Screening in Sorghum - can we avoid it?

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Take home message.

The major contributor to screenings in Sorghum is moisture stress from flowering to soft dough

The cause of screening in the 2007-08, was low starting moisture and very low rainfall after flowering

Planting sorghum on the Darling Downs on less than 120mm starting water significantly increases the risk of screenings and lodging

Planting early with lower populations slows the rate stored soil moisture usage through the vegetative period. Planting early also reduces the risk of heat damage.

Planting quicker varieties may maximize seed set, and yield, whilst increasing screenings.

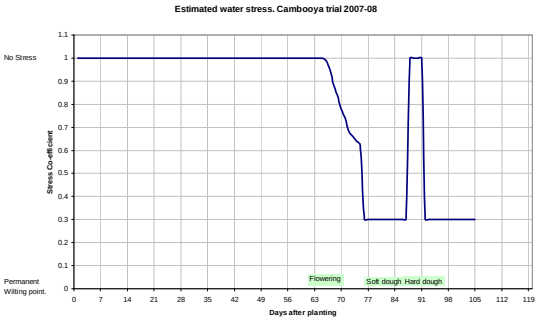
Wide rows can improve screening and lodging, but carries significant yield loss in most years on the Darling Downs. Wide rows reduce cover and fallow efficiency.

Causes of screening in grain sorghum

The cause of small grain in sorghum is usually associated with poor grain fill immediately after flowering has finished. This represents a relatively short period of time of around 10-15 days. On average the water requirement for this period could range from 75 to 150mm in un-stressed conditions and would account for around 25% of total water usage.

The major reason for screenings is moisture stress in this critical growth stage; other factors include disease such as charcoal rot, heat stress, chemical drift and insect damage. Moisture stress and heat stress can occur independently but often team up, charcoal rot infects plants under stress and is very difficult to determine weather it's the cause of screenings or a symptom of stress. The presence of charcoal rot exacerbates the degree of stress and increases screenings and lodging.

Chart 1. Pacific Seeds Trial at Cambooya, started on 100mm starting soil water; experienced high screenings; and lodging in long season varieties. Note heavy stress straight after flowering.

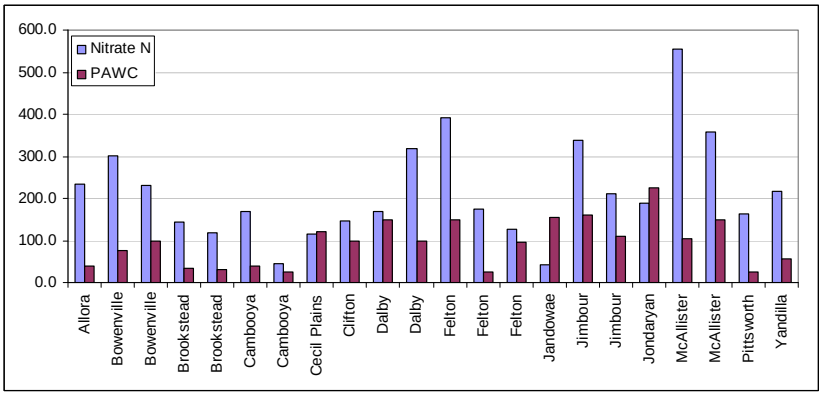


In the 2007 – 2008 season many Darling Down growers experienced lodging and screening problems, even though above average rainfall had occurred pre-flowering and the evapotranpiration demand was below average by up to 15%. Discussions with growers; indicates that the October and November plantings were worst affected.

In 2007 Pacific seeds began moisture testing some of its trial sites; the aim was to provide better information on hybrid performance to help evaluate management options based on starting soil water.
Information from these trials indicates that the major cause of screenings in 2007-2008 was moisture stress from flowering onward.
Four factors can be accredited for the moisture stress that some crops experienced;

- ***Low Starting Water***
- ***High starting nitrogen, promoted vegetative growth***
- ***Good early rainfall, promoted vegetative growth***
- ***Lack of effective rainfall in the grain fill period***

Chart 2; Starting Conditions 2007 on the Darling Downs; Low to moderate soil water And moderate to high Nitrogen.



Managing Sorghum to avoid Screening on the Darling Downs

Starting Soil Water;

The best management option to reduce screenings is to start on as much soil water as possible. Risk of screening will increase the lower the starting soil water content, soil water less than 120mm will greatly increase the risk of low yields and poor quality. The chance of receiving enough rainfall in the critical grainfill stage is low see table 1. Profiles need to be as close to full as possible at flowering for high yields to occur, if moisture stress begins at hard dough yield penalty is quite low.

Chart 3; Chance of exceeding target yield under 80mm,160mm and 240mm of starting water at Dalby

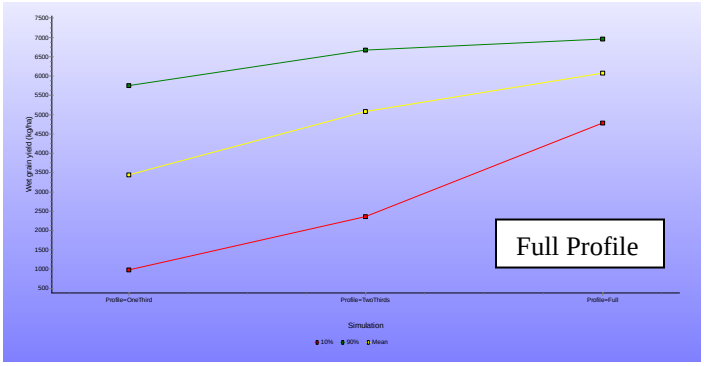


Chart 1; demonstrates the increasing risk to yield as starting soil water reduces. Profile one third(80mm) has a 10% chance of exceeding 5.6T/ha, a 50% chance of doing better than 3.4T/ha and a 10% chance of yielding less than 1T/ha. Note yield range is narrow when soil profile starts full

Planting Date;

- Plant to avoid heat at flowering and early grain fill
- Plant to time with best chance of rainfall at flowering

The table below indicates the optimum planting date for Dalby is mid September, planting early reduces water use in the vegetative phase which slows the depletion of soil water reserves. Conditions early often are ideal at head initiation 35 dap which sets up high yield potential.

However cool starts also promote high biomass as well as yield, if soil water is low variety choice will be a major consideration. Planting in September carries some risk from late frost, frosts later than October 30 could cause high yield loss.

The importance of starting soil water is highlighted here, the chance of matching crop demand at flowering onwards with rainfall are not high.

Table 1; Average conditions at flowering for Dalby by Planting Date

Planting Date	% chance of exceeding 50 mm from flowering + 20 days	% chance of exceeding 100 mm from flowering + 20 days	Average Max temperature; 2 weeks Pre & Post Flowering	No# Days >35°	No# Days >40°
15th September	51	14	30.8	2.8	0.2
15th October	48	12	31.8	5.8	0.3
15th November	42	15	32.1	6.8	0.4
15th December	37	11	31.4	4.6	0.2

Data source: Australian Bureau of Metrology, Wopper Cropper, How Often.

Chart 4; Water use pattern by planting date

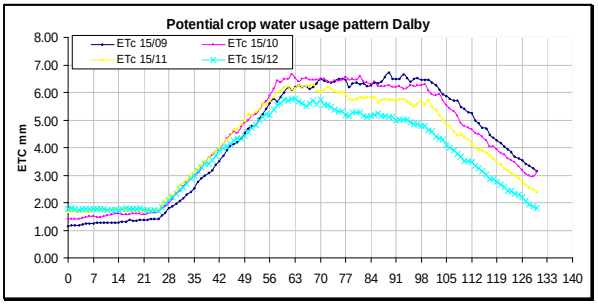
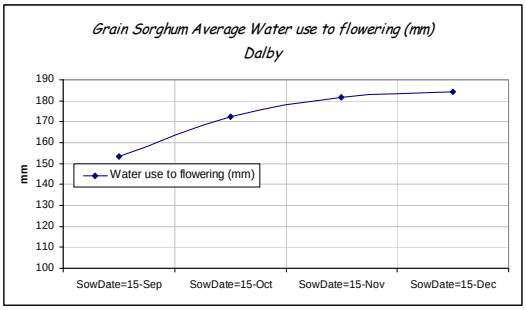


Chart 6; Average water use to flowering



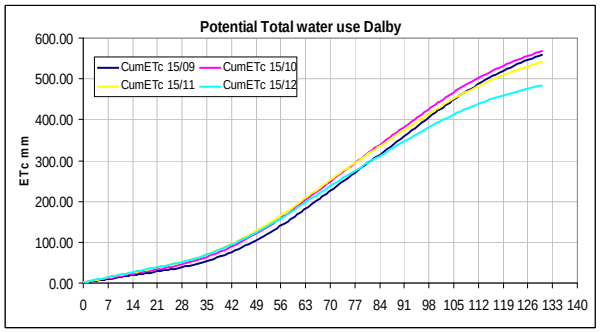


Chart 5; Cumulative potential water use

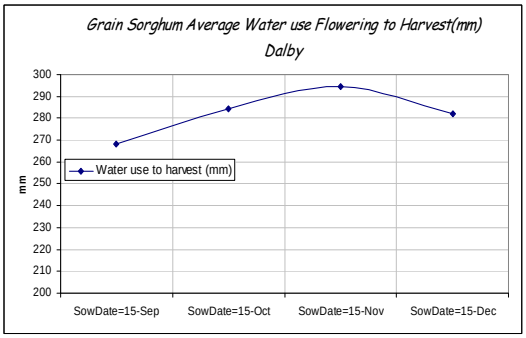


Chart 7; Average water use flowering to harvest

Charts 4-7 demonstrate the water use pattern, average water use and potential water use for the main planting months in the Dalby area.

Plant population, Row configuration, Maturity

The relationship between the agronomic management factors such as planting population, maturity type and row spacing and small seed size are complex. A great deal of the complexity is caused by the level of variability in the climate. The timing of moisture stress can have a large influence over the outcome in both yield and quality. Generally speaking moisture stress that occurs at booting through to flowering can reduce the total number of grains, depending on the severity of the stress and whether rainfall falls screening may not be a problem. If yield potential is high and good grain numbers have been set, severe moisture stress after flowering can cause high levels of screenings.

Lower plant populations grow slower conserving soil water, however they have higher tillering rates, tillers extend the period of flowering.

In terms of managing risk when soil water profiles are less than full mid quick varieties provide a good balance between yield and risk management, generally if moisture shortage begins in the booting phase onward the quicker the maturity the better the yield, however this can lead to an increase in the level of screenings and lodging.
Table 2, is a good example of the interaction of population and maturity on yield and quality; stress began at end of flowering for MR Buster and at the beginning of soft dough for MR 43. This represented about a 5 day difference in crop stage, quality of grain decreases as populations increase in both varieties. Yield increases in the mid quick maturity variety, MR 43 as population increases, it had time to set grain before moisture stress set in.
Wide rows were compared in this trial as an option for managing low soil water, 150 cm were compared to 75 cm rows, as you can see grain quality improves under wide rows. However yield is lower than the solid configuration, wide rows performed well in the MR Buster treatment, but wide row configuration has major farming system draw backs.

Table 2; Summary of population, row configuration by maturity length trial at Yandilla 2007-2008

VARIETY	CORR YLD.	Screenings	Test weight
MR Buster 40 000	5948	4.4	81.2
MR Buster 55 000	5879	6.6	82
MR Buster 60 000 @ 150 cm	5810	2.6	83.2
MR Buster 60 000	5614	7.7	78.2
MR Buster 80 000	5612	6.2	77

VARIETY	CORR YLD.	Screenings	Test weight
MR 43 80 000	6393	8.3	82.4

MR 43 40 000	6145	6.7	77.8
MR 43 60 000	6041	5.2	80.4
MR 43 60 000 @150 cm	5631	2.6	83.8

Chart 8; Yield vs Seed size high stress at Booting

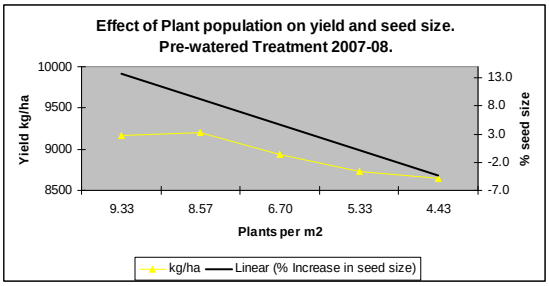
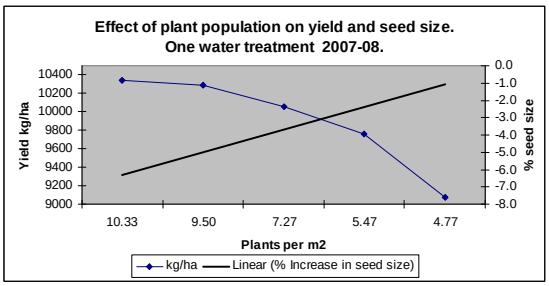


Chart 9; Yield vs Seed Size low stress at Booting



Note; different relationship between yield and seed size depending on timing and severity of stress

Chart 10; Single Skip vs Solid Pacific Seeds Trials.

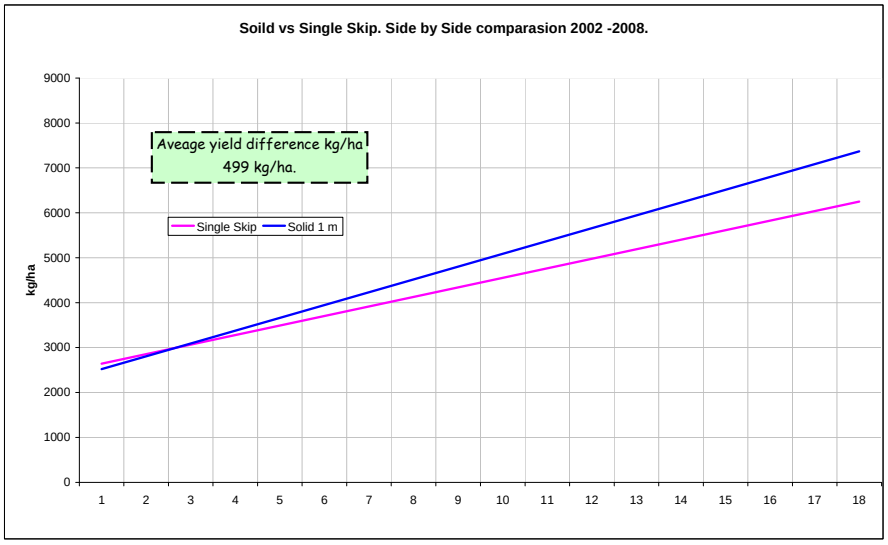
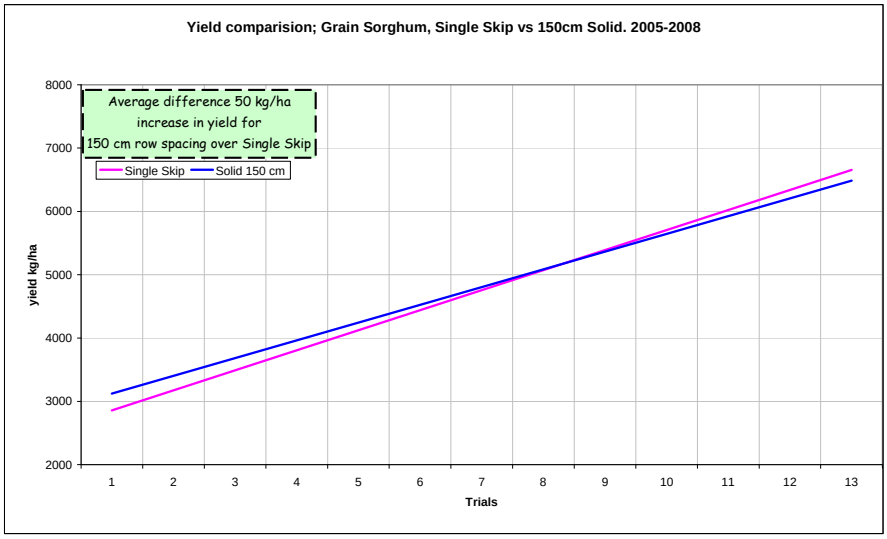


Chart 11; Single Skip vs 150 cm Solid Pacific Seeds Trials


Yield comparision; Grain Sorghum, Single Skip vs 150cm Solid. 2005-2008
Average difference 50 kg/ha
increase in yield for
150 cm row spacing over Single Skip
Single Skip
Solid 150 cm
yield kg/ha
8000
7000
6000
5000
4000
3000
2000
1
2
3
4
5
6
7
8
9
10
11
12
13
Trials