

## Barley varieties and agronomy

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### Key Points

- Barley trials have been conducted at many of the CWFS regional sites over the last three years.
- Barley is a valuable rotation crop as it is not susceptible to many wheat foliar diseases (yellow spot, stripe rust, septoria), suffers less yield loss from root diseases, and competes well with weeds.
- Schooner and Gairdner are the preferred malting varieties in central NSW. Schooner generally achieves better quality in the lower rainfall parts of the cropping belt.
- Gairdner has proved to be the highest yielding malting variety, but is prone to high screenings under dry conditions, late sowing and excessive nitrogen or seeding rates.
- Gairdner has inherently low grain protein concentration, particularly at high yield levels, and inadequate nitrogen nutrition will result in grain too low in protein for acceptance into malting classifications.
- Baudin, from Western Australia, and Cowabbie from the Wagga breeding program, are potential alternatives to Gairdner, both having better grain size and lower screenings.
- Tilga and Tantaranga are high yielding feed lines with Tilga better suited to drier areas. Binalong and Mackay are two new feed lines particularly suited to the northern half of the State.

### Introduction

Barley variety and agronomy trials have been conducted at many of the CWFS regional sites over the last three years, as part of a GRDC-funded project. The findings from those trials form the basis for much of this article.

In recent years, both the malt and feed markets have given good returns. New varieties with higher yield potential are being released and the colour standards for malting have been eased. Barley can be valuable as a rotation crop with wheat particularly in no-till and stubble retention systems as it is not a host for most wheat foliar diseases. Its vigorous early growth allows it to compete well with weeds, needing lower herbicide rates and restricting weed seed set. It often needs fewer inputs than wheat.

### Markets for barley

Variety selection and crop management decisions need to be made with the likely market in mind. The NSW *malting barley* market consists of two classes:

1. Demand for unprocessed malting barley in Australia's grain export markets, principally China. The very price sensitive Chinese market continues to grow. Demand for Schooner in China remains strong, with increasing acceptance of both Gairdner and Sloop. This is the major market for NSW grain.
2. Demand by domestic maltsters to supply malt to domestic brewing customers. This market is relatively static. Schooner is the preferred variety in this market.

Schooner and Gairdner remain the preferred malting varieties for 2003 in central NSW. Grimmett is accepted in the

north and there are small markets for other varieties such as Franklin and Baudin which are usually filled by direct contract.

Domestic *feed barley* demand is likely to remain steady with high numbers of cattle on feed and the continued requirements of the dairy and intensive livestock industries.

### Variety performance

- ◆ *Gairdner* has performed particularly well across the central region, the long term data (Table 1) showing a yield advantage of about 8% over Schooner. It has excellent malting quality, and although a semi-dwarf variety it can grow quite tall. It is slower to flower than Schooner and so best suited to early and main season planting and to favourable conditions.
- ◆ Long term results indicate *Gairdner* will often fail to meet grain size specifications for malting quality, particularly in drier environments (Table 1). Retention values for *Gairdner* average 69% while screenings average 4.9%, compared to 78% and 2.8% for Schooner.
- ◆ *Gairdner* does have inherently 0.5-1.0% lower grain protein content than Schooner, and this can be magnified by its higher yield potential. Some eastern farmers failed to achieve malting quality due to excessively low grain protein content in 2001.
- ◆ *Tilga* and *Tantangara* remain as high yielding feed varieties. *Tilga* is best suited to the more western areas and *Tantangara* to the east.
- ◆ *Binalong* and *Mackay* have also performed well as feed varieties and are probably best suited to the northern part of the central region. *Binalong* is short, has very good standability, and is of medium-slow maturity. *Mackay* also has strong straw but is better suited to main and late planting times. Both have good powdery mildew resistance but scald susceptibility limits their use further south.
- ◆ *Baudin* is a malting quality variety from Western Australia. It is seen as a *Gairdner* alternative with better grain size, lower screenings, quicker maturity and shorter straw. It is very susceptible to leaf rust and powdery mildew and growers would need to organise a market outlet.
- ◆ *Cowabbie* is another possible *Gairdner* alternative, released as feed but with the possibility of upgrading to malt quality, aimed more at the southern part of the State. It also has better grain size than *Gairdner* and good straw strength. Flowering time falls between *Gairdner* and *Baudin* and it is less susceptible than *Baudin* to leaf rust, leaf scald and powdery mildew.
- ◆ *Tulla* is an acid soils-tolerant, semi-dwarf feed variety with good grain size, straw strength, and disease resistance and yields similar to *Tantangara* on non-acid soils.
- ◆ *VB9926* and *Cameo\*Arupo 31-04* will be released shortly by the Northern breeding program.
- ◆ The Victorian program is about to release *VB0105*, a Franklin-derived malting line we have tested widely in NSW agronomy trials as a potential Schooner replacement. South Australia is placing major emphasis on CCN resistance with the lines *WI3804* and *JVJ3586*, neither of which look to have a major place in NSW.

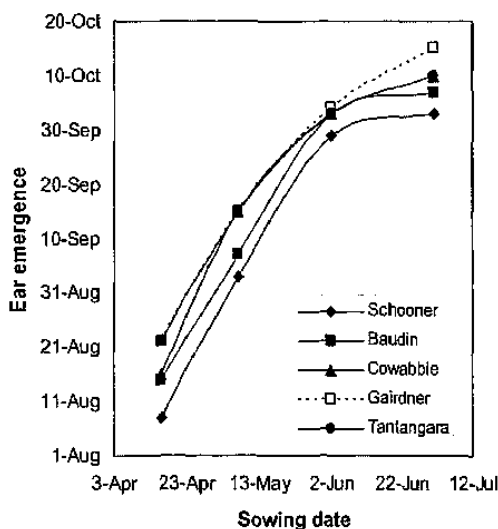
**Table 1. Across sites and years analysis for yield and screenings for main season trials (sown after 15 May). Yields are for 1997-2003 and expressed as a percentage of Schooner. Screenings and retention are % by weight and are from 1999-2003 trials.**

Variety	Yield as % Schooner (no. trials)	Retention (%>2.5 mm)	Screenings (%<2.2 mm)
Baudin	107 (6)	71	4,6
Binalong	110 (62)	-	-
Gairdner	108 (77)	69	4,9
Mackay	108 (39)	-	-
Schooner	100 (77)	78	2,8
Tantangara	106 (78)	68	4,5
Tilga	112 (78)	65	5,4
Tulla	107 (57)	68	4,5

**Phenology**

Flowering time is the most important factor in adapting a crop to an environment. Many barley varieties respond to day length as well as to temperature, and so their maturity rankings can change with latitude. Development pattern also has a strong

influence on grain number per ear in two row barleys. Figures 1 and 2 show ear emergence dates and time from sowing to ear emergence for five barley varieties sown on four dates in 2003.

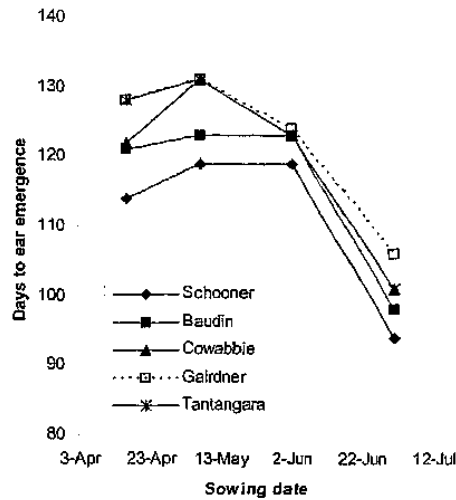


**Figure 1. Ear emergence dates for five barley varieties sown at four sowing dates, 2003**

Schooner was the quickest to flower at all sowing dates; Baudin was generally next quickest followed by Cowabbie and Tantangara while Gairdner was the slowest. The ideal ear emergence date

will vary with season, being a balance between achieving sufficient biomass (but not excessive water use) by flowering and the risk of frost. Based on the frost risk shown in Figure 3, an

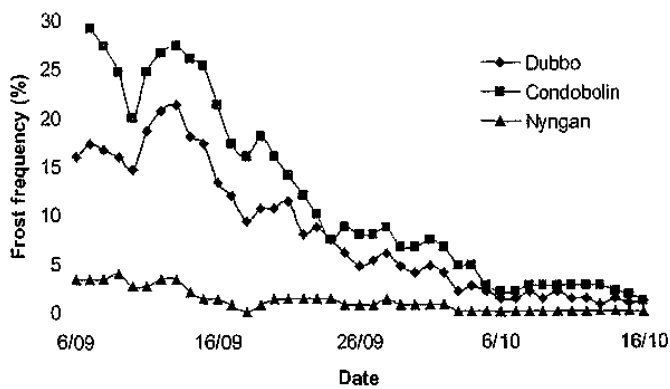
**Figure 2. Days from sowing to ear emergence for five barley varieties at four sowing dates**



an acceptable ear emergence period for Dubbo and Condobolin might be between the 20<sup>th</sup> and 28<sup>th</sup> of September. If so, Schooner should be sown in the last week of May or very early June whereas Gairdner should be sown at least two weeks earlier. If sowing is delayed until

the end of June, Schooner is able to dramatically reduce the time to ear emergence whereas Gairdner is not. Where the frost risk is lower (eg Nyngan), varieties such as Schooner can be sown quite early and this is confirmed by trial results and farmer experience.

**Figure 3. Frequency of frosts at three locations in central NSW**



**Nitrogen nutrition**

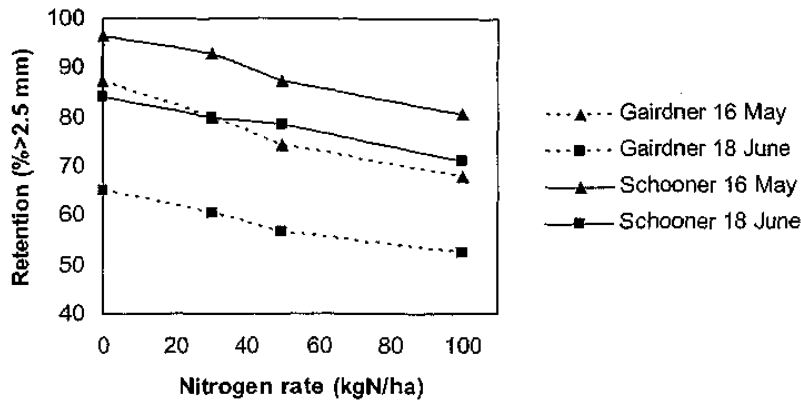
Protein content is a major determinant of malting quality. High protein concentrations reduce malt extract. In lower rainfall areas, keeping below the 12% upper limit can be difficult, as the nitrogen levels required to obtain maximum yield result in grain proteins of

about 11%. At low to moderate yield levels, only a small amount of additional nitrogen will rapidly increase grain protein and screenings. Figure 4 shows the effect of nitrogen fertiliser on grain plumpness for Schooner and Gairdner sown at two dates at Condobolin. There is a steady decrease for each variety at

each sowing time, and the slope of the lines is similar. However, retention was lower for Gairdner than Schooner at both

dates and lower for the June than the May sowing. The allowable limit for malting is 70%.

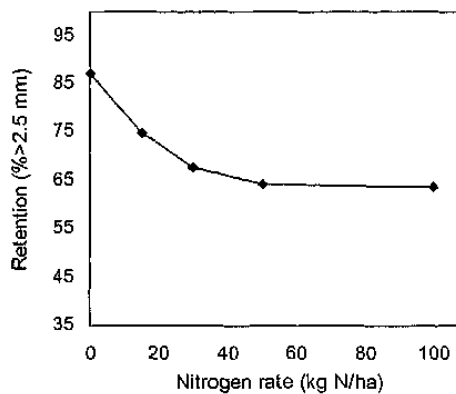
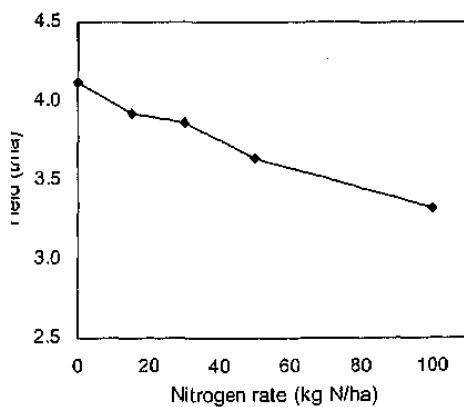
**Figure 4. Effect of fertiliser nitrogen on retention (plump grain) in Gairdner and Schooner at two sowing dates at Condobolin.**



Negative yield and grain quality responses were also seen in 2004, hardly surprising given the dry conditions. Results from our highest yielding site, Alectown, are shown in Figure 5. A deep nitrogen soil test at sowing showed that there was 130 kg of mineral nitrogen in the top 60 cm and this was sufficient for an average yield across varieties of 4.2

t/ha. Additional nitrogen fertiliser, as little as 15 kgN/ha, decreased yield and plump grain and increased screenings in all varieties. However, even at the highest nitrogen rate Schooner was above the 70% retention limit whereas any nitrogen pushed Gairdner below this level (data not presented).

**Figure 5. Effect of nitrogen fertiliser on yield and retention at Alectown, 2004. Values are the mean of four varieties.**



Low grain protein can also be a problem as most markets now require barley above 10%. Japanese malt markets have a preference for 11% protein. The

minimum for malting grade has therefore been increased to 9.5%. Due to both the inherently low grain protein content of Gairdner and the higher yielding

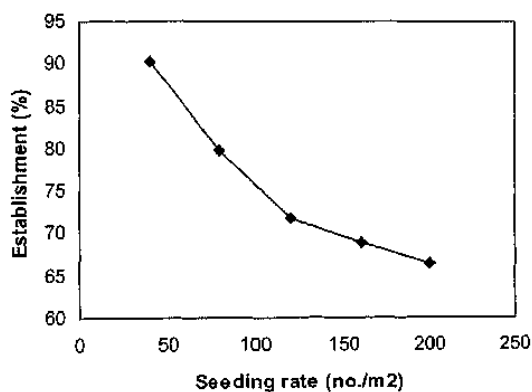
environments where Gairdner is being grown, appropriate N management for this variety is essential to avoid excessively low grain protein levels. Current advice, based largely on Schooner, is that if more than 100kg nitrate N per ha is present at sowing additional fertiliser N increases the risk of excessively high grain protein levels. However, higher levels of nitrate N may be acceptable, and preferable, for Gairdner production in the medium to high rainfall zone.

### Seeding rate

Higher seeding rates have been advocated in wheat as a way of reducing the number of higher order tillers and hence maintaining grain size and reducing

screenings. This can be dangerous in barley and particularly in Gairdner. In a series of trials across NSW, the yield and grain quality of existing varieties and lines close to release are being compared. Nominal seeding rates from 20 to 100 kg/ha are being used, equating to a range of 40 to 200 seeds/m<sup>2</sup>. In 2004, there was a wide variation in establishment percentage, reflecting difficult planting conditions, with site averages ranging from 50 to 95% of seed producing a plant. Establishment percentage also decreased with seeding rate at most sites, and the average decline is evident in Figure 6. Values declined from 90% at the lowest seeding rate to 65% at the highest.

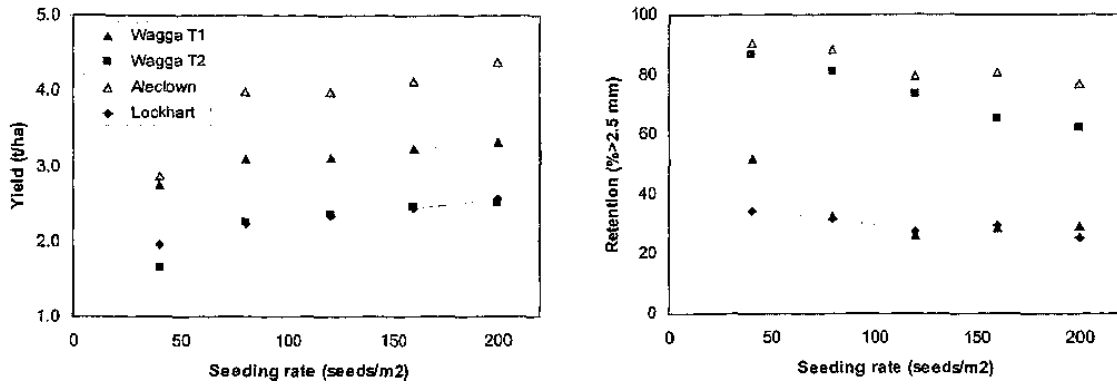
**Figure 6. The response of plant establishment (as a percentage of seeds sown) to seeding rate in 2004. Values are the mean of all varieties at 10 sites.**



Yield and grain plumpness data for four of the sites are shown in Figure 7. Yield responses were similar across the sites, even though average yields varied from 2 to 4 t/ha. In all cases there was a big response up to 80 seeds/m<sup>2</sup> and a small but continuing response to higher rate. This probably reflects the 2004 seasonal conditions at these sites, where stress around flowering was followed by milder conditions through grain-filling. At some

more severely stressed sites, yield decreased at the highest rates. Grain size, as indicated by retention, decreased at most sites as seeding rate was increased. At Alectown, this was largely due to Gairdner; Schooner and Cowabbie were much more stable in grain size. Based on results over a number of years, populations of 70-110 plants/m<sup>2</sup> are likely to be a good compromise for yield and grain quality for crops sown on time.

Figure 7. Effect of seeding rate on yield and retention (plump grain) at four sites in 2004. Values are the mean of four to six varieties at each site.



### Conclusions

Barley is an important crop in central NSW, giving good returns and acting as a "break" crop for wheat foliar diseases. Schooner is the malting variety best suited to lower rainfall areas and to later sowing because of its stability of grain

size. Gairdner is suited to higher rainfall areas and to earlier sowing where its higher yield potential can be expressed with less risk of high screenings. Excessive nitrogen and high seeding rates increase the risk of small grain and low retention values in barley.