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SORGHUM MIDGE SPRAY CALCULATOR FACT SHEET

GRDC
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NORTHERN REGION

COST AND BENEFIT OF TREATING SORGHUM MIDGE

The newly developed Economic Threshold Calculator allows growers to calculate the costs and benefits of spraying sorghum to treat sorghumn midge outbreaks.

KEY POINTS

- Sorghum midge is a 1–2 millimetre red fly that lays eggs in flowering sorghum spikelets.
- The midge larvae feed on the developing sorghum grains, ravaging the crop.
- Adult midge use plants other than sorghum to breed, such as the ubiquitous weed Johnson grass, so midge populations can build up before sorghum starts flowering.
- A high midge resistance (MR) rating does not guarantee a crop is immune from midge damage, especially when midge populations are high.
- The online *Economic Threshold Calculator* assesses whether growers will benefit from applying an insecticide. It considers the hybrid's level of midge resistance, growing conditions, insecticide costs and commodity prices.
- A grower's decision to treat depends on many factors, and the calculator helps growers determine the best strategy for their enterprise.

PHOTO: DAFF

Female sorghum midge on a sorghum head. The female midge lays her eggs in the sorghum flower. Larvae hatch within a few days and feed on the developing grain, causing considerable yield loss in affected crops.

Sorghum midge

Sorghum midge (*Stenodiplosis sorghicola*) is a widespread insect pest that breeds in sorghum, and costs from residual losses and uncontrolled damage have been estimated at $10 million annually in Australia.

Resistance traits introduced in all commercial sorghum hybrids in the 1980s have reduced the impact of midge. However, growers in the northern region still incur significant expenses on insecticides to reduce potential midge damage.

Growers can evaluate the costs and benefits of applying an insecticide with an online tool, the Economic Threshold Calculator, developed by researchers at the Department of Agriculture, Fisheries and Forestry Queensland (DAFFQ).

This Fact Sheet describes how growers can use the calculator to manage insecticide applications, saving them time and money.

Level 1, Tourism House | 40 Blackall Street, Barton ACT 2600 | PO Box 5367, Kingston ACT 2604 | **T** +61 2 6166 4500 | **F** +61 2 6166 4599 | **E** grdc@grdc.com.au | **W** www.grdc.com.au

Tailored cost–benefit advice from the Economic Threshold Calculator

The calculator helps growers decide whether to apply an insecticide by asking the question:

Is the number of midge high enough to justify insecticide and application expenses, or is the number too low to affect the crop yield?

The tool uses your specific farming conditions to provide tailored advice.

It is available online, along with information on how to collect the pest data used by the calculator, at http://thebeatsheet.com.au/sampling-2/.

The website offers a similar calculator for *Helicoverpa* in sorghum and chickpeas.

Midge population build-ups can ruin sorghum crops

Sorghum midge populations can build up from early spring because of their ability to breed in Johnson grass.

In warm, humid conditions, a new generation of flies is produced in as little as 18 days.

When sorghum flowers during mid-summer, the midge population may be extremely high, particularly if there has been a lot of Johnson grass around, or a succession of sorghum crops.

If you plant sorghum late in the season, or after neighbouring sorghum fields have finished flowering, you will benefit from a sorghum hybrid with a high MR rating.

Once the female has laid eggs in the flowering spikelets, larvae hatch within a few days and feed on the developing grain.

Larvae from the eggs laid by a single female midge can destroy up to 1.4 grams of grain—equivalent to 1.5 tonnes per hectare of grain loss in susceptible sorghum varieties (MR = 1). Adult midge live only for one day and cause no direct grain damage.

PHOTO: DAFF

Growers need to monitor midge flies on flowering sorghum heads and input their observations in the Economic Threshold Calculator. Midge are only 1–2 mm long so they can be difficult to spot. Growers should monitor about 10 metres / row in at least four different rows to get a good estimate of the number of midge in the field.

How the calculator works

Growers may be instructed to spray if:

$$\frac{M}{MR} \quad \text{is greater than} \quad \frac{\$ \text{ insecticide} \times W}{\$ \text{ crop} \times RL \times 1.4}$$

Where:

M = number of midge per metre of row

MR = the hybrid midge resistance rating

$ insecticide = cost of insecticide and application/hectare

W = row width (in centimetres)

$ crop = value of crop/tonne

RL = insecticide residual life

1.4 = grams of grain loss caused by midge larvae feeding

For example, if a grower:

- has 10 midge/metre row (1 midge/sorghum head: 10 heads/m row);
- has a MR5-rated hybrid;
- has 100 cm row spacing;
- uses a synthetic pyrethroid: $1.50/ha (insecticide) + $12/ha (to apply by ground) = $13.50/ha to treat; and
- uses an insecticide with a residual life of 3 days

If the grower's expected sorghum price is $180/tonne, the tool advises the grower that 'action may be warranted'—that is, the potential yield benefits of spraying are greater than the cost of spraying.

Sorghum midge resistance: tighter flowers and killing larvae

Two mechanisms give sorghum resistance to midge:

1. The sorghum flower structure is tighter than normal, which prevents the female midge from laying eggs inside. This is known as 'antixenosis'.

2. A process called 'antibiosis' leads to the death of midge larvae after the eggs hatch, so the grains develop almost normally. This was only recently discovered, and researchers are investigating what kills the larvae.

Breeders are now aiming to combine both mechanisms of resistance into new varieties to improve the overall resistance to midge.

This approach will decrease the risk of midge being able to overcome one of the mechanisms.

What factors does the calculator take into account?

The Economic Threshold Calculator helps growers evaluate the benefits of applying an insecticide using the following factors:

- MR rating of the sorghum variety;
- sorghum growing conditions;
- number of midge in the field, as calculated by the grower or consultant;
- sorghum market value; and
- insecticide application costs and residual life.

Sorghum with a high MR rating can still suffer midge damage

The official MR rating varies between 1, in the most susceptible varieties, to 8+ in varieties that sustain minimal midge damage.

For example, an MR rating of 7 means that, under similar midge pressure, the line sustains seven times less damage than a 1-rated hybrid.

A high MR-rated variety of sorghum can still sustain midge damage under high midge pressure.

An 8+ hybrid can lose up to 10 per cent of its yield. The rating is an indicator of MR level and should be used as a tool for managing crops rather than a guarantee of preventing midge damage.

By better planning, and limiting the number of insecticide treatments using the Economic Threshold Calculator, growers can save time and money. Fewer insecticide applications will also assist in preserving beneficial insects which, in turn, help minimise crop losses and improve yield.

The official MR rating

The MR rating is identifiable by its official logo.

The Sorghum Midge Tested Scheme offers growers independent guidance on the midge-resistance trait, which varies between sorghum hybrids. It was introduced in 1993 by DAFF and GRDC.

Every summer, at the height of the midge season, researchers from the DAFF Hermitage Research Facility in Warwick (Queensland) assess new sorghum varieties submitted by breeding companies.

Researchers plant the hybrids to be rated in a semi-controlled environment and in conditions ideal for both sorghum and midge. These hybrids are placed under high midge pressure.

PHOTO: DAFF

When the crop reaches maturity, the level of damage is assessed and compared with damage to control sorghum lines of a known MR rating. The official MR rating and logo can then be assigned to these

PHOTO: DAFF

Midge resistance varies between sorghum hybrids. The official MR rating, ranging from 1 to 8+, offers an independent assessment of the resistance level in hybrids under similar midge pressure. From left to right: 100% damage observed in a 1-rated hybrid; 50% damage in a 5-rated hybrid; 25% damage in a 7-rated hybrid; and the 8+ hybrid has less than 10% damage to its grains.

USEFUL RESOURCES

The DAFF Economic Threshold Calculator for sorghum midge
http://thebeatsheet.com.au/sampling-2/

The GRDC Sorghum Midge Tested Scheme
http://www.grdc.com.au/Research-and-Development/Major-Initiatives/The-Sorghum-Midge-Tested-Scheme

MORE INFORMATION

Tracey Shatte, Department of Agriculture, Fisheries and Forestry, Warwick, Queensland
07 4660 3628
tracey.shatte@daff.qld.gov.au

Dr Melina Miles, Department of Agriculture, Fisheries and Forestry, Warwick, Queensland
07 4688 1369
melina.miles@daff.qld.gov.au

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