



Oat Breeding Newsletter

Hay Edition

September 2013



Mark Hill and Peter Wheeler seeding trials at Turretfield in June

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SARDI Field Crops Pathology
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NVT Program
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This years winning Royal Show entry Mitika submitted by Blue Lake Milling Pty Ltd

Editors' note:

Just a reminder, this newsletter should not be quoted without consent from the authors.

1. Entries for 2013 Hay Trials

1.1 Hay trials

New in 2013

- Hay demonstration plots sown at Calingiri in WA
- Stage 5 hay trial at Katanning discontinued
- Stage 4 hay trial sown at Pingelly (replaces Williams)
- Septoria, stem and leaf rust and BYDV nurseries all located at Manjimup, WA

The hay and late hay trials in 2013 were once again separated for logistical purposes at hay cutting and also because the numbers of entries increased. The Stage 5 (S5) hay trial for 2013 has 32 entries and was sown at Wongan Hills in WA and Horsham in Victoria. The Stage 5 trial at Katanning was discontinued. Stage 4 (S4) hay trials included the 32 entries from the S5 trial and an additional 32 entries to make a total of 64 entries. Hay and grain yield and quality assessment will be conducted at three locations in SA, two locations in Victoria and three locations in WA (Table 3). A hay trial for demonstration only was sown at Calingiri in WA. The Stage 4 late hay trial for 2013 has 24 entries and was sown at three locations in SA and one location in WA. Trials sown at Riverton and Turretfield in SA will be cut for hay yield and quality assessments and all four trials will be assessed for grain yield and grain quality. The Stage 4 entries from both the hay and late hay trials were also sown in nurseries to evaluate stem and leaf rust, BYDV and septoria resistance in WA, CCN resistance at the Waite Campus in SA and rust by the Australian Cereal Rust Control Program at Cobbitty in NSW. In an effort to consolidate the work in WA the septoria, BYDV and rust nurseries were all sown at Manjimup in 2013. Information about the hay yield and hay quality as well as grain yield of released lines is included in section 6 of this newsletter.

Table 3: Stage 5 and Stage 4 hay and late hay trial and nursery locations in 2013

South Australia	Victoria	Western Australia
Stage 4 trials Pinery (hay & late hay) Turretfield (hay & late hay) Riverton (hay & late hay) Seed increase Arthurton Nurseries Waite Campus (CCN resistance)	Stage 5 Horsham (Longrenong) Stage 4 Elmore (32 out of 64 entries cut for hay and all harvested for grain)	Stage 5 Wongan Hills Stage 4 Pingelly York Rylington Park (late hay only) Calingiri (obs)
	New South Wales	Nurseries Manjimup (septoria) Manjimup (BYDV) Manjimup (rust)
	Nurseries Rust evaluation at ACRCP Cobbitty	

2. Breeding Program Developments

2.1 National Oat Breeding Program now on Facebook

The National Oat Breeding Program has a Facebook page. Stay up to date with developments in the program by liking our page.

https://www.facebook.com/permalink.php?story_fbid=187021938039599&id=156517477768433#!/pages/National-Oat-Breeding-Program/156517477768433

2.2 Staff Changes

The National Oat Breeding Program welcomes two new members to the team for 2013. Mark Hill replaces Marcus Crawford and heads up the field team. Mark comes to us from Neutrog Fertilisers and has had many years experience in agriculture having managed a farm in the South East of SA and worked at a seed cleaning plant.

Dr. Mahalakshemi Mahadaven is the new project officer appointed to the SAGIT & GRDC funded project “Enhancing the Grain Yield and Quality of Oat under Water Deficits”. Maha has been working at SARDI for 4 years on projects with the Climate Risk, Water Resource and Irrigated Crops and Viticulture Groups. Maha has a PhD in Horticulture.



New members of the National Oat Breeding team Dr. Mahalakshemi Mahadaven and Mark Hill

2.3 Project updates

2.3.1 Oat Pre-Breeding Project

A concerted effort to tackle the major limitations in oat breeding has been funded by GRDC. Commencing in July, 2013, researchers in SARDI and the University of Sydney have come together to help improve disease resistance and abiotic stress tolerance in oat. The Leslie Research Centre in Toowoomba will also collaborate with this new project.

The goals are

- accelerate the introduction of new sources of stem and leaf rust resistance and sources of CCN resistance and tolerance,
- identify oat germplasm with improved resistance to septoria avenae, and
- establish a protocol to test for the red leather leaf fungus.

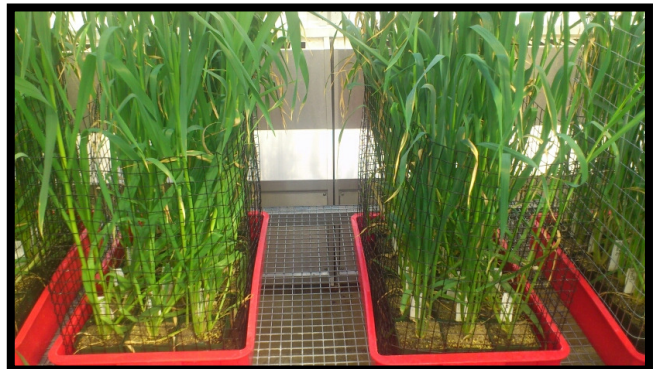
As part of this 5-year project, molecular markers will be developed to facilitate the introgression of rust and CCN resistance in breeding programs.

In addition to disease resistance traits, oat germplasm will be assessed regarding secondary plant traits that can contribute to better performance under low water availability. Specifically, traits like flowering time and maturity, early vigour, canopy temperature, yield components, leaf chlorophyll and water soluble carbohydrates will be evaluated in well-watered and drought-stressed conditions.

The collaborators and responsibilities of the project participants are; Robert Park and Davinder Singh - rust resistance including marker development, Victor Sadras - drought tolerance, Pamela Zwer and Bruce Winter - oat breeding and disease nurseries, Hugh Wallwork - Red Leather Leaf testing protocol, and Klaus Oldach as project leader and responsible for CCN and non-rust fungi resistance including marker development.

2.3.3 CORE Project

The 114 CORE lines from the North American Initiative were sown in single rows at Turretfield Research Centre in 2013. Agronomic characters of interest will be noted on these lines and once we have a seed build up we will begin to assess disease reactions in the Southern Hemisphere as well as drought tolerance in 2014. A group of 22 lines with adult stem rust resistance or high B-glucan levels have been sown in the glasshouse for use in crossing in 2013.



Core lines growing at Turretfield in 2013 and some of the oat plants being screened for molecular markers

2.3.4 Enhancing the Grain Yield and Quality of Oat under Water Deficits—project funded by SAGIT, GRDC and SARDI

Three drought tolerance trials were sown in 2013 at Pinery, Riverton and Turretfield. The trials consist of 32 diverse lines and varieties replicated three times. The following traits are being measured at Pinery and Riverton: early vigour, plant establishment, tiller number, leaf greenness, flowering date, canopy temperature, water soluble carbohydrates, hay yield and hay quality, yield components, grain yield, and grain quality. Calibrations for the Greenseeker measuring green matter production are being assessed at Turretfield, Riverton and Pinery.

There are also two shade trials sown at Pinery and in the birdproof enclosure at the Waite. These are split plot experiments with three varieties as main plots – Mitika, Williams (WA2332) and Wintaroo with a shade treatment at two weekly intervals as the sub plot. Using shade as a stress, these experiments are designed to work out at which growth stage the maximum yield and quality impact is incurred.



Dr Mahalakshimi Mahadaven measuring chlorophyll with SPAD and the shade trial at Pinery



Dr Mahalakshimi Mahadaven using the Greenseeker & casual Daniel Johnson cutting biomass samples to calibrate the Greenseeker for future use in the breeding program

2.4 WA program developments

2.4.1 Launch of Williams[®] at Oat Week

The new potential milling quality dwarf oat variety Williams (tested as WAOAT2332) was launched in September 2013 during Oat Week in WA. Seed is available from Heritage Seeds and a brochure is available from the Heritage Seeds website <http://www.heritageseeds.com.au/products/williams/>.



Pamela Zwer, SARDI, Rob Delane, Director General, DAFWA, John Sydenham, Joe Naughton and Max Karopoulos, DAFWA and Peter McCormack, SARDI at the launch of new oat variety Williams at York in WA



New oat variety Williams growing in trials at York in WA

2.5 Oat Seeding Rates an Important Link to Hay Yield and Quality!

Article Courtesy Denis McGrath, AEXCO

Key Points

- Seeding rates can play a major role in hay yield and quality.
- Grain weight of hay oat varieties can vary significantly for different varieties as well as seasonally.
- Measure the seed weight of the planting seed each year and target the optimum seeding rate that will maximize your financial returns.

It is common for hay producers in Australia to plant their hay crops at a seeding rate of 100kg per hectare. The chances of these hay crops achieving acceptable yield and quality specifications will depend significantly on the weight of the planted seed, the nutrition status of the paddock and the rainfall the crops receive.

Crops with a high seeding rate generally have a high plant density, higher yield potential, thinner stems and, depending on the variety, may have a higher risk of lodging. Crops with low seeding rates generally have a low plant density, thicker stems and achieve lower hay quality and yield.

It is important to know the grain weight of the seed you are sowing to ensure the optimum number of plants per square metre in your crop to maximize hay yield and quality.

The National Oat Breeding Program recently completed an analysis on the seed weight of various hay oat varieties collected from their 2010 to 2012 trial data. A summary of these results is provided in Table 1 which shows the large variability in seed weight between varieties. Mulgara has the largest seed size with its 1000 seed weight 8, 12 and 23 % heavier than Wintaroo, Carrolup and Tungoo, respectively. Table 1 also identifies the seeding rate in kilograms per hectare for varieties to achieve 250, 300 and 350 plants per square metre assuming 100% germination.



Kerry-Lee McMurray controlling weeds at the Arthurton trial site

Table 1. Average seed weight of hay oat varieties and their corresponding sowing rates to achieve 250, 300 and 350 plants per square metre. Data from the National Oat Breeding Program.

	2010-12	2010-12	250plts/sqm kg/ha	300plts/sqm kg/ha	350plts/sqm kg/ha
	1000GRWT(g) OVERALL	NO. TRIALS OVERALL			
BRUSHER	35.96	24	90	108	126
CARROLUP	33.81	23	84	101	118
FORESTER	32.78	15	81	98	115
KANGAROO	32.04	26	80	96	112
MULGARA	38.53	25	97	116	135
RIEL	23.63	15	59	71	83
SWAN	38.59	19	97	116	135
TAMMAR	29.87	27	75	90	105
TUNGOO	29.58	25	74	89	104
WAOAT2332	30.90	23	78	93	108
WINJARDIE	31.59	23	79	95	111
WINTAROO	35.45	24	88	106	124
YALLARA	36.89	15	93	111	129

The most desirable sowing rate for a hay crop also depends significantly on the rainfall and soil fertility into which the crop is sown. Agrilink Agricultural Consultants in South Australia have created the following guide in Table 2 to recommend plants per square metre by winter and spring rainfall dominant regions and soil fertility.

Table 2. Target plants per square metre by rainfall (winter and spring dominant regions) and soil fertility.

RAINFALL	SOIL NITROGEN FERTILITY		
	HIGH	MEDIUM	LOW
<350mm	120-160	150-180	150-200
350-425mm	160-200	180-220	200-240
425-500mm	200-220	220-250	240-280
> 500mm	210-230	250-280	250-300

Source: Agrilink Agricultural Consultants

AEXCO would encourage you to measure the seeding rate you planted in 2013 to improve your chances of growing hay crops with higher hay yield and quality. This can be done by counting the number of plants in a square metre area in your 2013 crops. Assessing the weight of 100 or 200 seeds of the varieties planted in future years is an easier way to ensure you are sowing the optimum seeding rate.

For more information please refer to the Rural Industries Research and Development Corporations (RIRDC) Publication – ‘Producing Quality Oat Hay’ which is available for free on line <http://www.rirdc.gov.au/search-results?searchCriteria=producing+quality+oat+hay> .

3. New varieties

Commercial seed production was undertaken in 2012 for three hay varieties – Tammar, Tungoo & Forester. Tammar (SV96098-24) and Forester (SV97200-3) were released in 2011 and Tungoo was released in 2010. Tammar is later than Tungoo by about four to seven days with excellent disease resistance and colour. Forester is the first very late line released from the program. It heads about seven to 10 days later than Glider, almost 16 days later than Tammar, and three weeks later than Wintaroo. It has much better early vigour than Glider and good foliar disease resistance. About 100 t of Tammar and 200 t of Forester seed was produced in 2012. Although Tungoo was released in 2010 there has been limited seed availability. Production for Tungoo was 250 t in 2012. Seed of Tungoo and Tammar is available from AEXCO and seed of Forester is available from AGF Seeds.

Wombat (SV87181-12) is the first dwarf milling variety with cereal cyst nematode (CCN) resistance and tolerance. It is also moderately tolerant to stem nematode. Seed will be available to growers for the 2014 growing season. Dunnart (SV98146-26) is a second potential milling variety released in 2012. It is about 10 to 15 cm taller than Possum, Wombat, and Mitika. Dunnart is also resistant and moderately tolerant to CCN and moderately tolerant to stem nematode with improved resistance to barley yellow dwarf virus. Due to limited seed production in 2012 and 2013, seed will be available to growers in 2014.

The commercial partner for Yallara, Wombat, and Dunnart is Seednet. The commercial partner was Viterra, but is now Seednet due to the purchase of the Viterra Seeds Business by Agrium.

A new milling variety, Bannister, was released in Western Australia last year. It has high grain yield potential with improved disease resistance compared to other Western Australian oat varieties. Bannister is in the seed production phase with seed available for eastern Australia in 2014. Seednet is also the commercial partner for Bannister. A second potential milling variety, Williams was launched in WA recently. Heritage Seeds is the commercial partner for Williams. It is a mid tall, high yielding line adapted to Western Australia which flowers slightly earlier than Carrolup and about a week to 10 days earlier than Kojonup. Williams is moderately resistant to stem rust and resistant to leaf rust in WA. It also has improved septoria resistance compared to Carrolup and Wandering. Hectolitre weight is similar to Kojonup and slightly lower than Carrolup. Screenings are similar to Carrolup and groat percent slightly lower than Carrolup and Mitika.

More detailed information including yield, quality and disease resistance attributes for these lines is included in sections 5 and 6 in this newsletter.

4. Long term hay trial results

Tables 3 to 14 show the long term hay yield, hay quality, grain yield, and grain quality of varieties in the hay series. The dataset has now been combined to include both hay and late hay trials. Grain quality data is a simple mean for the three year period 2010-2012. Tables 10 and 11 show the disease reactions of current and new hay varieties in SA and Victoria and in WA. **Please note:** Stem and leaf rust reactions reported for all oat varieties will vary by region due to genetic variation in the pathogen population. A pathotype that overcomes most resistance genes for stem rust is now present in southern Australia. Hence it is important to monitor oat crops for early detection of rust, so fungicide applications can be applied to control the diseases.

For more detailed or specific information please contact the National Oat Breeding Program.

4.1 Hay Variety Summary

Forester[Ⓛ]

Forester is a very late hay variety adapted to high rainfall and irrigated cropping regions that was released in 2012. It is seven to 10 days later than Glider, three days later than Riel, two days later than Targa, and three weeks later than Wintaroo. Forester has excellent early vigour and is an improvement compared to Glider. It has excellent lodging and shattering resistance.

Forester has an excellent foliar disease resistance spectrum. It is moderately susceptible to CCN. It has good hay colour, but like all late hay varieties may not resist hot dry winds as well as earlier varieties. Forester has excellent hay quality and is an improvement compared to Glider, Tammar, Targa, and Vasse, but similar to Riel.

Seed of Forester is available from AGF Seeds, Smeaton, Victoria.

Tammar[Ⓛ]

Tammar is a medium tall late variety that was released in 2012 and commercialised by AEXCO. It is four to seven days later than Tungoo to cut.

Tammar also has an excellent disease resistance profile. It is moderately resistant to stem and leaf rust, septoria, BYDV, and bacterial blight. Tammar is the first late variety available with resistance to CCN and SN, tolerance to CCN, and moderate tolerance to SN.

Tammar has improved hay quality compared to Kangaroo. It has high crude protein and hay digestibility with lower WSC than Mulgara and Brusher, but higher than Kangaroo.

Mulgara[®]

Mulgara was released in 2009 and commercialised by AEXCO. It is a tall mid season variety with excellent early vigour and good straw strength. Hay yield is lower than Wintaroo, but hay quality is better than Wintaroo. Mulgara also retains good hay colour and resists brown leaf tipping. Grain yield is similar to Wintaroo, but Mulgara has slightly better grain quality with the exception of high hull lignin. The seed size of Mulgara is larger than other hay varieties and similar to Swan. Care should be taken to sow this variety at the correct seed density taking into account its seed weight.

Mulgara has excellent disease resistance. It is resistant and tolerant to CCN and SN. Compared to Wintaroo, Mulgara has improved leaf rust, bacterial blight, and red leather leaf resistance.

Tungoo[®]

Tungoo was released in 2010. However, seed was not available until 2012, due to problems with commercial seed bulk-up. It is a medium tall mid to late season variety and seed is available through AEXCO.

Tungoo has an excellent disease resistance profile. It combines resistance and moderate tolerance to CCN and SN. It also is resistant to leaf rust and the only variety with red leather leaf resistance. Tungoo is moderately resistant to BYDV, septoria, and bacterial blight and moderately susceptible to stem rust. It has the best combination of disease resistance compared to all other varieties except Tammar.

Hay yield is slightly lower than Kangaroo, but Tungoo's hay quality is an improvement compared to Kangaroo. Tungoo has grain quality similar to Kangaroo, but the grain size is smaller resulting in higher screenings. Tungoo has low hull lignin which improves feed grain quality.

Yallara[®]

Yallara is a medium tall early to midseason variety similar to Euro for flowering and maturity. Yallara, released in 2009, is a milling line with slightly better grain quality than Euro but not as susceptible to stem rust. It has bright, plump grain suitable for the milling industry and specialised feed end-uses. Seednet is the commercial partner.

Yallara is a Euro look alike with improved leaf rust resistance. It is resistant but intolerant to CCN. It is moderately susceptible to BYDV, bacterial blight, and septoria. Yallara is susceptible and intolerant to stem nematode and susceptible to red leather leaf.

Yallara has excellent grain quality. It has high hectolitre weight, low screenings, and high groat percent. The grain is plump and bright and could suit niche markets like the horse racing industry in addition to human consumption. Yallara was evaluated for hay production and although the hay yield is lower than popular hay varieties it has excellent hay quality.

Table 3. Average hay yield (t/ha) for twenty oat varieties in three states during the period 2005 to 2012. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	South Australia	Victoria	Western Australia	All States
Early – Mid Season Varieties				
Bannister	9.5	9.2	8.4	9.2
Brusher	9.7	9.4	9.2	9.5
Carrolup	9.4	9.3	8.2	9.1
Mulgara	9.8	9.3	9.1	9.5
Swan	10.0	9.3	9.0	9.5
Wallaroo	9.6	9.3	8.3	9.2
Wandering	9.7	9.3	8.3	9.3
Williams	9.5	9.2	8.5	9.2
Winjardie	9.5	9.3	8.6	9.2
Wintaroo	10.2	9.4	9.8	9.9
Yallara	9.9	9.3	8.4	9.3
Mid-Late to Very Late Varieties				
Eurabbie	9.1	9.2	8.6	9.0
Forester	9.3	9.1	8.2	9.0
Glider	9.3	9.1	7.9	8.9
Kangaroo	9.9	9.2	9.0	9.5
Riel	9.2	9.0	7.3	8.6
Tammar	9.8	9.2	8.7	9.3
Targa	9.2	9.1	6.5	8.5
Tungoo	9.7	9.2	8.7	9.3
Vasse	10.4	9.2	9.2	9.8
<i>No. sites</i>	37	18	20	75

Table 4. Average grain yield (t/ha) from hay trials for twenty oat varieties in three states during the period 2005 to 2012. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	South Australia	Victoria	Western Australia	All States
Early – Mid Season Varieties				
Bannister	3.1	4.1	3.1	3.3
Brusher	2.4	3.1	2.3	2.5
Carrolup	2.6	3.4	2.7	2.7
Mulgara	2.5	3.2	2.6	2.6
Swan	2.1	2.9	2.1	2.3
Wallaroo	2.3	3.0	2.4	2.5
Wandering	3.1	3.9	3.1	3.2
Williams	3.0	4.0	3.0	3.1
Winjardie	2.5	3.3	2.7	2.7
Wintaroo	2.5	3.3	2.6	2.6
Yallara	2.7	3.5	2.8	2.8
Mid-Late to Very Late Varieties				
Eurabbie	2.7	4.0	2.7	2.9
Forester	1.6	2.7	1.8	1.9
Glider	1.8	2.8	1.9	2.0
Kangaroo	2.3	3.3	2.3	2.5
Riel	1.6	2.7	1.8	1.8
Tammar	2.4	3.3	2.3	2.5
Targa	1.6	2.9	1.8	1.9
Tungoo	2.2	3.1	2.1	2.3
Vasse	2.3	3.7	2.4	2.6
<i>No. sites</i>	<i>51</i>	<i>16</i>	<i>29</i>	<i>96</i>

Table 5. Average hay yield (t/ha) for twenty oat varieties in eight years averaged for three states. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	2005	2006	2007	2008	2009	2010	2011	2012
Early – Mid Season Varieties								
Bannister	10.9	5.9	7.8	8.3	10.5	10.0	10.6	9.3
Brusher	11.3	6.1	7.7	8.7	11.0	10.6	11.3	9.3
Carrolup	10.6	6.1	7.7	8.4	10.4	10.3	10.3	9.0
Mulgara	11.4	5.9	7.9	8.7	11.0	10.4	11.0	9.4
Swan	11.5	6.0	8.0	8.6	11.0	10.6	11.1	9.7
Wallaroo	10.6	6.1	7.8	8.3	10.5	10.4	10.4	9.2
Wandering	10.7	6.2	7.9	8.3	10.5	10.7	10.5	9.4
Williams	11.1	5.9	7.7	8.4	10.5	10.0	10.6	9.2
Winjardie	11.0	6.0	7.7	8.5	10.7	10.2	10.7	9.1
Wintaroo	11.6	5.9	8.6	9.1	11.9	11.0	11.5	9.7
Yallara	10.6	6.0	8.2	8.2	10.7	10.5	10.7	9.7
Mid-Late to Very Late Varieties								
Eurabbie	11.0	5.5	8.0	8.7	10.7	9.1	10.2	8.6
Forester	11.3	5.5	7.8	8.4	10.3	9.3	10.0	8.9
Glider	10.9	5.8	7.5	8.1	9.9	9.6	10.0	9.0
Kangaroo	12.1	5.8	7.8	8.9	10.9	10.6	10.6	9.1
Riel	10.3	5.5	7.9	7.3	9.7	8.8	10.0	9.6
Tammar	11.3	5.7	8.2	8.6	10.9	10.2	10.5	9.4
Targa	9.6	6.1	7.6	7.2	9.1	9.7	9.4	9.4
Tungoo	11.4	5.7	8.1	8.6	10.8	10.1	10.5	9.2
Vasse	10.9	5.7	9.3	8.6	11.8	10.6	11.2	10.3
<i>No. sites</i>	<i>11</i>	<i>11</i>	<i>9</i>	<i>8</i>	<i>11</i>	<i>7</i>	<i>10</i>	<i>8</i>

Table 6. Average grain yield (t/ha) from hay trials for twenty oat varieties in eight years averaged over three states. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	2005	2006	2007	2008	2009	2010	2011	2012
Early – Mid Season Varieties								
Bannister	4.2	2.6	3.5	2.1	3.4	3.2	3.6	4.2
Brusher	3.0	1.8	2.7	1.9	2.4	3.0	2.6	3.2
Carrolup	3.4	2.1	2.9	2.0	2.8	2.8	3.0	3.6
Mulgara	3.1	2.0	2.9	1.9	2.6	2.9	2.7	3.5
Swan	2.9	1.7	2.5	1.7	2.1	2.6	2.3	2.9
Wallaroo	2.9	1.8	2.7	1.8	2.4	2.8	2.5	3.2
Wandering	3.9	2.5	3.6	2.2	3.4	3.5	3.4	4.2
Williams	4.1	2.5	3.3	2.0	3.3	3.1	3.5	4.0
Winjardie	3.3	2.1	3.0	2.0	2.7	2.8	2.9	3.6
Wintaroo	3.2	2.0	2.9	1.9	2.6	2.8	2.8	3.5
Yallara	3.5	2.2	3.2	1.9	2.9	3.1	2.9	3.8
Mid-Late to Very Late Varieties								
Eurabbie	4.1	2.3	3.1	1.8	2.9	2.9	3.3	3.7
Forester	2.6	1.5	1.9	1.4	1.5	1.8	2.0	2.4
Glider	2.8	1.6	2.0	1.5	1.7	1.9	2.2	2.6
Kangaroo	3.3	1.9	2.5	1.7	2.4	2.4	2.8	3.1
Riel	2.6	1.6	1.8	1.3	1.5	1.5	2.0	2.4
Tammar	3.3	1.9	2.6	1.7	2.4	2.8	2.7	3.2
Targa	2.9	1.6	1.8	1.3	1.5	1.6	2.2	2.3
Tungoo	3.1	1.7	2.4	1.7	2.2	2.7	2.5	2.9
Vasse	3.8	2.1	2.6	1.6	2.4	2.3	3.0	3.2
<i>No. sites</i>	<i>16</i>	<i>11</i>	<i>9</i>	<i>20</i>	<i>13</i>	<i>7</i>	<i>12</i>	<i>8</i>

Table 7. Average hay yield (t/ha) for twenty oat varieties by rainfall zone averaged over three states for the period 2005 to 2012. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	<375mm	375-500mm	>500mm
Early – Mid Season Varieties			
Bannister	6.4	8.8	11.6
Brusher	6.8	9.5	11.4
Carrolup	6.2	8.9	11.4
Mulgara	6.7	9.3	11.7
Swan	6.8	9.3	11.9
Wallaroo	6.3	9.0	11.5
Wandering	6.4	9.1	11.5
Williams	6.4	8.8	11.7
Winjardie	6.4	9.0	11.5
Wintaroo	7.2	9.9	11.7
Yallara	6.5	9.1	11.6
Mid-Late to Very Late Varieties (not suited to low rainfall areas)			
Eurabbie	6.3	8.6	11.6
Forester	6.2	8.3	12.1
Glider	6.1	8.2	11.9
Kangaroo	6.7	9.1	12.2
Riel	6.0	7.8	12.0
Tammar	6.6	8.9	12.0
Targa	5.6	7.8	11.7
Tungoo	6.6	8.8	12.0
Vasse	7.1	9.6	11.9
<i>No. sites</i>	<i>14</i>	<i>40</i>	<i>21</i>

Table 8. Average grain yield (t/ha) from hay trials for twenty oat varieties by rainfall zone averaged over three states during the period 2005 to 2012. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	<375mm	375-500mm	>500mm
Early – Mid Season Varieties			
Bannister	2.4	3.3	3.9
Brusher	1.7	2.7	2.8
Carrolup	2.0	2.8	3.1
Mulgara	1.9	2.8	2.9
Swan	1.6	2.4	2.6
Wallaroo	1.8	2.6	2.8
Wandering	2.3	3.4	3.8
Williams	2.3	3.2	3.8
Winjardie	2.0	2.8	3.1
Wintaroo	1.9	2.8	3.0
Yallara	2.0	3.0	3.3
Mid-Late to Very Late Varieties (not suited to low rainfall areas)			
Eurabbie	2.1	2.9	3.7
Forester	1.4	1.9	2.2
Glider	1.5	2.1	2.4
Kangaroo	1.8	2.5	2.9
Riel	1.4	1.9	2.2
Tammar	1.8	2.6	3.0
Targa	1.4	1.8	2.4
Tungoo	1.6	2.4	2.8
Vasse	1.9	2.5	3.3
<i>No. sites</i>	23	46	27

Table 9. Average hay quality for twenty oat varieties in three states during the period 2005 to 2012. Data courtesy National Oat Breeding Program. Analysis by Chris Lisle, SAGI.

Variety	Digestibility (%dm)	WSC* (%dm)	ADF* (%dm)	NDF* (%dm)	Crude Protein (%dm)
Early – Mid Season Varieties					
Bannister	65.1	24.7	29.7	49.8	8.8
Brusher	64.1	26.8	30.4	49.6	8.5
Carrolup	62.6	26.0	31.4	50.2	8.6
Mulgara	63.0	26.4	31.6	50.4	8.6
Swan	62.9	26.4	31.7	50.4	8.2
Wallaroo	62.8	25.3	31.9	50.8	8.4
Wandering	64.5	24.6	29.5	49.2	8.9
Williams	63.5	23.5	30.9	51.3	9.0
Winjardie	63.5	25.3	31.2	50.8	8.5
Wintaroo	62.7	24.7	32.1	51.1	8.4
Yallara	62.8	28.3	30.8	48.9	8.4
Mid-Late to Very Late Varieties					
Eurabbie	66.9	28.2	27.6	46.9	8.8
Forester	66.4	27.2	27.9	47.5	8.7
Glider	63.0	23.7	30.1	49.9	8.8
Kangaroo	61.7	22.6	33.2	53.5	8.6
Riel	64.8	28.7	28.2	47.5	8.6
Tammar	63.4	24.7	31.6	51.7	8.8
Targa	64.2	25.3	29.0	48.6	8.8
Tungoo	63.4	24.0	32.0	52.0	8.7
Vasse	64.7	25.4	30.9	50.6	8.5
<i>No. sites</i>	58	60	59	59	56

*WSC=water soluble carbohydrates, ADF=acid detergent fibre, NDF=neutral detergent fibre

Table 10. Disease reactions in SA and Victoria and comparative stem diameter for current and new hay variety releases.

DISEASE PROFILE

Variety	Stem rust ¹	Leaf rust ¹	BYDV ¹	Septoria ¹	Bacterial blight ¹	CCN R ¹	CCN T ²	Stem Nematode R ¹	Stem Nematode T ²	Red leather leaf ¹	Stem diameter ³
Bannister	MR-S	R	MS	NA	MR-S	VS	I	NA	MI	MS	M
Brusher	MS-S	MR-MS	MS	MS	MR-MS	R	MI	MS	I	MS	M
Forester	R-S	MR-MS	MR-S	MR	MS-S	MS	MI	S	I	R-MR	MT
Kangaroo	MS-S	MS	MR-S	MR-MS	MR-MS	R	MT	MS	MI	MS	MF
Mulgara	MS-S	MR	MS	MS	MR	R	MT	R	MT	MS	M
Tammar	MR-S	MR	MS	MR	MR	MR	MT	R	MT	R-MS	MF
Tungoo	MS-S	MR	MR-MS	MR	MR	R	MT	R	MT	R	M
Wallaroo	S	S	MS	S	S	R	MT	MS	MI	MS	F
Wandering	MR-S	VS	MR-MS	S-VS	MR-S	VS	I	VS	I	MS	M
Williams	MR-S	R	MR-MS	MS	R	S	I	NA	I	MS	MT
Wintaroo	S	MS	MR-MS	MR-MS	MR	R	MT	MR	MT	MS	M
Yallara	MR-S	R	MS	MS	MR-MS	R	I	S	I	MS	MF

¹ Disease reactions where R= resistant, MR=moderately resistant, MS=moderately susceptible, S= susceptible, VS=very susceptible

² T=tolerant, MT= moderately tolerant, MI=moderately intolerant, I=intolerant

³ F=fine, MF=moderately fine, MT=moderately thick, T=thick, VT=very thick

(Rust and BYDV reactions may vary in different regions and with different seasonal conditions depending on the prevalent pathotype/serotype. Monitoring your oat crop is therefore essential.)

Table 11. Disease reactions in WA.

DISEASE PROFILE

Variety	Stem rust ¹	Leaf rust ¹	BYDV ¹	Septoria ¹
Brusher	MR-S	R-MS	MR-MS	S-VS
Carrolup	MS	S	MS	S-VS
Forester	R	R-MS	MS	MS-S
Kangaroo	R-S	MS-S	MR-S	MS-S
Mulgara	MR-MS	MR	MS-S	MR-S
Tammar	R-MR	R-MR	MS-S	MS
Tungoo	MR-S	R-MS	MR-MS	MS-S
Wallaroo	MS-S	VS	MS	S-VS
Wandering	MR	VS	MS-S	S-VS
Williams	MR	R	MR-MS	MS
Winjardie	MR-S	S-VS	MS-S	S-VS
Wintaroo	MR	S-VS	MR-MS	MS-S
Yallara	MR-MS	R	MR-MS	MS-S

¹ Disease reactions where R= resistant, MR=moderately resistant, MS=moderately susceptible, S= susceptible, VS=very susceptible

² T=tolerant, MT= moderately tolerant, MI=moderately intolerant, I=inblerant

Note: Stem rust, leaf rust, BYDV & Septoria reactions are from WA trials. Bacterial blight, CCN & red leather leaf reactions are from SA trials

(Rust and BYDV reactions may vary in different regions and with different seasonal conditions depending on the prevalent pathotype/serotype. Monitoring your oat crop is therefore essential.)

Table 12. Average physical grain quality characteristics for twenty hay oat varieties (combined SA, Victoria and WA data), 2010 to 2012. Data are unanalysed means from hay trials courtesy National Oat Breeding Program.

Variety	Hectolitre weight kg/hl	No. trials	1000 grain weight g	No. trials	Screenings %<2 mm	No. trials
Early – Mid Season Varieties						
Bannister	48.4	16	33.0	16	11.1	16
Brusher	48.3	24	36.0	24	10.9	24
Carrolup	51.9	23	33.8	23	14.8	23
Mulgara	47.6	25	38.5	25	8.7	25
Swan	48.9	19	38.6	19	14.5	19
Wallaroo	46.2	23	35.9	23	15.7	23
Wandering	48.0	18	30.6	18	14.7	18
Williams	47.8	23	30.9	23	16.6	23
Winjardie	45.3	23	31.6	23	16.2	23
Wintaroo	47.7	24	35.4	24	12.4	24
Yallara	50.5	15	36.9	15	11.2	15
Mid-Late to Very Late Varieties						
Eurabbie	44.9	27	29.3	27	16.1	27
Forester	43.3	15	32.8	15	11.4	15
Glider	41.8	14	31.1	14	17.0	14
Kangaroo	46.6	26	32.0	26	15.1	26
Riel	47.2	15	23.6	15	43.8	15
Tammar	44.5	27	29.9	27	21.2	27
Targa	44.6	14	33.3	14	12.9	14
Tungoo	44.1	25	29.6	25	22.2	25
Vasse	42.5	26	31.4	26	16.9	26

Table 13. Average chemical grain quality (measured using NIR) characteristics for twenty hay oat varieties (combined SA, Victoria and WA data), 2010 to 2012. Data are unanalysed means from hay trials courtesy National Oat Breeding Program.

Variety	NIR Protein %	No. trials	NIR Oil %	No. trials	NIR Groat %	No. trials
Early – Mid Season Varieties						
Bannister	11.9	16	7.8	16	71.3	16
Brusher	12.5	24	6.7	24	72.3	24
Carrolup	12.8	23	6.4	23	73.5	23
Mulgara	13.7	25	7.0	25	74.2	25
Swan	11.8	19	6.6	19	71.1	19
Wallaroo	12.1	23	7.5	23	70.0	23
Wandering	12.1	18	6.9	18	70.1	18
Williams	11.9	23	7.5	23	69.4	23
Winjardie	10.8	23	5.6	23	70.8	23
Wintaroo	12.4	24	7.2	24	70.8	24
Yallara	11.5	15	5.3	15	75.3	15
Mid-Late to Very Late Varieties						
Eurabbie	12.0	27	5.8	27	68.2	27
Forester	13.1	15	6.1	15	67.2	15
Glider	14.1	14	5.5	14	68.0	14
Kangaroo	12.2	26	6.2	26	70.2	26
Riel	12.0	15	5.8	15	68.9	15
Tammar	13.1	27	6.5	27	69.7	27
Targa	13.4	14	6.4	14	66.3	14
Tungoo	12.6	25	6.5	25	70.3	25
Vasse	12.6	26	6.1	26	68.6	26

Table 14. NIR measured Minolta L, estimated metabolisable energy and hull lignin (2010-2012) characteristics for twenty hay oat varieties (combined SA, Victoria, WA and NSW data). Data are unanalysed means from hay trials courtesy National Oat Breeding Program.

Variety	Minolta L	No. trials	Estimated ME MJ/kg dm	No. trials	Hull lignin	No. trials
Early – Mid Season Varieties						
Bannister	61.3	16	12.0	16	9.6 (High)	16
Brusher	58.7	24	12.5	24	4.2 (Low)	24
Carrolup	60.9	23	11.8	23	10.8 (High)	23
Mulgara	62.0	25	12.1	25	9.5 (High)	25
Swan	58.8	19	12.5	19	4.4 (Low)	19
Wallaroo	57.8	23	12.5	23	4.4 (Low)	23
Wandering	62.8	18	11.8	18	10.3 (High)	18
Williams	61.8	23	11.6	23	11.7 (High)	23
Winjardie	59.5	23	12.5	23	3.4 (Low)	23
Wintaroo	59.1	24	12.6	24	4.4 (Low)	24
Yallara	64.2	15	11.7	15	11.3 (High)	15
Mid-Late to Very Late Varieties						
Eurabbie	59.0	27	12.2	27	4.1 (Low)	27
Forester	64.4	15	11.7	15	8.9 (High)	15
Glider	62.7	14	12.2	14	4.8 (Low)	14
Kangaroo	61.6	26	11.7	26	10.6 (High)	26
Riel	62.4	15	12.2	15	6.3 (Mod low)	15
Tammar	60.2	27	12.4	27	5.2 (Low)	27
Targa	63.2	14	12.0	14	8.7 (Mod High)	14
Tungoo	61.0	25	12.4	25	5.3 (Low)	25
Vasse	61.3	26	11.8	26	8.9 (Mod high)	26