
Early sowing opportunities and managing frost risk

Focus Session Report

Summary and recommendations

A Focus Session entitled 'Early sowing opportunities and managing frost risk' was held on the second day of the Perth Grains Research Updates, 29th February - 1st March 2016.

The intent of the session was to address opportunities to sow early that can enable significant yield gains for growers but to illustrate that these opportunities have to be balanced by consideration of risks such as frost which a crop can encounter during the season and can result in devastating yield losses.

An interactive session was planned chaired by Michael Robertson, CSIRO, which incorporated a quiz to obtain audience engagement, a suite of speakers from CSIRO, Department of Agriculture and Food WA, ConsultAg and PlanFarm who addressed various aspects of early sowing, plant development and frost susceptibility and a discussion panel to further gain audience interaction.

As part of the session a new Frost Management Tips and tactics was launched by Peter Roberts and a new Frost Value tool was demonstrated. This is an interactive tool which can assist growers and advisers to fine tune their wheat and barley cultivar selection according to its susceptibility to frost at flowering. It is an output from the GRDC's multidisciplinary National Frost Initiative (NFI).

The audience number peaked at around 70 and included approximately 25 growers. There was lively discussion throughout the session.

It proved challenging to combine the messages of early sowing and frost mitigation in the timeframe of the Focus Session with a selection of speakers. In the future, effort will be maintained to ensure the integrity of each message.

The following recommendations arose from the Focus Session and the appropriate agency is noted in italics to progress each recommendation.

1. There is a need to obtain new genetic sources for vernalization and photoperiod response for Australian wheat and barley varieties. *GRDC to pursue within pre-breeding research agencies.*
2. Australian cereal breeding companies need to be encouraged to develop cultivars suitable for early sowing in WA cropping environments. Business cases need to be undertaken to justify investment and consider logistics in this area. *GRDC management to discuss with breeding companies.*
3. Growers and advisers require education in the understanding of yield components and the establishment of these components during the cereal growth cycle. This is

important to understand the plant physiological drivers for early sowing and agronomic aspects of frost management. *NFI management and DAFWA agronomy staff to undertake an extension effort.*

4. Changes in climate and particularly frost incidence need to be mapped for WA grain production regions to inform growers and advisors. *NFI management to address internally and possibly with AEGIC*
5. Decision support tools for growers and advisors that provide sowing time and risk information need to be updated with current varietal photoperiod, vernalization and basic development phase information eg. DAFWA's Flower Power. *GRDC to consider*
6. It was noted that additional NVT trial work needs to be carried out in the Albany/Kwinana East Port zone regions. *GRDC to follow up with NVT*
7. The FV Plus interactive tool requires more work and support information to clearly articulate how it is used to growers and advisors. *The NVT team will address this issue.*

The program was as follows:

Michael Robertson, CSIRO	<i>Introduction to the Focus Session</i>
Garren Knell, ConsultAg	<i>Setting the scene with a Quiz</i>
Peter Roberts, Chair GRDC Western Panel	<i>Launch of Frost Management Tips and Tactics</i>
Andrew Fletcher, CSIRO	<i>Flowering date in wheat</i>
Darshan Sharma, DAFWA	<i>How to structure the whole seeding program to maximise yield potential and returns</i>
Ben Biddulph, DAFWA	<i>Ranking cereal varieties for frost susceptibility using frost values</i>
Geoff Fosbery, ConsultAg	<i>Putting it all together</i>
<p><i>Discussion Panel</i> <i>chaired by Michael Robertson, CSIRO</i> <i>Featuring Garren Knell, ConsultAg and Richard Quinlan, Planfarm</i></p>	

Key messages delivered and discussion issues arising from the Focus Session

Initially there were about 46 attendees to the Focus Session and number of attendees peaked at around 70, of these there were around 25 growers according to a show of hands.

The session commenced with an introduction by Garren Knell from ConsultAg and an interactive quiz was run by Garren to gain some base level information from the audience and engage them in the Focus Session. The following series of graphs illustrate responses to the questions. Figure 1 illustrates that most attendees start seeding on April 15th, most of the attendees stop seeding by May 30th (Figure 2).

The biggest limitation to yield in for the attendees in WA cropping systems was considered to be moisture followed by heat (Figure 3). The most important factor for the attendees in selecting a variety was yield of cereal varieties followed by maturity (Figure 4).

The attendees surveyed manage frost by changing the flowering window of their crops, planting oats or a proportion don't bother (Figure 5). None of the attendees salvaged a frosted crop. Fifty percent of the attendees indicated that they require more information on flowering time *per se* of cereal crops.

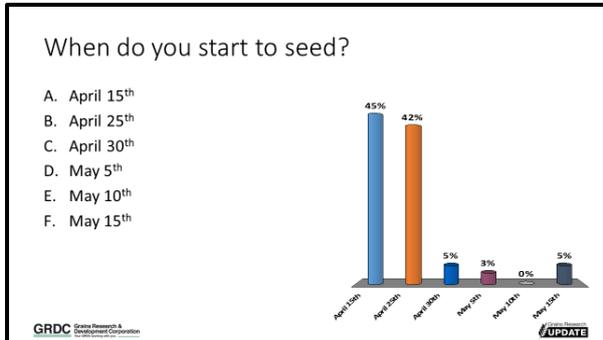


Figure 1: Attendees preferred starting seeding dates were predominantly April 15th & 25th for Western Australia

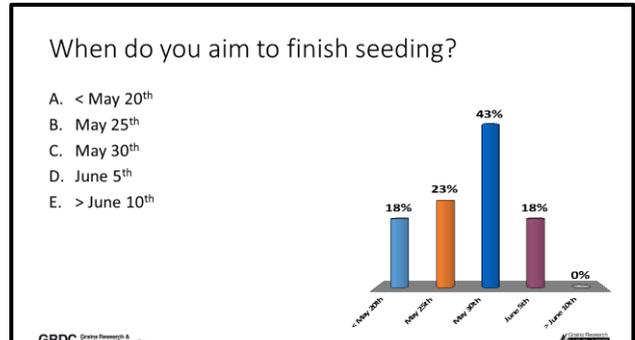


Figure 2: Most attendees finish seeding by 30th May but there is a spread from before May20th to June 5th

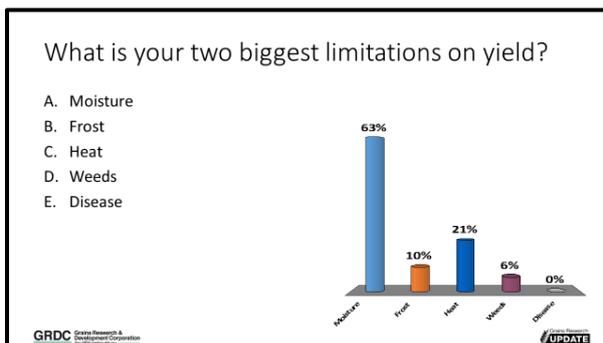


Figure 3: Moisture is the most important limitation to yield amongst the attendees cropping systems

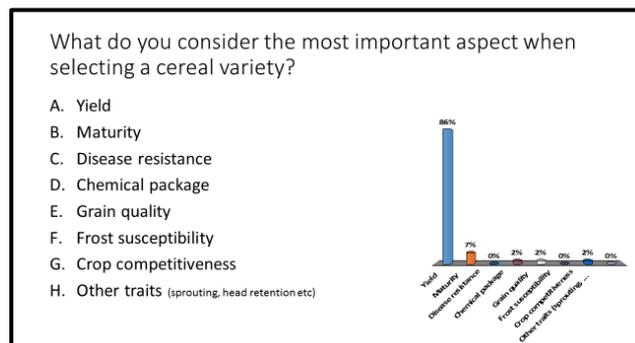


Figure 4: Attendees select cereal varieties for yield first

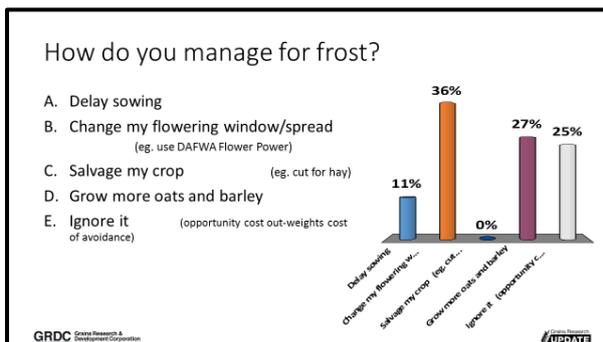


Figure 5: Attendees manage for frost primarily by changing the flowering window of their cereal crops

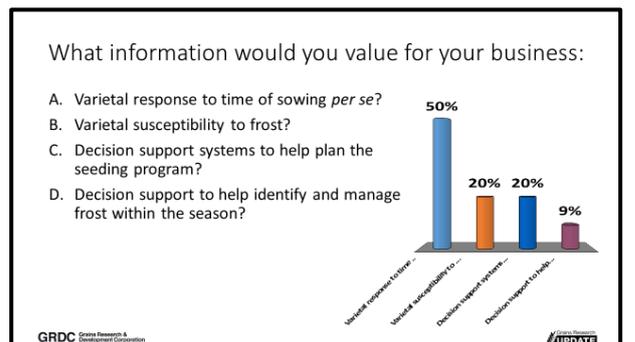


Figure 6: Varietal response to sowing date *per se* considered most important for attendees cropping systems

Garren discussed that the cost of frost to growers is twofold; in direct damage to a crop and in lost opportunities through conservative practices. Garren stated that the main management practice that growers use to mitigate the effects of frost is to change the

flowering window of their crops. He went on to question the audience as to whether growers and advisors have the correct data and tools to make the best decisions. He also pointed out that data being generated from the NVT trials is collected from crops which are not sown dry but usually sown following a rainfall event, and hence are later than the majority of commercial crops in the district.

Peter Roberts followed Garren Knell and launched the new GRDC Frost Management Tips and Tactics. This presents a risk management decision support framework for growers and advisors to work through to customise their own farm plan to mitigate frost in their particular cropping system. It steps readers through the current management strategies that are available pre-season, in-crop and post a frost event. Furthermore it puts into a hierarchical decision making framework the new frost susceptibility rankings for wheat and barley cultivars that are available to be 'dialled up' via an interactive tool on a regional basis. It is available at www.grdc.com.au/ManagingFrostRisk. Questions to Peter followed on detailed aspects of management for frost including nitrogen application and row direction.

Andrew Fletcher, CSIRO, was the next speaker setting the scene with fundamental physiological information on the drivers of wheat development. His key messages were that matching flowering time to the environment to avoid abiotic constraints such as heat and frost is very important. Flowering time in wheat is driven by the daylength, or photoperiod, often in combination with a cold requirement (vernalization). Early sowing requires a combination of these features and the optimum combination for a plant will depend on the growers' location. The ensuing discussion centred around photoperiod being the constant driver in Australian systems and the current extent of variation in Australian wheat vernalization responses and the need to source more novel variation.

Darshan Sharma, DAFWA, followed Andrew Fletcher with a talk titled 'How to structure the whole seeding program to maximise yield potential and returns'. His key messages were that building and protecting the yield potential must be considered simultaneously and flowering spread may provide buffering against risks of heat and frost. He demonstrated that flowering spread can successfully be created in wet and dry-sown crops but may be more challenging for dry sown programs. Darshan presented flowering window by location information and it was noted that the information was developed 15 years ago. The length of the flowering window for WA was noted by Neil Fettell, who was present in the audience, as being very wide compared to the eastern states of Australia

Ben Biddulph, DAFWA, was the next speaker presenting the rankings for frost susceptibility of cereals using frost values. His key messages were as follows:

- Preliminary wheat and barley frost performance values are available on the NVT website www.nvtonline.com.au/frost.
- The Frost Value information should be used to manage the frost risk of new varieties after they are adopted, based on how known varieties of similar performance are currently managed
- The Frost Value information should be used as just one step in the overall pre-season frost management plan.

- Ongoing work within the NFI is validating the relationship of Frost Value with yield

The final speaker was Dion Nicol, DAFWA, who presented information on a case study of sowing time in a frost prone location; Brookton, WA. His major take home message was to sow early and to sow over a long period. The upside of sowing a longer maturity wheat to obtain higher yields in early sowings is vastly greater than the downside of yield reductions with later sowings due to later maturity.

The Focus Session then moved into the discussion panel phase which included Garren Knell and Richard Quinlan from PlanFarm, the following issues were raised:

- It was noted that growers are being risk averse in their selection of maturity type of cereal varieties, and that they tend to select earlier maturing types when there are later maturing types available that can capitalize on early sowing opportunities.
- The importance of farm business level decision making for frost mitigation was reinforced during the Focus Session discussion (e.g. sowing alternative species in frost-prone situations).
- The conveners identified that the attendees did not fully understand what drives yield response of early time of sowing from a basic physiological/agronomic perspective. Building and then protecting yield potential concepts need further explanation with real data. As a result industry is still misinterpreting the implications of CSIRO and DAFWA time of sowing advice and still don't understand the need to sow appropriate maturity length varieties early.
- It was noted that decision support tools for growers and advisors that provide sowing time and risk information need to be updated with current varietal information eg. DAFWA's Flower Power.
- It was pointed out that as the climate warms we can't use the current suites of genes for wheat, the mid and short maturity types are accelerating too fast as they are driven by thermal time, we need more photoperiod sensitivity.
- It was stated that David Stephens suggests that the biggest opportunity for early sowing is the south coast of WA.
- Garren Knell noted that many of his clients are moving to producing more barley than wheat to cope with the climatic constraints but the head retention in barley is a problem. He noted the use of Yitpi/Mace blends and the need for a Yitpi replacement.
- The potential of oats in WA systems was noted as a viable grain crop and a tool to mitigate frost risk due to its scope for making hay.
- It was observed that business cases need to be developed for short season winter type to justify breeding companies investing in developing these maturity types.
- The potential for a dual purpose awnless wheat, for grain and hay, for WA regions was noted.
- The need to describe suitable characteristics for early sown cereal varieties was discussed and included the long coleoptile feature to chase available moisture
- A query was raised about the location of NVT sites in WA and the need for more sites in the Albany and Kwinana East ?? Port Zone regions. There was also concern about the timing of sowing of the NVT sites and that a 'stud book' approach is taken to

evaluating the material in the NVT system with sowing mainly starting around 15-25th May.

- It was highlighted that heat risk is more of a problem in northern wheat belt of WA and therefore less effort to extend frost mitigation strategies in this region is required.
- Attention was drawn to the fact that there is a need for frost incidence and historical frost maps for WA regions.
- It was noted that Focus Session focused solely on wheat and maybe growers would benefit much more from sowing other species early. Potential performance of other crops are higher than for wheat if sowing is to begin pre April 25th.

Conclusion

The organisers of the Focus Session found it challenging to devise a session to cover both messages of early sowing and frost management. However the session did determine that there are some fundamental education and extension issues to be addressed to underpin understanding the consequences of sowing wheat, in particular, early in WA cropping systems. These pertain to the physiological drivers of plant development; photoperiod and vernalization. Recommendations were noted in this area and agencies responsible were nominated.

Further opportunities were identified during the Focus Session for climate and environment classification, germplasm introduction, NVT evaluation and crop variety development. Again recommendations were made and appropriate agencies identified to follow up on these issues.

The GRDC's new Frost Management Tips and Tactics was launched. This provides a decision support framework for growers and advisors to customise a multi-pronged strategy to managing frost risk in their business. As part of this framework the FV Plus interactive tool was also launched with accompanying explanation. Further work is necessary by the National Frost Initiative to refine the delivery of the FV tool and provide additional support information.

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