FINAL REPORT

GRDC Grains Research & Development Corporation

Sorghum Midge Testing Scheme

DAQ00169

Project Details

- **Project Code:** DAQ00169
- **Project Title:** Sorghum Midge Testing Scheme
- **Start Date:** 30.06.2011 **End Date:** 30.06.2014
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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% in susceptible hybrids. Currently, the most effective means of minimiszing this damage is to grow midge resistant (MR) hybrids. The amountlevel of resistance can vary significantly between hybrids and as it is a factor in many crop management decisions, it is vital that growers are aware of the level of resistance present in the hybrids they grow. This project supports the Department of Agriculture, and Fisheries and Forestry's (DAFF)'s midge testing scheme by continuing to provide scientifically accurate and independent midge resistance ratings for commercially available sorghum hybrids.

Conclusions

The industry requirement and acceptance of the scheme can be demonstrated by the continued successful operation of the scheme since 1993 and the future support, with a new project operating until at least 2019. The ongoing refinement to obtain the current format by improveing both technical aspects and the statistical analyses, means that the scheme now runs more efficiently and accurately. Overall tThe scheme tested 34 hybrids over the past three3 year period and assigned ratings to all hybrids. Six hybrids were commercialised by the participating companies during this time.
The new online Economic Threshold Calculator will be a valuable tool to allow growers to assess whether it is economically viable to spray during midge outbreaks at peak times of the season.

Recommendations

While sorghum hybrids with varying levels of resistance are continuing to emerge in onto the marketplace, there is an expectation by the industry that the scheme should continue to provide MR ratings for these hybrids. This will ensure a level of quality assurance to growers by providing independent, accurate and consistent ratings of the commercial hybrids. This requirement has been recognised by: growers,; each of the seed companies (as they have agreed to ongoingcontinual funding of the scheme); DAFF(who supports the scheme with the staff, facilities and in-kind contributions required to undertake testing);, as well as GRDC., GRDC haswhowhich renewed funding of the scheme with a new five5 year project ending in 2019. Currently, 100% of the country's commercial grain sorghum breeding companies are involved in this scheme.

Outcomes

Economic Outcomes
The MR rating scheme provides information to growers as to the level of resistance a particular hybrid has to sorghum midge. This rating, in conjunction with other crop details (such as: midge densities, row spacing, crop value, cost of control and chemical residual life) are used in the Economic Threshold Calculator (available online at the DAFF run The BeatsSheet blog - http://thebeatsheet.com.au/economic-threshold-calculators/) to determine whether it is economical for growers to spray. The direct economic benefits are: better decisions regarding pest management, leading to less potential cost to growers (by targeted, more efficient use of insecticides), less loss of grain 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/beneficial insects to control pests, i.e. midge and Hheliothis. This leads to less reliance on broad spectrum insecticides which ,;can cause a build-up of resistance levels in pest insect species.,It canand also lead to flare ups of other pests on crops, due to the associated killing off of nanatural predators. This is better both economically and environmentally.

Achievement/Benefit

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 being greater than $20 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% in susceptible hybrids. The most effective means of managing this pest and minimizsiing damage is to grow midge resistant hybrids. Though tThese hybrids maintain some level of resistance, however, 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 the cost of insecticides. It is, therefore, a valuable tool for growers to have an accurate indication of the MR levels of sorghum hybrids they are choosing.astThis may lead to fewer, more targeted insecticide applications, leading to both economic and environmental benefits..

DAFF, in conjunction with industry, developed a protocol for the testing and official rating of resistance levels in MR 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 then subjected to high midge pressures and the resulting damage for each hybrid is compared. The test hybrids are then given a resistance rating. The current rating system begins at one1 (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, it means that a seven7 rated hybrid, when exposed to the same midge pressures as a one1 rated hybrid, will sustain seven7 times less damage. These official rating numbers and accompanying Trade Marked logo are only issued to hybrids, which have successfully passed through this scheme. The benefit of this testing regime is that it provides a measure of quality assurance to growers by: providing ratings which have been independently assessed, results which are very precise and which have been tested in a consistent manner each time.

The resulting ratings are then made available to growers, via the participating commercial seed companies when they package and promote their sorghum hybrids and by inclusion on both their websites and the GRDC website. These MR ratings, along with other crop information (e.g. crop densities, midge numbers, current market value of grain and cost of chemical control); can then be used to calculate the Tthreshold lLevels (particularly using the new calculators on the DAFF blog - The Beats Sheet) for their crops to provide a useful tool to help them manage the crops accordingly.

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

Project Achievements

- . Throughout the course of the project, three3 successful annual trials were run. A total of 34 hybrid entries were tested with all being given official ratings at the annual meetings.(dDetails and related data of these entries can be found in the attached documents: Table of hybrids tested.) and in the summary document of meeting minutes for each year. During the course of this project, six hybrids were commercialised, with one1 hybrid pending release this season.
- . Replacement hybrids for those lines which are currently standards, but for which seed is no longer being produced have also been tested during this project. Suitable possible replacements have been ascertained for three3 of these standards, with further testing required for two others. 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 the supply of the current standard lines becomes unavailable.
- .Due to the involvement of five5 companies throughout this project, a larger igloo was built to accommodate a larger sized trial to be able to maintain current entry numbers. This involved locating a suitable site at Hermitage Research Facility, and construction and fit out of the new igloo. This was done according to DAFF procurement policy, using surplus funds from each of the seed companies acquired over the length of the project. This igloo was used for the first time during the 2013-14 season.
- . Statistical analysis for this project is performed by Colleen Hunt, with support from the Core Breeding Project. The method of statistical analysis developed during the 2009-10 season has been used for these analyses.. (TThis 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). Erroneous data from the 2010-11 season waswere discovered in 2012, resulting in changes to ratings of several lines. None of these had been commercialised at this stage. Methods have been put in place to ensure data errors are eliminated in the future.
- . Certification Trade Mark registration of the rating series and the accompanying logos occurred in 2014. These new Class 31 Trade Marks will replace the old Class 42 Trade Marks previously held by DAFF. Contracts rescinding the Class 42 Trade Marks and issuing the new Class 31 Trade Marks will be sent out to participating companies in the near future. The purpose of this registration is to protect the integrity of the scheme by protecting both the ratings and accompanying logos from unauthorised use on hybrids not tested by the scheme.
- . Five companies were involved in the scheme at the outset of this project. This has now dropped to four4, with the folding of HSR. The involvement of these four4 companies means that the scheme is being utilised

by 100% of the commercial grain sorghum breeding companies in the country. All four4 companies supported the continuation of the scheme past the present completion date of this project. This support lead to the securing of a further five5 year project with GRDC, ensuring that MR testing will continue in its current format, into the future.

- . Another permanent staff member, with sufficient technical capability, is currently being trained in the planning and operation of this scheme. This was originally proposed due to the fact that there was 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 was potentially high. This person has been actively participating in all facets of preparation, maintenance and running of the scheme to ensure that comprehensive knowledge and technical skills are developed.
- . Detailed information about the scheme and its funding is now housed on the GRDC website: (http://www.grdc.com.au/SorghumMidge). This information is updated regularly to make sure the content is current. Each company should have a link to this centraliszed site, to direct searchers to more information if required.
- . The inclusion of an online Economic Threshold Calculator on the DAFF run The Beats Sheet Blog occurred over the course of this project. Though not funded by this project, it ishas direct links as the ratings assigned by this scheme are an input into this calculator. The calculator allows growers to input a number of crop details to help determine whether spraying for sorghum midge is warranted. Being available online allows growers easy access and the outcome delivered provides good economic advice. An article about the scheme and this calculator was published in Groundcover (Issue 107: Nov-Dec 2013) and aA GRDC Fact Sheet was alsoreleased re the online calculator.

Outputs 1

Testing - Scientifically and accurately assigning independent MR ratings on 6-12 pre-commercial hybrids each year. This involves planning, planting, screening, assessment and statistical analysis of trial hybrids, in comparison to standard hybrids, to obtain the overall resistance ratings.**Output 2**

Delivery - Official ratings and logos are issued to each company after the annual meeting. These are then disseminated to industry by:P placement of rating and logo on each company web site, bags of seed, product brochures and other means of marketing and communication. They are also placed onto DAFF and GRDC websites.

Output 3

Other Research

N/A

Intellectual Property Summary

This pProject uses existing intellectual property (IP) re methodology to perform testing, developed by DAFF and GRDC in previous projects.
Seed and related information supplied by commercial seed companies remains confidential and the property of that company.
SThe scheme provides official MR ratings to all commercial hybrids prior to release. Ratings and accompanying logos can be used when marketing hybrids (placement on seed bags, websites, promotional material). For the protection against unauthorised and incorrect use, the ratings and logo obtained Certification Trade Marks (CTM1427348 and CTM1427349) during this project. They are owned and issued by DAFF. Only hybrids successfully rated by the scheme are able to display the logo. A Trade Mark Licencscse is issued by DAFF and the use of the rating and logo must be in accordance with this Licence.

IP papers (Deprecated - use Recommendations instead)

Certification Trade Mark registration (Class 31)
o CTM1427348 - Final - Department of Agriculture, Fisheries and Forestry - Certificate - 11 March 2014

o CTM1427349 - Final - Department of Agriculture, Fisheries and Forestry - Certificate - 11 March 2014
Shatte TS, Hardy AT, 2010. Midge Tested Scheme - Rating of Midge Resistance Levels in Commercial Sorghum Hybrids. Australian Summer Grains Conference. 21-24 June 2010. Gold Coast, Australia.

Additional Information

Conference Poster
Shatte TS, Hardy AT, 2010. Midge Tested Scheme - Rating of Midge Resistance Levels in Commercial Sorghum Hybrids. Australian Summer Grains Conference. 21-24 June 2010. Gold Coast, Australia.