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Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics area

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Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics area

Preliminary conclusions and feedback to participating productivity services and growers
Trials on alternative pre-emergent options to diuron

The project aims to find an effective alternative to pre-emergence with diuron which is currently a regulated chemical in Great Barrier Reef regions.

Four replicated trials were conducted in trash blanketed ratoons, two within the Mulgrave region.

**Table 1:** Details of sites for trials on alternative pre-emergence options to diuron.

<table>
<thead>
<tr>
<th>Trial site</th>
<th>1a</th>
<th>1b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Low rainfall, well drained</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Edmonton</td>
<td></td>
</tr>
<tr>
<td>GPS coordinates</td>
<td>145.7583744E 17.03686842S</td>
<td>145.7590917E 17.0378108S</td>
</tr>
<tr>
<td>Farmer name</td>
<td>Peter Bosanquet</td>
<td></td>
</tr>
<tr>
<td>Farm and block number</td>
<td>0172 3-1</td>
<td>0172 1-A</td>
</tr>
<tr>
<td>Cane variety and ratoon number</td>
<td>Q208 3 R</td>
<td>Q208 4 R</td>
</tr>
<tr>
<td>Soil type</td>
<td>Edmonton Red/Brown schists and volcanics Friable non-cracking clay or clay loam soils - Dermosols, Ferrosols</td>
<td>Edmonton Mission Red/Brown schists and volcanics Red, yellow or grey loam or earth soils - Kandosols</td>
</tr>
<tr>
<td>Date and time sprayed</td>
<td>17/09/2014 (7:30 am to 8:30 am)</td>
<td>19/11/2014 (7:00 am to 7:50 am)</td>
</tr>
</tbody>
</table>
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**Table 2:** Details of treatments in the three pre-emergent herbicides trials.

<table>
<thead>
<tr>
<th>T</th>
<th>Treatment</th>
<th>Treatment description</th>
<th>Active</th>
<th>Rate kg or L/ha</th>
<th>Water rate L/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Diu HR</td>
<td>Barrage full rate (as reference product)</td>
<td>diuron 468 g/L, hexazinone 132 g/L</td>
<td>4</td>
<td>300</td>
</tr>
<tr>
<td>T2</td>
<td>Diu LR</td>
<td>Barrage low rate (as reference product)</td>
<td>diuron 468 g/L, hexazinone 132 g/L</td>
<td>0.9</td>
<td>300</td>
</tr>
<tr>
<td>T3</td>
<td>IMA</td>
<td>Flame max label rate</td>
<td>imazapic 240 g/L</td>
<td>0.4</td>
<td>300</td>
</tr>
<tr>
<td>T4</td>
<td>Iso</td>
<td>Balance max label rate</td>
<td>isoxaflutole 750 g/kg</td>
<td>0.2</td>
<td>300</td>
</tr>
<tr>
<td>T5</td>
<td>Met</td>
<td>Clincher max label rate</td>
<td>metolachlor 960 g/L</td>
<td>2.7</td>
<td>300</td>
</tr>
<tr>
<td>T6</td>
<td>Ami</td>
<td>Dynamic max label rate (pending registration)</td>
<td>amicarbazone 700 g/kg</td>
<td>1.4</td>
<td>300</td>
</tr>
<tr>
<td>T1, T3, T4</td>
<td>+ Par</td>
<td>Shirquat added to tank</td>
<td>paraquat 250 g/L</td>
<td>1.2</td>
<td>300</td>
</tr>
</tbody>
</table>

**Soil analysis**

Soil at Bosanquet a and b has a CEC <3 me%. These soils have a reduced capacity to adsorb the herbicide in the soil, which may result in the herbicide leaching past the weed root zone into the cane root zone. Balance is not recommended on this soil types.

Other combinations of soil/herbicide are compatible according to the labels. Note that the use of Flame at Bosanquet 1a may be limited due to the nature of the soil (ferrosol) with pH close to 5 and medium/high Fe content.
### Soil Analysis Report

**SRA Lab Number:** SOIL 150948-150951  
**Number of Samples:** 4  
**Sample Description:** Soil  
**Project Description:** Developing alternative herbicide strategy for Wet Tropics  
**Project Code:** Project: 2014050, c/- E. Filliol, SRA Meringa  
**Date Received:** 16/04/2015  
**Date Sampled:** April 2015  
**Date Reported:** 2/06/2015

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>SRA Lab No.</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>SEC</th>
<th>pH</th>
<th>S</th>
<th>BSES</th>
<th>AgThU</th>
<th>CEC</th>
<th>ESP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 2014050, Meringa SRA, Boosanquet, IA</td>
<td>SOIL 150948</td>
<td>0.62</td>
<td>0.30</td>
<td>0.024</td>
<td>0.123</td>
<td>0.027</td>
<td>5.11</td>
<td>15</td>
<td>39</td>
<td>2.50</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Project 2014050, Meringa SRA, Boosanquet, IB</td>
<td>SOIL 150949</td>
<td>0.17</td>
<td>0.18</td>
<td>0.026</td>
<td>0.097</td>
<td>0.017</td>
<td>5.04</td>
<td>25</td>
<td>16</td>
<td>2.66</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Project 2014050, North Mossman, P. Thompso</td>
<td>SOIL 150950</td>
<td>0.51</td>
<td>0.36</td>
<td>0.071</td>
<td>0.123</td>
<td>0.019</td>
<td>5.22</td>
<td>10</td>
<td>36</td>
<td>3.80</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Project 2014051, Tully, Gilbert</td>
<td>SOIL 150951</td>
<td>0.83</td>
<td>0.92</td>
<td>0.063</td>
<td>0.246</td>
<td>0.030</td>
<td>5.13</td>
<td>30</td>
<td>49</td>
<td>6.28</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Soil analysis report for the four trial sites.
Results: Trial 1a

Weather data

![Graph showing temperature and rainfall over time]

**Figure 2**: Minimum and maximum temperatures, cumulative rainfall recorded at trial 1a and 1b. (Note: temperature and rainfall logger failure from 1st February). Soil type: Red/Brown schists and volcanics.

Weed population in untreated plots

The weed population was mainly composed of vines (calopo and red convolvulus). There were only a small amount of grasses (green summer grass, couch grass) and broadleaves (square weed, ludwigia, sicklepod, spiny spider flower).
Figure 3: Average percentage of weed coverage in the untreated controls in trial 1a.

Herbicide efficacy

- Diuron high rate was the most efficient herbicide at reducing the total weed coverage. It was effective on the largely dominant vine species calopo and red convolvulus. Amazingly it was still 86% effective 177 days after spraying.

- Amicarbazone was also quite effective, but its efficacy dropped under 80% after the first month of rainfall events (135 DAT). It was quite effective to control the vine species.

- Isoxaflutole efficacy ranged between 80 and 60% for the first month after the rainfall events (until 135 DAT). It performed well against the vines (particularly calopo), with 80 to 60% efficacy throughout the assessment period. It rules out the soil type as being an impediment to Isoxaflutole activity as suggested per label.
The rather poor efficacy on the total weed coverage obtained by Imazapic can be partly explained by its poor performance on legume vines (calopo) that were dominant in this trial. It is also possible that the soil type or the delayed incorporation have contributed to its poor performance.

Diuron low rate controlled poorly the weed coverage and the vines, likely because the low rate could not achieve a long term weed control and cope with the delayed incorporation.

Metolachlor was the least effective herbicide against all types of weeds, which is to be fully expected as it was incorporated by the first rainfall more than 10 weeks after application.

**Figure 4:** Mean of percentage reduction of total weed coverage compared to the adjacent untreated controls in trial 1a. Same letter within one assessment date means no statistical difference.
Results: Trial 1b

Weed population in the untreated controls

The weed population was mainly composed of vines (calopo and some stinking passion fruit) and broadleaves (square weed and some sensitive weed, sicklepod and praxelis). There was only a small amount of grasses (sour grass, summer grass, green summer grass, Guinea grass).

Figure 5: Average percentage of weed coverage in the untreated controls in trial 1b.
Herbicide efficacy

- Diuron high rate was the most efficient herbicide at reducing the total weed coverage. It was effective on all weed types.

- Amicarbazone and Diuron low rate were also quite effective, especially during the first 55 days after application. Amicarbazone was particularly effective against broadleaves and vines, whereas Diuron low rate was better at controlling grasses and broadleaves. The low rate of Diuron is effective at controlling weeds for a short term period only.

- The rather poor efficacy on the total weed coverage obtained by Imazapic can be explained by its poor performance on legume vines (calopo) that were dominant in this trial. Imazapic was efficient at controlling broadleaves and grasses. It rules out the soil type as being an impediment to Imazapic activity.

- The global poor efficacy of Isoxaflutole is the result of:
  - no efficacy at controlling the broadleaves (square weed)
  - excellent efficacy at controlling the calopo vine
  - medium efficacy against grasses

  It rules out the soil type as being an impediment to Isoxaflutole activity as suggested per label.

- Metolachlor was the least effective herbicide against all types of weeds, which is to be expected as it was incorporated by the first rainfall more than 2 weeks after application.
Figure 6: Mean of percentage reduction of total weed coverage compared to the adjacent untreated controls in trial 1b. Same letter within one assessment date means no statistical difference.

General conclusion for the four pre-emergent trials and perspective for 2015-16

Diuron high rate was the most efficient herbicide across all trial sites, regardless of the soil type and the weed composition. It was particularly stable during the very long drought period that preceded its incorporation, and was very efficient at controlling weeds after activation.

Amicarbazone was nearly as effective as Diuron high rate in most situations (no significant difference) especially against broadleaves and vines, however its efficacy did not last as long as Diuron high rate.

Imazapic performance varied in relation to the weed species present in the trials. It was particularly effective against the grass and broadleaves but did not control the legume vines (like calopo). It is also possible that the Ferrosol soil type in trial 1a (Mulgrave) limited its activity.
Isoxaflutole performance varied in relation to the weed species present in the trials. It was particularly effective against legume vines (calopo), but controlled poorly the broadleaf square weed. Its efficacy was not limited by the soil type as suggested by the label and no phytotoxicity on cane was observed. In trial 2 (Tully), isoxaflutole did not control Barnyard grass, suggesting the herbicide had been washed away from the root zones by the heavy rainfall events early January (runoff or leaching).

Diuron low rate was effective at controlling weeds for a short term only. It was more effective against grasses and broadleaves than vines. In trials where its incorporation was overly delayed, Diuron low rate did not perform.

Metolachlor efficacy was mediocre for all trials, likely because it did not get incorporated within 24h as stated in the label.

As 2014-15 wet season was really delayed and abnormally low in rainfall for the Wet Tropics, we plan to implement again 3 trials:

- 1 RCB trial in a poorly drained high rainfall area
- 1 RCB trial in a well-drained high rainfall area
- 1 RCB trial in a well-drained moderate rainfall area

One demonstration strip trial will be implemented for well drained areas with moderate rainfall (where the 2014-15 trials were the most successful) to test the best treatment options as defined in 2014-15 RCB pre-emergent trials.

**Trials on alternative post-emergent options to Diuron to control perennial grasses**

The project aims to find an effective alternative to spot spraying with diuron which is currently a regulated chemical in Great Barrier Reef regions.

Two replicated trials were conducted in trash blanketed ratoons badly infested with Guinea grass. This case study focuses on the trial run on a commercial cane block in Mirriwinni, due to be harvested this year (2015).

**Trial design**

- Q208®, second ratoon
- Soil type: Thorpe, granite gravel
- Typically a high rainfall, well drained site but experiencing hot, dry conditions in 2014/15 season
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Equipment used

**T2, T3 and T4**

Irvin leg with two LD110 03 flat fan nozzles in the middle and 4 DG110 02 VP nozzles for the sides. Leg fitted to the SRA custom 6 tank sprayer.

**T6**

Dual spray bar with one AI110 025 nozzle in the centre (delivering glyphosate) and two Hardi 468021 E for the sides. Bar fitted to the SRA custom 6 tank sprayer with an additional tank and spray pump.

**T1 and T5**

Dual tank Weedseeker Shield sprayer: inside the shield equipped with two Albuz AVI OC80 01 nozzles on the side and one Agrotop Airmix 110 01 nozzle in the centre (the Weedseeker sensors were not used in this trial). Side nozzles were two flat fan 65 03E Teejet nozzles.
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Treatments

All treatments sprayed initially with isoxaflutole 750 g/kg and paraquat 250 g/L as a broadcast following harvest.

- T1 banded spray for asulam (sprayed on Guinea grass up to 40 cm tall), followed by glyphosate in the inter-row using the shielded sprayer
- T2 diuron low rate + paraquat using Irvin leg (sprayed on Guinea grass up to 60 cm tall)
- T3 isoxaflutole low rate + paraquat using Irvin leg (sprayed sprayed on Guinea grass up to 60 cm tall)*
- T4 isoxaflutole low rate + MSMA using Irvin leg (sprayed sprayed on Guinea grass up to 60 cm tall)*
- T5  isoxaflutole low rate + MSMA in the row/glyphosate interrow using shield and its side nozzles (sprayed sprayed on Guinea grass up to 60 cm tall)
- T6 isoxaflutole low rate + MSMA in the row*/glyphosate interrow using DAF dual herbicide spray bar (sprayed sprayed on Guinea grass up to 60 cm tall)

* Isoxaflutole used as post-emergent, or mixed with MSMA are off label applications

Measurements

Efficacy of post-emergent herbicides was achieved by rating the visual symptoms on cane and Guinea grass.

In each plot, three ratings were given:

- phytotoxicity of the treatment on cane
- phytotoxicity of the treatment on Guinea grass in the row
- phytotoxicity of the treatment on Guinea grass in the interrow

A second trial run as part of this project utilised the same treatments as detailed above however was conducted in an old cane block with a heavy infestation of Guinea grass. This trial allowed for very accurate visual assessment of the effectiveness of the treatments on the grass population. Both trials showed very similar results.
Results

• Asulam was the safest option on cane but the least effective to control Guinea grass stools in the row. The hot, dry weather conditions may have slowed plant uptake and translocation and contributed to this poor performance.

• Herbicide mixes containing MSMA were more effective than paraquat mixes to damage Guinea grass both in the row and in the interrow. This result may be due to paraquat underperforming when applied in hot and dry weather (as per label).

• The application of the MSMA mix with the shield side nozzles seemed more effective for controlling Guinea grass than the dual herbicide bar or the Irivn leg side nozzles.

• According to the visual assessment ratings, glyphosate had the most damaging impact on the Guinea grass in the interrow, especially when applied with the shield compared to the dual spray bar. The low vertical setting of the dual spray bar resulted in narrowing the swath sprayed by the middle nozzle in the interrow, reducing the number of Guinea grass stools sprayed with glyphosate.

• Counting the remaining stools of Guinea grass in May indicated slightly more regrowth of Guinea grass that were treated with glyphosate versus isoxaflutole and MSMA, suggesting a better longer term effect using the later mix under hot, dry climatic conditions.

• None of the control methods completely eradicated Guinea grass in the row or the interrow, likely because of the hot and dry weather that limited the uptake and translocation of the herbicides. A follow-up spray application may have improved the control.

Perspectives for 2015-16

As the 2 post-emergent trials were carried out in abnormally hot and dry conditions, it is difficult to extrapolate the conclusions to normal Wet Tropics conditions.

As the two 2014-15 post-emergent trials results were very similar, we are confident that one additional trial is enough to test the treatments in 2015-16 environmental conditions.

The demonstration strip trial will also include the best post-emergent treatment options as defined in 2014-15 RCB post-emergent trials.