Q – OAT VARIETIES AND AGRONOMY

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Bilby (SV06204-16) tested as 06204-16 is the newest milling oat variety, released in September 2019 by the National Oat Breeding Program led by SARDI. It is a dwarf variety with a high β-glucan content and quick to mid-quick development speed. Bilby has high grain yield potential in South Australia similar to Williams and Bannister with improved grain quality due to lower screenings, a higher groat percentage and greater protein content. Compared to other dwarf varieties Bilby has improved barley yellow dwarf virus resistance and is rated resistant to moderately resistant (R-MR) to red leather leaf. Bilby has been commercialised by Heritage Seeds.

Koorabup (SV05096-32) tested as 05096-32 is a mid-tall oaten hay variety developed for the Western Australian market that was released in 2019 by the National Oat Breeding Program. It is similar in height, grain yield and stem diameter to Yallara but with mid development speed and two to four days later than Yallara to hay cut from a late May sowing date. Compared to other hay varieties, Koorabup has lower hay yield but improved disease resistance rated moderately resistant to Septoria and Bacterial Blight. Koorabup has been commercialised by AEXCO.

Kingbale (GIAO-1701) is a single gene IMI tolerant oaten hay variety with mid-development speed and an improved tolerance to soil residual imidazolinone herbicides. It is an ideal variety for use where there are IMI residue concerns from previous crops. Preliminary data shows KingBale has a similar disease and agronomic profile to Wintaroo and indicates that it is resistant to CCN although, rust (likely susceptible) will require proactive management. The original breeding work was undertaken by Grains Innovation Australia (GIA) and the line will be commercialised by InterGrain. A Sentry® registration has been submitted to APVMA for pre-emergent use only, with earliest potential registration for use in oaten hay production in March 2021. It is important to note that delays may occur and Kingbale may not be released if Sentry® registration is not received. Sentry®, pending successful registration, will be the only imidazolinone herbicide registered for use on Kingbale.

For more information on these varieties and other oat varieties, please check the South Australian Crop Sowing Guide: (https://grdc.com.au/NVT-south-australian-crop-sowing-guide).

NATIONAL HAY AGRONOMY

BACKGROUND

The National Hay Agronomy trial is a four year project supported by AgriFutures, focusing on improving the quality of export hay in Australia. The core trial series located at Hart in SA, Muresk in WA, Birchip in Victoria and Yanco in NSW has a focus on developing updated guidelines for export oaten hay that optimise variety selection, seeding date and in-crop nutrition requirements. The 2020 trial is our second of three seasons at Hart. In these trials, we are investigating the influence and interaction between oaten hay variety, sowing date and nitrogen to provide best practice guidelines for growers to maximise both hay yield and hay quality.

Varieties:

Nine oat varieties: Durack, Brusher, Carrolup, Koorabup, Mulgara, Vasse, Williams, Wintaroo and Yallara. Vasse is a new addition in 2020, replacing Forester which was deemed too slow developing to be relevant for the medium rainfall areas targeted in these core trials.

Management treatments:

- Two times of sowing (TOS), early May and late May/early June.
- Three nitrogen (N) rates (30 kg N/ha, 60 kg N/ha or 90 kg N/ha) for all varieties.
- Yallara, Mulgara and Wintaroo have an additional three N treatments of 10 kg N/ha, 120 kg N/ha and 150 kg N/ha to further validate the N response curve.
- N treatments were split with 2/3 applied at seeding, and 1/3 applied six weeks after seeding when the plants were tillering. This split was according to current best practice for hay to achieve good early vigour, plant establishment and thin stems.
- Plots were sown at a target seeding density of 320 plants/m^2.
- Growth stage of varieties were monitored from heading, and hay cuts were taken for each plot at watery ripe (Zadoks 71). Hay was cut 15 cm height above the ground, before getting dried for two days at 60°C, and hay yield determined. Hay cuts were then ground to < 1mm, and hay quality determined by NIR.

KEY 2019 RESULTS

2019 Season

2019 was defined by spring drought, and increased frost damage in cereal crops. These seasonal conditions coupled with a strong domestic demand for fodder highlighted the benefit of oaten hay as a risk management strategy. Hart received 161 mm of growing season rainfall (GSR) from May to October and 188 mm annual rainfall, resulting in a decile one year and very low hay yields (site mean of 2.9 t/ha) for the season. Responses to applied nitrogen (N) were significant but small. The increase in N from 30 to 60 kg N/ha increased biomass yields when sown in early May (3.0 to 3.6 t/ha,least sig. difference (LSD) 0.4 t/ha), however there was no increased biomass as a result of increasing applied N above 30 kg N/ha when sown in early June. This result is unsurprising as both the availability of applied N, and the plants ability to uptake applied N would have been low in 2019, due to the reduced in-season rainfall, and shortened growing season.

Oat development differences

Due to the dry conditions experienced at Hart, many varieties flowered in the boot which made flowering date observations difficult. This is a problem in some varieties that is likely to influence hay quality. The spread in flowering date between oat varieties with the exception of Forester was about three weeks when sown early May or two weeks when sown early June. Durack was the earliest variety to flower, on average flowering a week before all other varieties. Forester is a very slow developing variety and did not flower at Hart with panicles emerging only in the outside rows from the early May sowing date at Hart. Forester plots sown in early May were cut at the end of October and the early June sown plots were cut at the end of November after observing a halt in biomass growth over the previous two weeks. Forester is unlikely to be a suitable variety for the low-medium rainfall environments of SA.

Yield and quality

In 2019, biomass and grain yields were maximised from early May sowing with differences observed between varieties (Table 1). Forester which struggled to flower did not yield any grain from either sowing date. To meet Grade 1 hay quality requirements, neutral detergent fibre (NDF) should be below 57% and water soluble carbohydrates (WSC) should be greater than 18%. All treatments at Hart achieved this in 2019. Neutral detergent fibre increased with delayed sowing but decreased with increased applied N. These differences were small and not replicated across the other core trial locations. It is generally observed that NDF will increase with earlier sown crops due to taller plants with thicker stems. There was a decrease in WSC with later sowing and as applied N increased (data not shown). Varieties responded differently to management with WSC of Carrolup stable across sowing date whilst all other varieties had lower WSC with the early June sowing date. Stem thickness was thin across all treatments but decreased with delayed sowing (4.0 vs 3.1 mm LSD 0.2 mm). There were differences between varieties with Forester, Carrolup and Koorabup having the thinnest stems and Wintaroo and Mulgara the thickest stems. Increasing applied N also increased stem thickness (data not shown).

Table 1. Hay and grain yield (t/ha) and key hay quality parameters for Hart in 2019.

	Hay yield (t/ha)		Grain yield (t/ha)		Neutral detergent fibre (%)		Water soluble carbohydrates (%)		Stem thickness (mm)
Sowing date	3 May	5 June	3 May	5 June	3 May	5 June	3 May	5 June	
Brusher	3.8 ab	2.4 ef	1.6 c	1.0 fg	42.7 bc	47.5 g	34.6 hi	23.8 b	3.5 cd
Carrolup	3.3 c	2.6 d	1.8 b	1.1 ef	42.3 bc	43.4 cd	32.1 gh	29.6 efg	3.2 e
Durack	3.7 b	2.4 e	1.8 b	1.3 d	45.5 ef	46.5 efg	30.8 fg	26.3 bcd	3.5 cd
Forester	1.9 g	1.1 h	0.0 i	0.0 i	38.7 a	43.1 bc	39.8 j	29.8 efg	3.3 e
Koorabup	3.6 b	2.4 ef	1.8 b	1.1 ef	45.6 efg	46.5 efg	30.1 efg	27.4 cde	3.4 de
Mulgara	3.9 a	2.6 d	1.9 ab	1.3 d	43.3 c	47.4 fg	34.5 hi	25.2 bc	3.8 ab
Williams	3.3 c	2.0 fg	1.8 b	0.8 h	45.1 de	46.1 efg	28.5 def	24.4 b	3.5 cd
Wintaroo	3.9 a	2.5 de	1.6 c	0.9 gh	45.2 de	50.0 h	31.0 fg	20.3 a	4.0 a
Yallara	3.8 ab	2.6 d	2.0 a	1.2 de	41.4 b	42.7 bc	35.6 i	31.2 fg	3.7 bc
LSD (p≤0.05)	0.4 (0.2 within same TOS)		0.21 (0.16 within same TOS)		1.9 (1.8 within same TOS)		2.8 (2.9 within same TOS)		0.2

Within a trait, varieties that have different letters indicate significant differences (p≤0.05)

Figure 1 shows how the hay quality of three varieties changes in response to the full range of N treatments. Both Wintaroo and Yallara had relatively stable NDF across N treatments with Wintaroo continuously higher than Yallara. Mulgara however had decreased NDF as the applied N increased suggesting it is more responsive to management than the other two varieties. Likewise for WSC, Yallara was higher than Wintaroo across all N application rates whilst Mulgara varied with N rate.

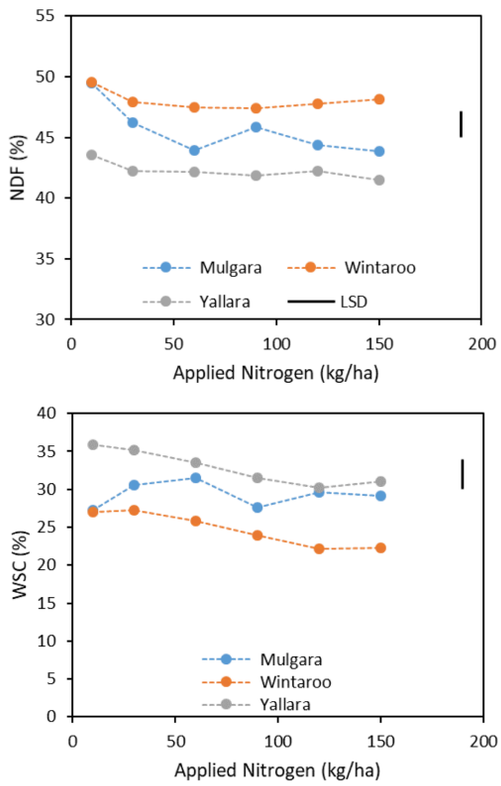

Figure 1. Neutral detergent fibre (NDF%) and water soluble carbohydrate (WSC%) of Mulgara, Wintaroo and Yallara in response to applied Nitrogen from 10 to 150 kg N/ha.

CONCLUSION

Although 2019 was only the first year of trials for the National Hay Agronomy project, we have been able to get some baseline data on the performance of oaten hay. Most oat varieties are of the fast to mid-fast development speed, and will flower from an early May sowing date within a two to three week period in September. Due to the low rainfall experienced in 2019, hay yields were very low at Hart but were maximised from earlier sowing. There were limited differences between varieties, with the exception of Forester which was too slow in its phenology to be suitable for export oaten hay in this environment. With a dry finish and low yields, hay quality across all treatments was good with thin stems, high water soluble carbohydrates (WSC) and low NDF%. There were some differences between varieties in their response to management which will be investigated further over the coming seasons.

2020 SEASON AT HART

Despite a promising start to the season, Hart experienced a disappointing winter with warm and dry conditions. Rainfall for June and July totaled 38 mm and as a result, the trial experienced both water and N stress presenting as red leaf tipping. The increased August rainfall has been a welcome relief with response to N treatments evident throughout both NDVI and visual assessment. With the timing of rainfall coinciding with late tillering to early stem elongation (TOS 2), the 2020 season is shaping up to provide greater yield potential.

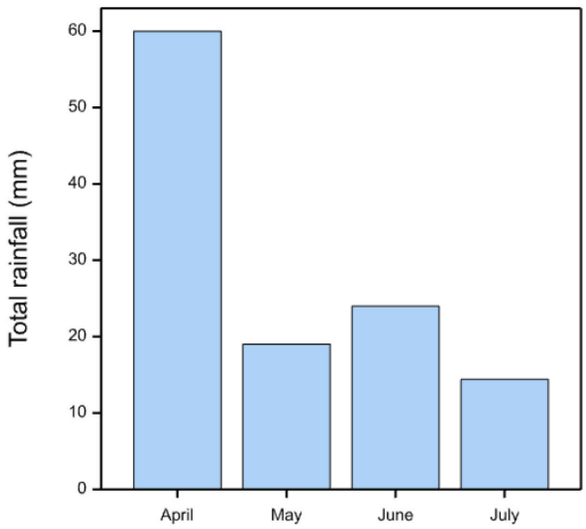

Figure 2. 2020 monthly rainfall at Hart (April to July).

ACKNOWLEDGEMENTS

The National Hay Agronomy trial is a four year project funded by AgriFutures (formerly known as RIRDC). The project is being led by Georgie Troup from the Department of Primary Industries and Regional Development (DPIRD), Western Australia and includes collaborators from SARDI and Hart Field-Site Group in SA, Agriculture Victoria and Birchip Cropping Group in Victoria and Department of Primary Industries NSW in NSW.

Oat variety (national hay program) trial plan

1	Buffer	Buffer	Buffer	
2	TOS2_Vasse_90N	TOS2_Durack_30N	TOS2_Wintaroo_30N	
3	TOS2_Vasse_60N	TOS2_Durack_90N	TOS2_Wintaroo_60N	
4	TOS2_Vasse_30N	TOS2_Durack_60N	TOS2_Wintaroo_90N	
5	TOS2_Yallara_30N	TOS2_Koorabup_90N	TOS2_Wintaroo_120N	
6	TOS2_Yallara_90N	TOS2_Koorabup_60N	TOS2_Wintaroo_150N	
7	TOS2_Yallara_60N	TOS2_Koorabup_30N	TOS2_Wintaroo_10N	
8	TOS2_Yallara_150N	TOS2_Mulgara_30N	TOS2_Williams_90N	
9	TOS2_Yallara_120N	TOS2_Mulgara_90N	TOS2_Williams_30N	
10	TOS2_Yallara_10N	TOS2_Mulgara_60N	TOS2_Williams_60N	
11	TOS2_Brusher_90N	TOS2_Mulgara_120N	TOS2_Carrolup_60N	
12	TOS2_Brusher_30N	TOS2_Mulgara_150N	TOS2_Carrolup_90N	
13	TOS2_Brusher_60N	TOS2_Mulgara_10N	TOS2_Carrolup_30N	
14	Buffer	Buffer	Buffer	Block 1
15	TOS1_Mulgara_120N	TOS1_Durack_60N	TOS1_Koorabup_90N	
16	TOS1_Mulgara_150N	TOS1_Durack_30N	TOS1_Koorabup_60N	
17	TOS1_Mulgara_10N	TOS1_Durack_90N	TOS1_Koorabup_30N	
18	TOS1_Mulgara_30N	TOS1_Brusher_60N	TOS1_Vasse_30N	
19	TOS1_Mulgara_90N	TOS1_Brusher_30N	TOS1_Vasse_60N	
20	TOS1_Mulgara_60N	TOS1_Brusher_90N	TOS1_Vasse_90N	
21	TOS1_Carrolup_60N	TOS1_Wintaroo_90N	TOS1_Yallara_60N	
22	TOS1_Carrolup_90N	TOS1_Wintaroo_30N	TOS1_Yallara_30N	
23	TOS1_Carrolup_30N	TOS1_Wintaroo_60N	TOS1_Yallara_90N	
24	TOS1_Williams_90N	TOS1_Wintaroo_10N	TOS1_Yallara_120N	
25	TOS1_Williams_60N	TOS1_Wintaroo_120N	TOS1_Yallara_150N	
26	TOS1_Williams_30N	TOS1_Wintaroo_150N	TOS1_Yallara_10N	
27	TOS1_Brusher_30N	TOS1_Yallara_90N	TOS1_Durack_30N	
28	TOS1_Brusher_60N	TOS1_Yallara_30N	TOS1_Durack_60N	
29	TOS1_Brusher_90N	TOS1_Yallara_60N	TOS1_Durack_90N	
30	TOS1_Wintaroo_60N	TOS1_Yallara_150N	TOS1_Mulgara_30N	
31	TOS1_Wintaroo_30N	TOS1_Yallara_10N	TOS1_Mulgara_90N	
32	TOS1_Wintaroo_90N	TOS1_Yallara_120N	TOS1_Mulgara_60N	
33	TOS1_Wintaroo_150N	TOS1_Carrolup_90N	TOS1_Mulgara_150N	
34	TOS1_Wintaroo_120N	TOS1_Carrolup_60N	TOS1_Mulgara_10N	
35	TOS1_Wintaroo_10N	TOS1_Carrolup_30N	TOS1_Mulgara_120N	
36	TOS1_Koorabup_30N	TOS1_Vasse_90N	TOS1_Williams_60N	
37	TOS1_Koorabup_60N	TOS1_Vasse_60N	TOS1_Williams_90N	
38	TOS1_Koorabup_90N	TOS1_Vasse_30N	TOS1_Williams_30N	
39	Buffer	Buffer	Buffer	Block 2
40	TOS2_Wintaroo_90N	TOS2_Carrolup_30N	TOS2_Durack_60N	
41	TOS2_Wintaroo_30N	TOS2_Carrolup_60N	TOS2_Durack_30N	
42	TOS2_Wintaroo_60N	TOS2_Carrolup_90N	TOS2_Durack_90N	
43	TOS2_Wintaroo_10N	TOS2_Yallara_90N	TOS2_Brusher_60N	
44	TOS2_Wintaroo_150N	TOS2_Yallara_30N	TOS2_Brusher_90N	
45	TOS2_Wintaroo_120N	TOS2_Yallara_60N	TOS2_Brusher_30N	
46	TOS2_Koorabup_30N	TOS2_Yallara_10N	TOS2_Mulgara_150N	
47	TOS2_Koorabup_60N	TOS2_Yallara_120N	TOS2_Mulgara_120N	
48	TOS2_Koorabup_90N	TOS2_Yallara_150N	TOS2_Mulgara_10N	
49	TOS2_Williams_30N	TOS2_Vasse_60N	TOS2_Mulgara_90N	
50	TOS2_Williams_90N	TOS2_Vasse_30N	TOS2_Mulgara_60N	
51	TOS2_Williams_60N	TOS2_Vasse_90N	TOS2_Mulgara_30N	
52	Buffer	Buffer	Buffer	
53	TOS1_Vasse_60N	TOS1_Williams_30N	TOS1_Wintaroo_150N	
54	TOS1_Vasse_90N	TOS1_Williams_90N	TOS1_Wintaroo_10N	
55	TOS1_Vasse_30N	TOS1_Williams_60N	TOS1_Wintaroo_120N	
56	TOS1_Yallara_120N	TOS1_Mulgara_10N	TOS1_Wintaroo_60N	
57	TOS1_Yallara_150N	TOS1_Mulgara_120N	TOS1_Wintaroo_30N	
58	TOS1_Yallara_10N	TOS1_Mulgara_150N	TOS1_Wintaroo_90N	
59	TOS1_Yallara_60N	TOS1_Mulgara_30N	TOS1_Brusher_30N	
60	TOS1_Yallara_30N	TOS1_Mulgara_90N	TOS1_Brusher_90N	
61	TOS1_Yallara_90N	TOS1_Mulgara_60N	TOS1_Brusher_60N	
62	TOS1_Durack_30N	TOS1_Koorabup_60N	TOS1_Carrolup_90N	
63	TOS1_Durack_60N	TOS1_Koorabup_30N	TOS1_Carrolup_60N	
64	TOS1_Durack_90N	TOS1_Koorabup_90N	TOS1_Carrolup_30N	
65	Buffer	Buffer	Buffer	Block 3
66	TOS2_Carrolup_90N	TOS2_Williams_90N	TOS2_Yallara_90N	
67	TOS2_Carrolup_30N	TOS2_Williams_60N	TOS2_Yallara_30N	
68	TOS2_Carrolup_60N	TOS2_Williams_30N	TOS2_Yallara_60N	
69	TOS2_Durack_60N	TOS2_Brusher_90N	TOS2_Yallara_10N	
70	TOS2_Durack_90N	TOS2_Brusher_60N	TOS2_Yallara_120N	
71	TOS2_Durack_30N	TOS2_Brusher_30N	TOS2_Yallara_150N	
72	TOS2_Mulgara_10N	TOS2_Wintaroo_10N	TOS2_Koorabup_60N	
73	TOS2_Mulgara_150N	TOS2_Wintaroo_150N	TOS2_Koorabup_30N	
74	TOS2_Mulgara_120N	TOS2_Wintaroo_120N	TOS2_Koorabup_90N	
75	TOS2_Mulgara_90N	TOS2_Wintaroo_30N	TOS2_Vasse_60N	
76	TOS2_Mulgara_30N	TOS2_Wintaroo_60N	TOS2_Vasse_90N	
77	TOS2_Mulgara_60N	TOS2_Wintaroo_90N	TOS2_Vasse_30N	
78	Buffer	Buffer	Buffer	

N →

Seeding date: TOS 1 - May 6, 2020 TOS 2 - May 25

Fertiliser: DAP + Impact

Fertiliser rate: 60 kg/ha