Sorghum Midge Testing Scheme

PROJECT DETAILS

PROJECT CODE: DAQ00138

PROJECT TITLE: SORGHUM MIDGE TESTING SCHEME

START DATE: 01.07.2008

END DATE: 30.06.2011

SUPERVISOR: TRACEY SHATTE (RESEARCH SCIENTIST)

ORGANISATION: DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY (FORMERLY DEPARTMENT OF EMPLOYMENT, ECONOMIC DEVELOPMENT AND INNOVATION)

CONTACT NAME: TRACEY SHATTE

Summary

Sorghum midge is one of the most important economic insect pests of grain sorghum in Australia, leading to yield losses of up to 100 per cent in susceptible hybrids. The most effective means of minimising this damage is to grow midge-resistant hybrids. The levels of resistance present in commercial hybrids can however, vary significantly. It is therefore important for growers to be aware of the level of resistance present in the hybrids they grow, as it can be a factor involved in many crop management decisions. This project supports the Department of Agriculture, Fisheries and Forestry’s (DAFF) Midge Testing Scheme (MTS) in continuing to provide these scientifically accurate and independent midge resistance ratings for commercially available sorghum hybrids.

Report Disclaimer

This document has been prepared in good faith on the basis of information available at the date of publication without any independent verification. Grains Research & Development Corporation (GRDC) does not guarantee or warrant the accuracy, reliability, completeness or currency of the information in this publication nor its usefulness in achieving any purpose. Readers are responsible for assessing the relevance and accuracy of the content of this publication. GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on information in this publication. Products may be identified by proprietary or trade names to help readers identify particular types of products but this is not, and is not intended to be, an endorsement or recommendation of any product or manufacturer referred to. Other products may perform as well or better than those specifically referred to. Check www.apvma.gov.au and select...
product registrations listed in PUBCRIS for current information relating to product registration.

Copyright
Grains Research and Development Corporation. This publication is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced in any form without written permission from the GRDC.

Old or Archival Reports (Projects that concluded in 2007 or earlier)
The information contained in these older reports is now several years old, and may have been wholly or partially superseded or built upon in subsequent work funded by GRDC or others. Readers should be aware that more recent research may be more useful for their needs. Findings related to agricultural chemical use are also potentially out of date and are not to be taken as a recommendation for their use.

Conclusions
The industry requirement and acceptance of the MTS can be demonstrated by its successful operation since 1993 and the commitment from industry for its continuation in the future. Ongoing refinement to obtain the current format by improving both technical aspects and the statistical analysis means that the scheme now runs more efficiently and accurately. This new method of statistical analysis gives more power to the rating and ranking of the standard lines, making them more reliable and therefore the ratings of the test entries more accurate.

Overall, we tested 23 hybrids over the three-year duration of the project and ratings were assigned to 20 hybrids. Four hybrids were commercialised by participating companies during this time.

Recommendations
While sorghum hybrids with varying levels of resistance are continuing to emerge in the marketplace, there is an expectation by industry that the scheme should continue to provide midge resistance ratings for these hybrids. This will ensure a level of quality assurance for growers by providing independent, accurate and consistent ratings of commercial hybrids. This requirement has been recognised by each of the commercial seed companies which have agreed to continue funding of the scheme; DAFF, which supports the scheme with staff, facilities and in-kind contributions required to undertake testing, as well as GRDC, which is continuing funding of the scheme at least until 2014. The inclusion of another seed company into the scheme from the beginning of the 2011-2012 season is also seen as an endorsement, with all of the country's commercial grain sorghum breeding companies involved in the scheme.

There is only one key staff member with the relevant knowledge to perform this testing. To minimise the possible risks a recommended was made that an additional permanent staff member with technical capability be trained in the operation of this scheme. A staff member has been nominated and training will begin during the 2011-2012 season. Any additional costs will be met by contributions from the four commercial parties.

Outcomes
Economic outcomes
The midge resistance rating scheme provides information to growers as to the level of resistance a particular hybrid has to sorghum midge. This rating, in conjunction with midge densities, may be used in Economic Injury Level (EIL) calculations (which take into account cost of spraying, residual life of chemicals, $ value of crop) to determine spraying threshold levels for crops, that is, whether it is economical to spray. The direct economic benefits are: better decision-making regarding pest management, leading to less potential cost to growers (by more efficient use of insecticides); less grain loss caused by preventable midge damage and more flexible planting times (to obtain optimal soil moisture and yield).

Environmental outcomes
Enhanced knowledge of midge resistance leads to improved integrated pest management (IPM) options as growers are able to better manage insecticides and beneficial insects to control pests, that is, midge and Heliothis (Franzmann et al., 2008). This leads to less reliance on broad-spectrum insecticides which can cause a build up of resistance levels in pest insect species, and also lead to outbreaks of other pests on crops due to the associated deaths of natural predators.

**Achievements/Benefits**

**Project overview/background**

Sorghum midge is one of the most important economic insect pests of grain sorghum in Australia, with costs from residual losses and uncontrolled damage estimated at up to $10 million annually. The damage is caused by female midge laying eggs in the sorghum head during flowering. The resulting larvae feeding off the developing grain can cause yield losses of up to 100 per cent in susceptible hybrids. The most effective means of managing this pest and minimising damage is to grow midge resistant hybrids. Though these hybrids maintain some level of resistance, chemical intervention during periods of peak midge activity may still be required. Threshold limits for chemical application vary with the resistance levels of the hybrids as well as commodity prices and cost of insecticides. Therefore, an accurate indication of the midge resistance levels of sorghum hybrids is a valuable tool for growers when selecting hybrids. This may lead to fewer, more targeted insecticide applications, resulting in both economic and environmental benefits.

DAFF, in conjunction with industry, developed a protocol for the testing and official rating of midge resistance (MR) levels in grain sorghum hybrids. It involves an annual igloo-based trial in which the test hybrids and standard lines (of known resistance ratings) are grown alongside each other.

These lines are subjected to high midge pressures and the resulting damage for each hybrid is statistically compared. The test hybrids are then given a resistance rating. The current rating system ranges from 1 (nil resistance) through to 8+ (practical field immunity or maximum resistance commercially available). This rating is a measure of the amount of grain lost per visiting female per day. In practical terms, a 7-rated hybrid, when exposed to the same midge pressures as a 1-rated hybrid, will sustain seven times less damage. These official rating numbers and accompanying logo are only issued to hybrids which have successfully passed through this scheme. The benefit of this testing regime is that it offers a measure of quality assurance for growers by providing ratings which have been independently assessed, results which are very precise and which have been tested in a consistent manner.

The resulting ratings are made available to growers through participating commercial seed companies when they package and promote their sorghum hybrids. These MR ratings, along with other crop information enable growers to calculate the EIL for their crops and provide a useful tool to help manage the crops accordingly.

The project continues through the support and funding of GRDC, DAFF, HSR Seeds, Pacific Seeds and Pioneer Hi-Bred.

**Project achievements**

Throughout the course of the project, we ran three successful annual trials. We tested 23 hybrid entries with 20 of these being given official ratings at annual meetings. Four hybrids were also commercialised during this time.

Replacement hybrids for those lines which are currently standards, but for which seed is no longer being produced, have also been tested over the duration of this project. Suitable possible replacements have been determined for two of these standards, with further testing required for two more. This testing will be conducted over several years to determine consistency of results and suitability of hybrids. The replacement of standards will ensure continuation of the scheme, even when supply of current standard lines becomes unavailable.

Due to reassignment of key staff during this project, the location of the trial was moved from Toowoomba to Warwick in 2009. This involved locating a suitable site at Hermitage Research Facility, relocation and repair of the igloo, construction and setup of irrigation and other required infrastructure. This was done at minimal cost, using existing assets where possible. Testing is now proceeding at the new Hermitage site.

Statistical analysis for this project was performed by Colleen Hunt, with support from the Core Breeding Project (DAQ00017). During the course of this project (2009-2010 season), the method of statistical analysis was changed to improve the accuracy of the results. The new method uses data from multiple years (similar to a multi-environment trial) to improve the level of
confidence in the standard lines and therefore make the results of the test entries more reliable.

Trade Mark registration of the rating series and the accompanying logos occurred during this project. DAFF now holds Class 42 trade marks (TM registration numbers 1301060 and 1301061) for the scheme and these will be upgraded to Class 31 certified TM (for use by third parties) in the near future. The Class 31 trademarks will automatically replace those Class 42 trademarks already issued. The purpose of this registration is to safeguard the integrity of the scheme by protecting both the ratings and accompanying logos from unauthorised use on hybrids not tested by the scheme.

The admission of a fourth company into the scheme as of the 2011-2012 season means the scheme will be used by all the commercial grain sorghum breeding companies in the country. This provides a benefit to growers in that all new hybrids released into the market in the coming years will have been assessed and rated in an identical fashion, therefore the ratings will be directly comparable.

As there is only a single member of staff with the knowledge and expertise to perform the testing for this scheme, the risk of failure due to loss of key staff is potentially high. During the final year of this project we proposed that an additional permanent staff member, with sufficient technical capability, be trained in the planning and operation of this scheme. A staff member has been nominated and this training will begin during the 2011-2012 season. This person will actively participate in all facets of preparation, maintenance and running of the scheme to ensure that comprehensive knowledge and technical skills are developed. This person will then be able to assist in future seasons, where required, to maintain these skills/knowledge.

A request was received by GRDC that current information about the scheme and its funding be provided on the websites of all companies involved. With thoughts on maintaining both current and consistent information, we suggested that each company website contain a link on a relevant page to a central information bank on a single website. This idea was approved by GRDC and a document was drafted with the relevant information. This document has now received GRDC approval for uploading to their website and when this has been completed, each company has agreed to place the links on the relevant pages of their respective websites. DAFF will also update the information on its website to reflect this current information.

We gave a presentation at the annual Australian Sorghum Research Group meeting (AussORGM) at Cedar Creek in 2010. This presentation provided an overview of the scheme since its inception, details of the operation of the scheme and an explanation of the changes in statistical analysis. The audience at this meeting included researchers from various organisations, grain sorghum company representatives and funding body representatives. A poster was also presented at the Australian Summer Grains Conference where it was viewed by a broad ranging, grains industry audience.

Intellectual property summary
This project uses existing intellectual property (IP) involving how the scheme is run, developed by DAFF and GRDC in previous projects. Any seed supplied by the commercial seed companies remains confidential and the property of that company.

This scheme provides midge resistance ratings to all new commercial hybrids prior to release. This allows companies to use this rating and the accompanying logo when marketing hybrid seed (e.g. placement on seed bags, websites, promotional material). For protection against unauthorised use, the ratings and logo were trademarked during this project. The trade marks (TM Registration numbers 1301060 and 1301061) are owned and issued by DAFF, so only hybrids successfully rated by the scheme have the logo displayed.

Additional information
Trade Mark registration # 1301060 and 1301061.

References

Conference Poster
Research Update

Melina Miles, Tracey Shatte and David Murray, ‘Rutherglen bug, sorghum midge and diagnosing poor seed set in grain sorghum’, GRDC Research Update, 2008.


More research is being conducted in follow-on project DAQ00169 Sorghum Midge Testing Scheme.