldton, Esperance and the Avon Valley, but the pest can occur sporadically across the WA wheatbelt. Oat varieties are not as tolerant as barley to CCN, and yield loss can be expected when infection occurs. Choose a more resistant and tolerant variety if growing oats in a paddock infested with CCN. This should limit nematode multiplication for future crops and yield loss in the current oat crop. CCN resistance and tolerance ratings for milling oat varieties sourced from NVT online and SARDI indicate that Bannister and Durack have the best tolerance to CCN. At the same time, Mulgara, Tammar, Tungoo and Wintaroo are moderately tolerant among the hay-only varieties (Table 13).

Planting CCN-resistant oat varieties slows nematode development, leading to lower nematode levels in the soil for subsequent crops. The milling oat varieties, Bannister, Durack and Yallara, slow CCN numbers. Among the hay-only varieties, Brusher, Mulgara, Tammar, Tungoo and Wintaroo slow CCN numbers.

Further reading

In Australia, a range of fungal, bacterial and viral pathogens infect oats, impacting the yield and quality of grain and hay crops. The overall impact of these diseases on oaten hay production is not well researched or understood, especially compared to other cereal crops.

How individual diseases impact the nutritional quality of hay is less well understood than physical qualities. Export hay is evaluated on physical qualities such as stem thickness, greenness and nutritional attributes, including WSC, ADF, NDF and dry matter digestibility. The colour/greenness of oaten hay can be reduced by disease lesions, chlorosis and saprophytic fungi growing on dead tissue, all of which can cause export hay to be downgraded.

A 22-page review outlining the significant diseases of oaten hay crops in Australia was published in September 2020 by DPIRD as a milestone of the NHA project supported by AgriFutures (project number PRJ-011029). The review summarises disease symptoms, epidemiology and current control strategies. The review also contains a list of registered (as of August 2020) seed dressings, in-furrow treatments and foliar fungicides, and the withholding period following foliar fungicide application for grazing and harvesting. The review can be found online at: agrifutures.com.au/product/plant-diseases-impacting-oaten-hay-production-in-australia-a-review/.

Fact sheets on oat septoria, rusts (both OLR and OSR) and RLL published by the National Hay Agronomy Project are available on the AgriFutures website agrifutures.com.au/knowledge-hub.

Table 12. Oat leaf disease resistance profiles when grown in WA

Disease[1]	Oat septoria	Oat leaf rust	Oat stem rust	Barley and cereal yellow dwarf[4]
Pathotype[2]	Mixed	0001-2 [4,7]	94-1,2,4	–
Growth stage[3]	Adult	Adult	Adult	Seedling and Adult
Deliverable as OAT1				
Bannister	MSS	MR	MS	MS
Bilby	S	MRMS	SVS	S
Carrolup	MSS	VS	S	SVS
Kojonup	MSS	SVS	MSS	MSS
Kowari	S	MR	S	S
Mitika	SVS	MRMS	S	SVS
Williams	MSS	MR	MSS	MSS
Yallara	MSS	MR	MSS	MSS
Deliverable as OAT2				
Durack	S	MRMS	SVS	S
Wandering	MSS	VS	SVS	S
Not yet evaluated for milling				
13008-18	MS	MR	MSS	MS
Koala	MSS	MR	MRMS	S
Hay-only variety				
Archer	MSS	MR	MS	MS
Brusher	MSS	MR	S	MSS
Forester	S	-	-	-
Kingbale	MSS	S	S	MS*p*
Koorabup	MRMS	MRMS	MSS	MSS
Kultarr	MSS*p*	MR*p*	MSS*p*	MSS*p*
Mulgara	S	MR	MR	MS
Swan	-	-	-	-
Tammar	-	-	-	-
Tungoo	MRMS	RMR	MS	MSS
Wallaby	MSS*p*	MR*p*	MS*p*	MSS*p*
Winjardie	SVS	SVS	-	MS
Wintaroo	MSS	S	MS	MS

Source: Manisha Shanker, InterGrain and NVT Online, nvtonline.com.au

[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, *p* = provisional rating. No score '-' = no rating is currently available. *Refer to page 4 for interpreting resistance classification.*

[2] Pathotype: the strain of the pathogen used in evaluating the disease reaction of the different oat 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 and the adult resistance score reflects resistance after flag leaf emergence.

[4] 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.

Table 13. Oat nematode resistance profiles

Disease[1]	Root lesion nematode[3]	Root lesion nematode[3]	CCN resistance[4]	CCN tolerance[4]
Species	***Pratylenchus neglectus***	***Pratylenchus quasitereoides***	***Heterodera avenae***	***Heterodera avenae***
Growth stage[2]	**Seedling and Adult**	**Seedling and Adult**	**Seedling and Adult**	**Seedling and Adult**
Deliverable as OAT1				
Bannister	MSS	S*p*	MR	MI
Bilby	MS*p*	VS*p*	VS	-
Carrolup	S	S*p*	S	I
Kojonup	MSS	SVS*p*	VS	I
Kowari	-	-	VS	-
Mitika	-	-	VS	I
Williams	MRMS	MSS*p*	S	I
Yallara	-	-	R	I
Deliverable as OAT2				
Durack	MS	S*p*	RMR	MI
Wandering	-	-	VS	I
Not yet evaluated for milling				
13008-18	-	-	-	-
Koala	-	-	-	-
Hay-only variety				
Archer	-	-	S*p*	-
Brusher	MS	SVS*p*	MR	MI
Forester	-	-	MS	MI
Kingbale	MS*p*	VS*p*	R	-
Koorabup	MS*p*	VS*p*	S	-
Kultarr	-	-	MR*p*	-
Mulgara	MS	MSS*p*	R	MT
Swan	-	-	MR	I
Tammar	-	-	MR	MT
Tungoo	-	-	R	MT
Wallaby	-	-	R	-
Winjardie	MSS*p*	-	S	I
Wintaroo	-	-	R	MT

Source: Carla Wilkinson, InterGrain and NVT Online, **nvtonline.com.au**

[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, MT = moderately tolerant, MI = moderately intolerant, I = intolerant, *p* = provisional rating. No score '-' = no rating is currently available. *Refer to page 4 for interpreting resistance classification.*

[2] Growth stage: the seedling resistance score reflects resistance at the two to the three-leaf stage and the adult resistance score reflects resistance after flag leaf emergence.

[3] Root lesion nematode: oat 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. *Pratylenchus teres* has been renamed *Pratylenchus quasitereoides*. Ratings are based on data collected in WA.

[4] CCN: oat varieties differ in their resistance (a resistant variety retards nematode development) and tolerance (tolerant varieties yield better in the presence of nematodes). CCN resistance and tolerance data are based on variety responses in SA.

Variety snapshots

Georgie Troup and Blakely Paynter (DPIRD)

Variety snapshots are presented for:

- seven dual-purpose varieties (Bannister, Carrolup, Durack, Kojonup, Wandering, Williams and Yallara) deliverable into milling oat segregations in WA are also suitable for export hay.
- three grain-only varieties (Bilby, Kowari and Mitika) that are deliverable into milling oat segregations in WA but are not suitable for export hay.
- two grain varieties that have not yet been classified (13008-18 and Koala).
- ten hay-only varieties (Archer, Brusher, Kingbale, Koorabup, Kultarr, Mulgara, Swan, Winjardie and Wintaroo) that can be cut for export hay but cannot be delivered into milling oat segregations in WA.

The comment section in each snapshot describes essential characteristics of a variety, including yield relative to another variety and key weaknesses and strengths.

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 Bannister) rather than the site mean yield (as shown in Tables 3 to 8) for each year from 2018 to 2022. Single-site MET data from Table 9 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 under the same agronomy (in the same trial).

DPIRD collects disease resistance data for grain varieties under a service agreement with GRDC for the NVT system. InterGrain supplies hay disease data (except Koorabup). Disease and nematode resistance ratings are sourced from Tables 12 and 13 and presented for the plant's adult growth stages (if known).

Phenology information is an output of the new flowering date predictive program, "FlowerPower" oat (available at fp.dpird.app/), developed by DPIRD. "FlowerPower" oat is a statistical model that predicts the date of the watery ripe (Z71) growth stage for oats in two WA environments (Northam and Katanning). 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/). Data presented relative to a control variety (typically the dual-purpose variety Carrolup and the hay variety Brusher) for two model environments (Northam and Katanning) for five sowing dates (10-April, 20-April, 10-May, 20-May and 10-June). The phenology data presented in the snapshots is the median predicted date to Z71 (date expected for 50% of seasons) based on "FlowerPower" oat version v7.0.10.

Agronomic traits are tabulated based on published data generated by NOBP in their annual newsletters (pir.sa.gov.au/research/research_specialties/crop_sciences/crop_improvement), data collected by DPIRD, research findings from the DPIRD-GRDC co-funded projects DAW00107, DAW00227 and DAW1901-002RTX and in some cases, directly from the breeder. Data presented includes:

- Plant type is based on the genetic background of the variety. Data sourced from NOBP.
- Coleoptile and coleoptile + mesocotyl length. Short = 40–60mm, medium = 60–80mm, long = 80–100mm, very long = 100–120mm and extremely long = >120mm. Oat seedlings emerge by elongating the mesocotyl and coleoptile (in wheat and barley, it is only through coleoptile elongation), so oats can safely be sown deeper than wheat and barley. The coleoptile and mesocotyl lengths were measured after germinating seeds in rolled, moistened filter paper for 15 days at 15°C in the dark. DPIRD collected data.
- Hull lignin is an empirical phloroglucinol test where colour either develops or does not. Hull lignin ratings are based on data published by NOBP. There is a 0–5 scale where 0 is no hull lignin. Hull lignin is also measurable by near-infrared spectroscopy (NIR). Data sourced from NOBP.

- Stem diameter ratings based on data published by NOBP where fine = <4mm, moderate = 4–6mm, thick = 7–8mm and very thick = >8mm. Data sourced from NOBP.

Variety information, including pedigree, 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).

Bannister(Þ)

OAT1 grain and hay variety

Comments

Bannister (tested as WAOAT2354) is a medium spring, tall milling oat variety suitable for export hay. Bannister is susceptible to grain staining. Growers should avoid sowing Bannister in high risk, grain staining scenarios, oat-on-oat rotations and where pre-harvest rain is a high risk. Carrolup has been the dominant dual-purpose variety cut for export hay, but the popularity of Bannister amongst export hay growers is growing. Bannister hay has better quality and increased hay yield than Carrolup in trials. While hay yields are lower than Brusher, hay quality in breeder trials was comparable. Bannister is the most widely sown oat variety in WA, occupying half the area sown to oats in 2022.

Grain yield (% Carrolup)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	131	111	120	126	124
Agzone 3	119	117	125	120	120
Agzone 4	117	110	120	130	147
Agzone 5	119	111	126	120	122
Agzone 6	127	120	135	127	124
Statewide	125	114	124	125	124

Disease resistance	Rating
Septoria	MSS
Leaf rust	MR
Stem rust	MS
BYD and CYD	MS
RLN (*P. neglectus*)	MSS
RLN (*P. quasitereoides*)	S*p*
CCN (resistance)	MR

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+3	+3	+3	+3	+3
Katanning	+3	+3	+3	+3	+3

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+1	+1	+1	+1	+1
Katanning	+1	+1	+1	+1	+0

Agronomic traits	
Plant type	Dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	High
Stem diameter	Moderate

Variety information	
Pedigree	93Q440-44-12/95Q624-30
Breeder / Seed licensee	DPIRD / Seednet
Access to seed	Seednet Partners
EPR ($/t, excl GST) (grain / hay)	$2.30 / $2.00

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

Carrolup

OAT1 grain and hay variety

Comments

Carrolup (tested as 81Q:346) is a medium spring, mid-tall milling oat variety suitable for export hay. Carrolup has a significantly lower grain yield than the new milling varieties Bannister and Williams. Carrolup grain has the best hectolitre weight of current milling varieties, but screenings tend to be high similar to Williams. Hay quality of Carrolup is comparable to many of the specialist hay varieties but at a lower hay yield. Carrolup is the second most widely grown oat variety in WA after Bannister, occupying 16% of the oat area in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	76	90	83	79	81
Agzone 3	84	86	80	84	84
Agzone 4	86	91	83	77	68
Agzone 5	84	90	80	83	82
Agzone 6	79	83	74	79	81
Statewide	80	88	81	80	81
Disease resistance	**Rating**				
Septoria	MSS				
Leaf rust	VS				
Stem rust	S				
BYD and CYD	SVS				
RLN (*P. neglectus*)	S				
RLN (*P. quasitereoides*)	S*p*				
CCN (resistance)	MR				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Bannister**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-3	-3	-3	-3	-3
Katanning	-3	-3	-3	-3	-3
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-2	-2	-2	-2	-2
Katanning	-2	-2	-2	-2	-3
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	Moderate				
Variety information					
Pedigree	Mortlock/80Q256				
Breeder / Seed licensee	DPIRD				
Access to seed	Free to trade				
EPR ($/t, excl GST) (grain / hay)	No EPR payable				

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

Kojonup

OAT1 grain and hay variety

Comments

Kojonup (tested as 91Q291-23-23) is a medium spring, medium height, milling oat variety suitable for export hay. Grain yield is between Carrolup and Bannister. It has good grain quality, large seed size, high hectolitre weight and low screenings. Kojonup is susceptible to oat Septoria and OLR. Kojonup is not recommended for lower rainfall regions (e.g. less than 200mm growing season rainfall). While Kojonup is suitable for export hay, hay yields are generally lower than Carrolup. Kojonup is a minor variety and occupied about 0.5% of the planted area to oats in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	81	82	84	95	95
Agzone 3	94	99	84	93	96
Agzone 4	79	69	67	85	94
Agzone 5	83	79	85	91	97
Agzone 6	96	98	103	103	98
Statewide	87	88	87	94	96
Disease resistance	**Rating**				
Septoria	MSS				
Leaf rust	SVS				
Stem rust	MSS				
BYD and CYD	MSS				
RLN (*P. neglectus*)	MSS				
RLN (*P. quasitereoides*)	SVS*p*				
CCN (resistance)	VS				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	-				
Variety information					
Pedigree	83Q:384/Coomallo				
Breeder / Seed licensee	DPIRD				
Access to seed	Free to trade				
EPR ($/t, excl GST) (grain / hay)	$ 2.25 / -				

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

Williams(Þ)

OAT1 grain and hay variety

Comments

Williams (tested as WAOAT2332) is a medium spring, mid-tall milling oat variety suitable for export hay. Williams has a similar grain yield to Bannister and Wandering but may lodge in high yielding environments. Williams grain has lower hectolitre weight and higher screenings than Bannister and Yallara, especially in lower rainfall regions. Williams has a higher level of grain β-glucan. Hay yields are around 0.5–1.0t/ha less than specialist hay varieties like Brusher, Mulgara and Winjardie at a comparable hay quality. Hay quality is similar to Wintaroo, with slightly lower WSC and slightly higher crude protein. The main issue with Williams hay is stem thickness, so a target density of 320 plants/m2 is required when grown for export hay. Williams is the third most widely sown oat variety, occupying 12% of the oat planted area in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	97	102	95	94	94
Agzone 3	99	98	95	95	99
Agzone 4	104	110	96	91	89
Agzone 5	101	99	98	96	96
Agzone 6	97	97	97	92	95
Statewide	98	100	96	94	95
Disease resistance	**Rating**				
Septoria	MSS				
Leaf rust	MR				
Stem rust	MSS				
BYD and CYD	MSS				
RLN (*P. neglectus*)	MRMS				
RLN (*P. quasitereoides*)	MSS*p*				
CCN (resistance)	S				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+3	+2	+2	+2	+2
Katanning	+3	+2	+2	+2	+3
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+1	+0	+0	+0	+0
Katanning	+1	+0	+0	+0	+0
Agronomic traits					
Plant type	Non-dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Very long				
Hull lignin	Moderately high				
Stem diameter	Moderately thick				
Variety information					
Pedigree	85Q845-59/Carrolup//93Q496-13/Carrolup				
Breeder / Seed licensee	SARDI / Barenbrug				
Access to seed	Free to trade				
EPR ($/t, excl GST) (grain / hay)	$2.30 / $2.00				

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

Yallara(Þ)

OAT1 grain and hay variety

Comments

Yallara (tested as SV97001-13-4) is a medium spring, mid-tall milling oat variety suitable for export hay. Grain yields are similar to Carrolup, with improved disease resistance. Yallara grain has a slightly lower hectolitre weight than Carrolup grain but improved grain plumpness (lower screenings). Yallara has bright grain and high grain digestibility, making it suitable for the horse racing industry. Hay yields are slightly higher than Williams and comparable to the specialist hay variety Brusher. Yallara can produce high-quality hay with moderately fine stems and is replacing Winjardie as a hay variety in the northern half of Agzone 2. Yallara has some tolerance to oat septoria and OSR, with good resistance to OLR. Yallara is the fourth most popular oat variety in WA in 2022, occupying about 6% of the area sown to oats.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	81	95	87	75	78
Agzone 3	80	83	86	83	79
Agzone 4	85	98	75	88	61
Agzone 5	86	98	80	86	77
Agzone 6	78	76	56	71	76
Statewide	81	89	81	79	76
Disease resistance	**Rating**				
Septoria	MSS				
Leaf rust	MR				
Stem rust	MSS				
BYD and CYD	MSS				
RLN (*P. neglectus*)	–				
RLN (*P. quasitereoides*)	–				
CCN (resistance)	R				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-1	-2	-1	-2	-2
Katanning	-1	-2	-1	-2	-1
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-3	-4	-3	-4	-4
Katanning	-3	-4	-3	-4	-4
Agronomic traits					
Plant type	Non-dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	Moderately fine				
Variety information					
Pedigree	Euro/ND931075//Euro				
Breeder / Seed licensee	SARDI / Seednet				
Access to seed	Seednet Partners				
EPR ($/t, excl GST) (grain / hay)	$2.00 / $2.00				

Refer to page 4 for interpreting resistance classification.

Durack(Þ)

OAT1 grain and hay variety

Comments

Durack (tested as WA02Q302-9) is an early spring, mid-tall, milling variety suitable for export hay. Durack is only deliverable as an OAT2 variety. When evaluated, Durack was not granted OAT1 status as it failed to meet the target grain β-glucan target of 4%. It is similar in height and grain yield to Carrolup and Yallara with comparable hectolitre weight but improved grain plumpness relative to Carrolup. Grain plumpness (or screenings) is similar to Yallara. Durack is the earliest maturing oat variety of any current milling or hay variety. While earlier flowering helps produce large grains, it may also increase the risk of frost during flowering, so growers are encouraged to sow between May and mid-June when sowing in frost-prone areas. Hay yields are generally lower than Carrolup and Williams. Durack is susceptible to oat septoria and OSR. Durack was the eighth most popular oat variety in 2022 but occupying only 1% of the area sown to oats.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	75	93	93	79	81
Agzone 3	79	75	85	86	75
Agzone 4	86	91	127	81	69
Agzone 5	81	101	79	81	79
Agzone 6	65	76	59	76	74
Statewide	75	86	85	81	77
Disease resistance	**Rating**				
Septoria	S				
Leaf rust	MRMS				
Stem rust	SVS				
BYD and CYD	S				
RLN (*P. neglectus*)	MS				
RLN (*P. quasitereoides*)	Sp				
CCN (resistance)	RMR				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-6	-7	-7	-7	-7
Katanning	-7	-7	-7	-7	-6
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-8	-9	-9	-9	-9
Katanning	-9	-9	-9	-9	-9
Agronomic traits					
Plant type	Non-dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	Moderate				
Variety information					
Pedigree	01Q211/94Q601-45-28				
Breeder / Seed licensee	SARDI / Barenbrug				
Access to seed	Barenbrug				
EPR ($/t, excl GST) (grain / hay)	$2.30 / $2.00				

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

Wandering

OAT2/OWAN grain and hay variety

Comments

Wandering (tested as WAOAT2052) is a medium spring, medium height feed variety received as OAT2 and OWAN only. Wandering has comparable grain yield to Bannister and Williams but is less competitive at sites with a yield potential above 3t/ha. Wandering is suitable for cutting for hay but is not preferred by the export industry. Hay yields are generally higher than Carrolup, with improved digestibility and WSC. Wandering is very susceptible to OLR and OSR. Wandering was the fifth most popular oat variety, occupying 4.4% of the area sown to oats in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	98	102	100	99	99
Agzone 3	101	97	97	99	100
Agzone 4	106	107	122	92	98
Agzone 5	101	101	101	96	100
Agzone 6	95	100	103	98	98
Statewide	99	100	101	98	99
Disease resistance	**Rating**				
Septoria	MSS				
Leaf rust	VS				
Stem rust	SVS				
BYD and CYD	S				
RLN (*P. neglectus*)	–				
RLN (*P. quasitereoides*)	–				
CCN (resistance)	VS				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	+2	+1	+1	+1	+1
Katanning	+2	+1	+1	+1	+2
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	+0	-1	-1	-1	-1
Katanning	+0	-1	-1	-1	-1
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	Moderate				
Variety information					
Pedigree	SA Seln 41/75Q36-144-31				
Breeder / Seed licensee	DPIRD				
Access to seed	Free to trade				
EPR ($/t, excl GST) (grain / hay)	No EPR payable				

Refer to page 4 for interpreting resistance classification.

Bilby(b)

OAT1 grain variety

Comments

Bilby (tested as 06204-16) is an early-medium spring, short milling oat variety not suitable for export hay. The grain quality of Bilby is comparable to Bannister but with a lower grain yield above 3t/ha. Grain yields are between Kojonup and Wandering. Since 2017, grain yields of Bilby have been similar to Williams with a higher hectolitre weight and lower screenings. Bilby has higher grain β-glucan and lower oil than other dwarf varieties with bright grain. Bilby is very susceptible to oat septoria and OSR. The Bilby area has grown, and it occupied just under 3% of the area sown to oats in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	91	99	103	97	97
Agzone 3	94	87	96	98	91
Agzone 4	100	96	148	91	96
Agzone 5	94	104	95	92	95
Agzone 6	81	94	91	95	92
Statewide	91	95	100	96	94
Disease resistance	**Rating**				
Septoria	S				
Leaf rust	MRMS				
Stem rust	SVS				
BYD and CYD	S				
RLN (*P. neglectus*)	MS*p*				
RLN (*P. quasitereoides*)	S*p*				
CCN (resistance)	MR				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-2	-2	-2	-2	-2
Katanning	-2	-2	-2	-2	-1
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-4	-4	-4	-4	-4
Katanning	-4	-4	-4	-4	-4
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	High				
Stem diameter	–				
Variety information					
Pedigree	98011-6/98240-19				
Breeder / Seed licensee	SARDI / Barenbrug				
Access to seed	Barenbrug				
EPR ($/t, excl GST) (grain / hay)	$2.50 / -				

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

Kowari(b)

OAT1 grain variety

Comments

Kowari (tested as SV03198-18) is a medium spring, medium height milling oat variety not suitable for export hay. Kowari is an alternate to Bilby, but with lower yield potential, similar hectolitre weight and improved grain plumpness (lower screenings). Kowari has slightly longer straw and higher grain yield than Mitika at comparable grain quality. Kowari grain is attractive to millers seeking health claims for their products as it has a higher level of grain β-glucan. Kowari is susceptible to oat septoria and OSR. Kowari grain has low hull lignin, which improves feed grain quality. Kowari occupied 0.6% of the area sown to oats in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	85	96	101	92	93
Agzone 3	89	83	92	95	85
Agzone 4	94	92	148	88	90
Agzone 5	89	103	90	87	91
Agzone 6	74	88	82	91	87
Statewide	85	92	96	92	89
Disease resistance	**Rating**				
Septoria	S				
Leaf rust	MR				
Stem rust	S				
BYD and CYD	S				
RLN (*P. neglectus*)	–				
RLN (*P. quasitereoides*)	–				
CCN (resistance)	VS				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-8	-9	-9	-9	-9
Katanning	-8	-9	-9	-9	-8
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-10	-11	-11	-11	-11
Katanning	-10	-11	-11	-11	-11
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	Low				
Stem diameter	–				
Variety information					
Pedigree	Mitika/WAOAT2099				
Breeder / Seed licensee	SARDI / Barenbrug				
Access to seed	Barenbrug				
EPR ($/t, excl GST) (grain / hay)	$2.50 / -				

Refer to page 4 for interpreting resistance classification.

Mitika(Þ)

OAT1 grain variety

Comments

Mitika (tested as SV94046-57) is a medium spring, short height milling oat variety not suitable for export hay. The grain yield of Mitika is an improvement on Carrolup, but is significantly lower than Bannister and Williams. Mitika grain is comparable to Kowari for hectolitre weight and grain plumpness, but is lower yielding. Mitika, like Kowari, has higher levels of β-glucan than current milling and dual-purpose varieties. Mitika is susceptible to oat septoria and OSR. Mitika has improved feed quality due to low husk lignin and high grain digestibility. Mitika is a minor variety occupying less than 0.5% of the area planted to oats in 2022.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	82	94	96	-	-
Agzone 3	87	82	90	-	-
Agzone 4	91	91	133	-	-
Agzone 5	86	100	86	-	-
Agzone 6	74	85	77	-	-
Statewide	83	90	91	-	-
Disease resistance	**Rating**				
Septoria	SVS				
Leaf rust	MRMS				
Stem rust	S				
BYD and CYD	SVS				
RLN (*P. neglectus*)	–				
RLN (*P. quasitereoides*)	–				
CCN (resistance)	VS				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
Agronomic traits					
Plant type	Dwarf				
Coleoptile length	Medium				
Coleoptile + mesocotyl length	Extremely long				
Hull lignin	Low				
Stem diameter	–				
Variety information					
Pedigree	OX87;072-13/OX87;080-1//OX88;045-12				
Breeder / Seed licensee	SARDI / Barenbrug				
Access to seed	Free to trade				
EPR ($/t, excl GST) (grain / hay)	$2.00 / -				

Refer to page 4 for interpreting resistance classification.

13008-18

Not yet evaluated for milling

Comments

13008-18 is a medium spring variety suited to all milling oat-growing regions in WA. 13008-18 is derived from Bannister and has the following pedigree – 02095-9/Bannister. It has been accepted for milling evaluation by Grains Australia.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	-	-	-	104	104
Agzone 3	-	-	-	104	98
Agzone 4	-	-	-	101	106
Agzone 5	-	-	-	99	102
Agzone 6	-	-	-	100	99
Statewide	-	-	-	102	101
Disease resistance	**Rating**				
Septoria	MS				
Leaf rust	MR				
Stem rust	MSS				
BYD and CYD	MS				
RLN (*P. neglectus*)	-				
RLN (*P. quasitereoides*)	-				
CCN (resistance)	-				
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Carrolup**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
'FlowerPower' predicted days to watery ripe (Z71)	**Relative to Brusher**				
	10-Apr	**20-Apr**	**10-May**	**20-May**	**10-Jun**
Northam	-	-	-	-	-
Katanning	-	-	-	-	-
Agronomic traits					
Plant type	-				
Coleoptile length	-				
Coleoptile + mesocotyl length	-				
Hull lignin	-				
Stem diameter	-				
Variety information					
Pedigree	02095-9/Bannister				
Breeder / Seed licensee	SARDI / InterGrain				
Access to seed	to be advised				
EPR ($/t, excl GST) (grain / hay)	to be advised				

Refer to page 4 for interpreting resistance classification.

Koala(Þ)

Not yet evaluated for milling

Comments

Koala (tested as SV09143-35) is late spring, tall grain oat derived from Bannister that is yet to be evaluated for its milling potential. Suitability for export hay has not been established. Koala has a similar tolerance to oat septoria and OLR as Bannister but is improved for OSR. Grain quality packages (hectolitre weight and screenings through a 2.0mm sieve) for Koala and Bannister are similar. Koala seed will be bulked in WA in 2023 and is planned for release as a feed oat in 2024 for on-farm and domestic use, with Seednet indicating it will submit the variety for milling accreditation in 2023.

Grain yield (% Bannister)	2018	2019	2020	2021	2022
Agzone 1	-	-	-	-	-
Agzone 2	102	94	92	100	102
Agzone 3	101	110	100	100	105
Agzone 4	90	91	42	107	101
Agzone 5	99	90	98	106	102
Agzone 6	115	103	104	105	106
Statewide	103	99	94	102	103

Disease resistance	Rating
Septoria	MSS
Leaf rust	MR
Stem rust	MRMS
BYD and CYD	S
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	–

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	Moderately low
Stem diameter	–

Variety information	
Pedigree	02088-70/Bannister
Breeder / Seed licensee	SARDI / Seednet
Access to seed	Seednet Partners
EPR ($/t, excl GST) (grain / hay)	$2.50 / -

Refer to page 4 for interpreting resistance classification.

Archer(Þ)

Hay variety

Comments

Archer (GIA1803-040) is a single gene, imidazolinone (IMI) tolerant, mid-maturity and mid-height hay-only variety. Preliminary data indicates Archer has high hay yields with suitable quality for export hay, and a useful disease profile, although CCN may require rotational management. Archer was developed through mutation breeding by GIA and is being commercialised by InterGrain. Archer appears to have a comparable grain yield to Carrolup, allowing for easier seed bulk-up for the following year's hay crop. Archer has improved tolerance to soil residual IMI herbicides as a plant back option. The APMVA have registered the Sentry® herbicide with Archer for pre-plant IBS application for forage, seed, and grain (domestic feed market only). Archer cannot be sprayed post-emergent with an IMI herbicide. Farmer-to-farmer trading of Archer seed will not be allowed, as with IMI tolerant wheat and barley varieties. Suggested alternative to Brusher, Carrolup, Mulgara, and Yallara.

Hay yield and quality	Archer	Carrolup
Hay yield (t/ha)	10.8	10.3
Digestibility (% dm)	63.3	63.2
CP (% dm)	6.1	5.9
WSC (% dm)	25.4	27.1
ADF (% dm)	33.1	33.3
NDF (% dm)	52.4	52.2

Disease resistance	Rating
Septoria	MSS
Leaf rust	MR
Stem rust	MS
BYD and CYD	MS
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	S*p*

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Wintaroo				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	–
Stem diameter	–

Variety information	
Pedigree	Euro/ND931075//Euro
Breeder / Seed licensee	GIA / Intergrain
Access to seed	Seedclub members and resellers
EPR ($/t, excl GST) (grain / hay)	$3.65 / $3.65

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

Brusher(b)

Hay variety

Comments

Brusher (tested as SV87103-109) is a tall, medium spring hay-only oat variety. Brusher reaches watery ripe about five days earlier than Wintaroo and two days later than Carrolup across a range of sowing dates. Brusher hay is similar in height to Mulgara and Wintaroo with thinner stems and lower fibre levels. It also has improved digestibility, metabolisable energy and WSC than Wintaroo. Brusher has improved hay yield and quality relative to Carrolup and is the most widely sown hay-only variety cut for export hay. Brusher is susceptible to oat septoria and OSR, and is suitable for sowing in lower rainfall areas.

Hay yield and quality	Brusher	Carrolup
Hay yield (t/ha)	11.1	10.3
Digestibility (% dm)	64.5	63.2
CP (% dm)	6.0	5.9
WSC (% dm)	26.9	27.1
ADF (% dm)	32.9	33.3
NDF (% dm)	52.1	52.2

Disease resistance	Rating
Septoria	MSS
Leaf rust	MR
Stem rust	S
BYD and CYD	MSS
RLN (*P. neglectus*)	MSS
RLN (*P. quasitereoides*)	SVS*p*
CCN (resistance)	MR

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+2	+2	+2	+2	+2
Katanning	+2	+2	+2	+2	+3

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Wintaroo				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-5	-5	-5	-5	-4
Katanning	-5	-5	-5	-4	-4

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	Low
Stem diameter	Moderate

Variety information	
Pedigree	Dumont/Wallaroo//Bandicoot
Breeder / Seed licensee	SARDI / AEXCO
Access to seed	AEXCO seed distributor
EPR ($/t, excl GST) (grain / hay)	$2.00 / $2.00

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

Kingbale(b)

Hay variety

Comments

Kingbale (tested as GIA1701O-I) is a single gene, imidazolinone (IMI) tolerant, hay-only oat variety. Kingbale has a similar agronomic and disease profile to Wintaroo. Kingbale was developed through mutation breeding from Wintaroo by GIA and is being commercialised by InterGrain. The breeding process was similar to the development of Scope CL from Buloke barley. Kingbale has improved tolerance to soil residual IMI herbicides as a plant back option. The APMVA have registered the Sentry® herbicide with Kingbale for pre-plant IBS application for forage, seed and grain (domestic feed market only). Kingbale cannot be sprayed post-emergent with an IMI herbicide. Farmer-to-farmer trading of Kingbale seed will not be allowed, as with IMI tolerant wheat and barley varieties. Suggested alternative to Carrolup, Koorabup, Winjardie, and Wintaroo.

Hay yield and quality	Kingbale	Carrolup
Hay yield (t/ha)	10.8	10.3
Digestibility (% dm)	63.5	63.2
CP (% dm)	5.6	5.9
WSC (% dm)	27.0	27.1
ADF (% dm)	34.5	33.3
NDF (% dm)	52.8	52.2

Disease resistance	Rating
Septoria	MSS
Leaf rust	S
Stem rust	S
BYD and CYD	MS*p*
RLN (*P. neglectus*)	MS*p*
RLN (*P. quasitereoides*)	VS*p*
CCN (resistance)	R

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	-
Stem diameter	-

Variety information	
Pedigree	MIOLRP-86-3/Echidna//Wallaroo
Breeder / Seed licensee	GIA / Intergrain
Access to seed	Seedclub members and resellers
EPR ($/t, excl GST) (grain / hay)	$3.65 / $3.65

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

Koorabup(b)

Hay variety

Comments

Koorabup (tested as 05096-32) is a new medium spring, hay-only oat variety developed for WA. Relative to Carrolup, it is about a week later to cut, with a similar plant height and hay yield but improved oat Septoria resistance. Koorabup has comparable grain yield to Carrolup, allowing ease of seed bulk-up for the following year's hay crop. Koorabup hay yields are lower than Archer and Brusher and close to Carrolup. It has better lodging and shattering resistance than Wintaroo and Brusher and similar to Mulgara. Koorabup hay has quality tested poorly in breeder variety trials since 2017 and in National Hay Agronomy trials.

Hay yield and quality	Koorabup	Carrolup
Hay yield (t/ha)	10.1	10.3
Digestibility (% dm)	63.3	63.2
CP (% dm)	5.8	5.9
WSC (% dm)	26.5	27.1
ADF (% dm)	33.9	33.3
NDF (% dm)	52.7	52.2

Disease resistance	Rating
Septoria	MRMS
Leaf rust	MRMS
Stem rust	MSS
BYD and CYD	MSS
RLN (*P. neglectus*)	MS*p*
RLN (*P. quasitereoides*)	VS*p*
CCN (resistance)	S

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+6	+6	+6	+6	+6
Katanning	+6	+6	+6	+6	+6

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+4	+4	+4	+4	+4
Katanning	+4	+4	+4	+4	+3

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	High
Stem diameter	Moderately fine

Variety information	
Pedigree	WAOAT2282/WAOAT2236
Breeder / Seed licensee	SARDI / AEXCO
Access to seed	AEXCO seed distributor
EPR ($/t, excl GST) (grain / hay)	$2.00 / $2.00

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

Kultarr(b)

Hay variety

Comments

Kultarr (tested as 07423-18), according to the commercialising agent InterGrain, is a quick-mid maturing oaten hay with a tall plant height and offers excellent hay yields. Kultarr has a higher yield potential than Brusher and Mulgara. It is slightly later to flower than Brusher, and similar to Mulgara. Preliminary hay quality data indicates the variety has a suitable quality profile for export hay. Kultarr has useful resistance to oat septoria and OLR. Kultarr was bred by SARDI with support from AgriFutures and AEXCO, and is being commercialised by InterGrain. Kultarr is an option where Brusher, Carrolup, Mulgara, or Yallara are currently planted.

Hay yield and quality	Kultarr	Carrolup
Hay yield (t/ha)	10.8	10.3
Digestibility (% dm)	63.7	63.2
CP (% dm)	5.6	5.9
WSC (% dm)	26.5	27.1
ADF (% dm)	33.6	33.3
NDF (% dm)	52.4	52.2

Disease resistance	Rating
Septoria	MSS*p*
Leaf rust	MR*p*
Stem rust	MSS*p*
BYD and CYD	MSS*p*
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	MR*p*

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Wintaroo				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Long
Coleoptile + mesocotyl length	Extremely long
Hull lignin	–
Stem diameter	–

Variety information	
Pedigree	IL3587/Mulgara
Breeder / Seed licensee	SARDI / Intergrain
Access to seed	Seedclub members and resellers
EPR ($/t, excl GST) (grain / hay)	$3.00 / $3.00

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

Mulgara(Þ)

Hay variety

Comments

Mulgara (tested as SV96025-7) is a tall, medium spring hay-only oat variety. Mulgara reaches watery ripe at a similar time to Brusher and about three days later than Carrolup across a range of sowing dates. Mulgara has excellent resistance to OLR and OSR, but is rated as S to oat septoria. It is an improvement compared to Wintaroo for lodging, shattering resistance and early vigour. Hay yield in breeder's trials was an improvement over Carrolup and comparable to Brusher. Hay digestibility and WSC is better than Carrolup but similar for fibre. Mulgara has excellent hay colour and resists brown leaf tipping. Mulgara is al alternative to Kingbale and Wintaroo where OLR, OSR, or lodging are problematic year in, year out. Mulgara seed is large and care must be taken to compensate for this at sowing to ensure a target density of 320 plants/m^2 is acheived in medium to higher rainfall areas.

Hay yield and quality	Mulgara	Carrolup
Hay yield (t/ha)	10.6	10.3
Digestibility (% dm)	64.7	63.2
CP (% dm)	5.7	5.9
WSC (% dm)	27.6	27.1
ADF (% dm)	33.3	33.3
NDF (% dm)	52.4	52.2

Disease resistance	Rating
Septoria	S
Leaf rust	MR
Stem rust	MR
BYD and CYD	MS
RLN (*P. neglectus*)	MS
RLN (*P. quasitereoides*)	MS*p*
CCN (resistance)	R

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+3	+3	+3	+3	+3
Katanning	+3	+3	+3	+3	+4

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+1	+1	+1	+1	+1
Katanning	+1	+1	+1	+1	+1

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Long
Coleoptile + mesocotyl length	Extremely long
Hull lignin	High
Stem diameter	Moderate

Variety information	
Pedigree	OX89;030-26/93-112
Breeder / Seed licensee	SARDI / AEXCO
Access to seed	AEXCO seed distributor
EPR ($/t, excl GST) (grain / hay)	$2.00 / $2.00

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

Swan

Hay variety

Comments

Swan (tested as Oat 3) is a tall, medium spring, hay-only oat variety. Relative to Carrolup, it is ready for cutting at a similar time, with taller hay of higher yield that is susceptible to lodging. It also has comparable hay quality and a similar disease resistance profile to Carrolup. Older hay varieties such as Swan (first registered in 1967) are not widely accepted by export due to their thicker stems. Swan is best suited to lower rainfall environments e.g. eastern wheatbelt. Swan grain has low hull lignin, which improves feed grain quality.

Hay yield and quality	Swan	Carrolup
Hay yield (t/ha)	-	10.3
Digestibility (% dm)	-	63.2
CP (% dm)	-	5.9
WSC (% dm)	-	27.1
ADF (% dm)	-	33.3
NDF (% dm)	-	52.2

Disease resistance	Rating
Septoria	–
Leaf rust	–
Stem rust	–
BYD and CYD	–
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	MR

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	Low
Stem diameter	Moderately thick

Variety information	
Pedigree	Kent/Ballidu
Breeder / Seed licensee	DPIRD
Access to seed	Free to trade
EPR ($/t, excl GST) (grain / hay)	No EPR payable

Refer to page 4 for interpreting resistance classification.

Wallaby(b)

Hay variety

Comments

Wallaby (tested as 07079-9), according to the commercialising agent InterGrain, is a mid-slow maturing oaten hay variety with similar hay yields to Brusher and Mulgara. The variety has excellent quality attributes including good digestibility and high WSC levels. Wallaby has a medium to tall plant height and is likely suited to medium and high rainfall zones and resistant to CCN. Provisional ratings suggest Wallaby has useful resistance to oat septoria, OLR and OSR. Wallaby appears to have a comparable grain yield to Carrolup, allowing for easier seed bulk-up for the following year's hay crop. Wallaby was bred by SARDI with support from AgriFutures and AEXCO, and is being commercialised by InterGrain. Wallaby is an option where Brusher, Carrolup, Koorabup, Mulgara or Wintaroo are currently planted.

Hay yield and quality	Wallaby	Carrolup
Hay yield (t/ha)	10.7	10.3
Digestibility (% dm)	66.0	63.2
CP (% dm)	5.7	5.9
WSC (% dm)	28.5	27.1
ADF (% dm)	32.6	33.3
NDF (% dm)	52.5	52.2

Disease resistance	Rating
Septoria	MS*p*
Leaf rust	MR*p*
Stem rust	MS*p*
BYD and CYD	MS*p*
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	R

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Wintaroo				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Long
Coleoptile + mesocotyl length	Very long
Hull lignin	–
Stem diameter	–

Variety information	
Pedigree	98228-3/00167-14
Breeder / Seed licensee	SARDI / Intergrain
Access to seed	Seedclub members and resellers
EPR ($/t, excl GST) (grain / hay)	$3.00 / $3.00

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

Winjardie

Hay variety

Comments

Winjardie (tested as Oat 146) is a tall, medium spring hay oat variety. A low disease resistance profile makes it unsuitable for disease-prone locations. However, Winjardie can produce quality export hay when grown in the northern half of Agzone 2 where disease pressure is reduced. Winjardie grain has low hull lignin, which improves feed grain quality.

Hay yield and quality	Winjardie	Carrolup
Hay yield (t/ha)	10.1	10.3
Digestibility (% dm)	63.3	63.2
CP (% dm)	5.8	5.9
WSC (% dm)	25.9	27.1
ADF (% dm)	33.2	33.3
NDF (% dm)	52.5	52.2

Disease resistance	Rating
Septoria	SVS
Leaf rust	SVS
Stem rust	–
BYD and CYD	MS
RLN (*P. neglectus*)	MS*p*
RLN (*P. quasitereoides*)	–
CCN (resistance)	S

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Brusher				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	-	-	-	-	-
Katanning	-	-	-	-	-

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Very long
Hull lignin	Low
Stem diameter	Moderate

Variety information	
Pedigree	66Q01-44/XBVT183
Breeder / Seed licensee	DPIRD
Access to seed	Free to trade
EPR ($/t, excl GST) (grain / hay)	No EPR payable

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

Wintaroo(b)

Hay variety

Comments

Wintaroo (tested as SV88083-4) is a tall, medium-late spring, hay oat variety. Wintaroo reaches watery ripe about five days later than Brusher and seven days later than Carrolup across a range of sowing dates. Susceptible to OLR. It resists brown leaf tipping by hot winds and maintains good colour longer than most varieties. Care must be taken to monitor the stems as they tend to turn white while the top remains green. Wintaroo hay is sought after by export hay houses. Experienced hay growers with cutting, conditioning and bailing equipment or access to a contractor will have an advantage in achieving the maximum potential from Wintaroo. Wintaroo grain has low hull lignin, which improves feed grain quality, but its grain yield is not as high as other hay or grain varieties.

Hay yield and quality	Wintaroo	Carrolup
Hay yield (t/ha)	10.7	10.3
Digestibility (% dm)	63.3	63.2
CP (% dm)	5.7	5.9
WSC (% dm)	26.7	27.1
ADF (% dm)	34.8	33.3
NDF (% dm)	52.8	52.2

Disease resistance	Rating
Septoria	MSS
Leaf rust	S
Stem rust	MSS
BYD and CYD	MSS
RLN (*P. neglectus*)	–
RLN (*P. quasitereoides*)	–
CCN (resistance)	R

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Carrolup				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+7	+6	+7	+7	+6
Katanning	+7	+7	+7	+7	+7

'FlowerPower' predicted days to watery ripe (Z71)	Relative to Wintaroo				
	10-Apr	20-Apr	10-May	20-May	10-Jun
Northam	+5	+4	+5	+5	+4
Katanning	+5	+5	+5	+5	+4

Agronomic traits	
Plant type	Non-dwarf
Coleoptile length	Medium
Coleoptile + mesocotyl length	Extremely long
Hull lignin	Low
Stem diameter	Moderate

Variety information	
Pedigree	MIOLRP-86-3/Echidna//Wallaroo
Breeder / Seed licensee	SARDI / AEXCO
Access to seed	AEXCO seed distributor
EPR ($/t, excl GST) (grain / hay)	$2.00 / $2.00

Refer to page 4 for interpreting resistance classification.

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