06

FarmLink Research Report 2015

Optimising management of early sown EGA Wedgetail for either dual-purpose and grain-only production

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Project Partners

FarmLink, CSIRO

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GRDC Grains Research & Development Corporation

Trial Site Location

Hart Bros Seeds 2014 & TAIC 2015

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Introduction

Experiments in southern NSW have repeatedly shown the yield and WUE benefits from sowing early with slow developing cultivars. This practice is highly suited to SNSW where rainfall is evenly distributed throughout the year and early sowing opportunities are more frequent than they are in other locations in the Australian wheat belt with winter dominant rainfall. There is also a history of early sowing in the region, particularly of dual purpose crops, and Australia's only milling quality winter wheat breeding program was located at Wagga Wagga and Temora. Winter wheat cultivars are much better suited to early sowing and dual purpose grazing because of their vernalisation requirement which keeps them in a vegetative phase for much longer than spring wheats. The obvious cultivar of choice for early sowing in SNSW remains to the last cultivar released by the DPI NSW winter wheat breeding program in 2002 – EGA Wedgetail.

For much of its life EGA Wedgetail has been thought of as a dual purpose cultivar that 'needed' to be grazed so that excessive early growth did not hay-off the crop. However, its use as a grain only cultivar has been increasing. The area planted to EGA Wedgetail has increased in SNWS from just under 80,000 Ha in 2011 to over 120,000 Ha in 2014. The aim of this series of experiments was to determine if management of EGA Wedgetail should be different to that of spring wheats sown in May, and if grown for grain only or dual purpose use.

High plant density, N broadcast at sowing

High plant density, N top dressed at Z30

Low plant density, N broadcast at sowing

Low plant density, N top-dressed at Z30

Methods

Two identical experiments were established in successive years at Junee Reefs (2014) and Temora (2015). The experiments were partially factorial split-plot designs with three different management factors designed to reduce the amount of pre-anthesis vegetative growth and improve harvest index;

1. Time of sowing x cultivar combination

   a. Winter wheat - EGA Wedgetail sown early-mid April

   b. Spring wheat - EGA Gregory and Suntop sown early-mid May

2. Nitrogen fertiliser timing

   a. Broadcast at sowing

   b. Top-dressed at Zadoks stage 30 (Z30 – start of stem elongation)

3. Target plant density (EGA Wedgetail only)

   a. 50 plants/m^2 (~25 kg/ha seed)

   b. 100 plants/m^2 (~50 kg/ha seed)

4. Defoliation at Z30 (EGA Wedgetail only, to simulate grazing with livestock)

   a. Defoliated

   b. Undefoliated

Timing of operations in both experiments were slightly different in both years (Table 1). Gravimetric soil cores taken to 1.6 m were used to determine plant available water and mineral N prior to sowing. All plots were direct drilled into standing previous crop residues using a six row plot seeder with spear points and press wheels on 305 mm row spacing.

Dry matter cuts were taken in plots to be defoliated before and after defoliation to determine how much dry matter was removed (forage yield). Dry matter cuts (0.5 x 1.2 m) were taken from each plot at crop maturity to determine total dry matter production, stem frost damage and harvest index. Grain yield was estimated by mechanically harvesting only the middle four rows of each plot, and all grain yields are reported at 12.5% moisture. Grain quality measurements were made on header harvest grain.

Previous crop	Junee Reefs 2014 Field peas	Temora 2015 Lupins
Summer fallow rain (Nov-Mar)	132 mm	169 mm
Growing season rain (Apr-Oct)	252 mm	276 mm
Soil mineral N to 1.6 m(kg/ha)	86 kg/ha	208 kg/ha N
Sowing date	8 April, 21 May	20 April, 7 May
Defoliation date (t/ha remaining)	2 July (0.9 t/ha)	30 July (0.9 t/ha)
Top-dressing date (N rate)	8 July (100 kg/ha N as urea)	30 July (46 kg/ha N as urea)

Table 1. Paddock history and management details of the 2014 and 2015 experiments

Methods

2013

The season broke in late March and both the Wedgetail and spring wheat treatments were sown into seed bed moisture and established at target densities (Table 2). Temperatures in the first half of May were well above average, and EGA Wedgetail growth and development was extremely rapid. The warm conditions also allowed a large infestation of aphids that persisted beyond the control period provided by imidacloprid seed dressing, and despite application of foliar insecticide in late May the Wedgetail treatment was severely infected with barley yellow dwarf virus (BYDV). The spring wheats were sown late enough to escape both the warm weather and the aphid shower.

EGA Wedgetail reached Z30 on 2 July, about 3-4 weeks earlier than expected. Higher plant densities and N at seeding increased forage yield by an average of 0.4 t/ha and 0.8 t/ha respectively.

From mid-July through to mid-September there were 18 days during which minimum temperature fell below -2°C. The worst of these were during mid-July and early August which was during EGA Wedgetail stem elongation, but the spring wheats were still vegetative. This resulted in significant stem frost damage in the EGA Wedgetail, but not in the spring wheats. There was significantly less frost damage in the EGA Wedgetail treatments that were top-dressed (mean 26%) compared to those that had N at sowing (mean 32%), and top dressed treatments also yielded more (Table 4). The highest yielding treatments of EGA Wedgetail could not match the yields of the spring wheats due to stem frost damage and BYDV.

		Actual plant density (plants/m^2)	
Cultivar	Target plant density (plants/m^2)	2014	2015
EGA Wedgetail	50	51	48
EGA Wedgetail	100	92	74
EGA Gregory	100	95	58
Suntop	100	98	64

Table 2. Target and actual plant densities achieved in 2013 and 2014

		Forage yield (t/ha)	
Target plant density (plants/m^2)	N timing	2014	2015
50	Broadcast at sowing	1.7	0.9
50	Top-dressed Z30	0.9	0.8
100	Broadcast at sowing	2.1	1.4
100	Top-dressed Z30	1.3	1.4
	P-value	<0.001	0.004
	LSD (p=0.005)	0.3	0.3

Table 3. Forage yield (dry matter removed during defoliation) for EGA Wedgetail at different plant densities and N timings

Grain yield (t/ha) and stem frost damage (% stems)		EGA Wedgetail sown 7 April		EGA Gregory sown 21 May		Suntop sown 21 May	
Target plant density (plants/m^2)	Defoliation @ Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30
50	Defoliated	2.0 (27%)	2.3 (24%)	-	-	-	-
50	Undefoliated	1.6 (29%)	2.3 (24%)	-	-	-	-
100	Defoliated	1.9 (34%)	2.6 (27%)	-	-	-	-
100	Undefoliated	1.7 (34%)	2.5 (29%)	3.0 (1%)	2.9 (0%)	2.9 (2%)	3.1 (6%)
P-value (yield)		<0.001					
LSD (yield)		0.2					
P-value (frost)		<0.001					
LSD (frost)		9					

Table 4. Grain yield and frost damage of experimental treatments in 2014.

2015

The season broke on 7 April but sowing of EGA Wedgetail was delayed until 20 April. The seed bed in this year was compacted from grazing and came up cloddy which resulted in poor depth control and seed-soil contact. As a result, actual plant populations were well below target in all the 100 plants/m^2 treatments (Table 2). EGA Wedgetail reached Z30 on 30 July. Forage yield in the higher plant population was 0.5 t/ha more than the lower (Table 3) and there was no effect of N timing, probably due to the higher soil mineral N at the site (Table 1).

There was an interaction between N timing and plant density on grain yield, however effect sizes were small. At low plant density applying N at sowing decreased yield, but increased yield at high plant density (Table 5). There was no effect of grazing or interaction with any of the other treatments. Yield of EGA Wedgetail was not significantly different to yield of either EGA Gregory or Suntop with the same N timings (Table 5).

Grain yield (t/ha)		EGA Wedgetail sown 20 April		EGA Gregory sown 7 May		Suntop sown 7 May	
Target plant density (plants/m^2)	Defoliation @ Z30	46 kg/ha N broadcast at sowing	46 kg/ha N top-dressed Z30	46 kg/ha N broadcast at sowing	46 kg/ha N top-dressed Z30	46 kg/ha N broadcast at sowing	46 kg/ha N top-dressed Z30
50	Defoliated	3.5	3.9	-	-	-	-
50	Undefoliated	3.6	3.8	-	-	-	-
100	Defoliated	4.0	3.7	-	-	-	-
100	Undefoliated	4.0	3.7	3.8	3.8	4.2	3.8
P-value		0.041					
LSD (p=0.05)		0.3					

Table 5. Grain yield of experimental treatments in 2015.

Conclusion

Despite being 14 years old, EGA Wedgetail can successfully be grown for grain only or dual purpose use and achieve yields competitive with recently released main season cultivars sown in May. Growers wishing to graze EGA Wedgetail should use high plant densities (at least 100 plants/m^2 on 305 mm row spacing, higher on narrower spacing) and some N fertiliser at sowing (particularly if soil mineral N is low) to maximise forage yield. Growers who wish to grow EGA Wedgetail for grain only should defer N fertiliser application until after Z30 to reduce early vegetative growth. Neither of these experiments or any others during the early sowing project have found a yield benefit from reducing plant populations, and target plant density should be kept at 100-150 plants/m^2 (less on wide rows, more on narrow rows) in order to better compete with weeds.