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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, one within the Mossman region.

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

<table>
<thead>
<tr>
<th>Trial site</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>High rainfall, poorly drained</td>
</tr>
<tr>
<td>Location</td>
<td>Mossman</td>
</tr>
</tbody>
</table>
| GPS coordinates | 145.387207E  
16.396978S |
| Farmer name | Peter Thompson |
| Farm and block number | 5121  
3-4 |
| Cane variety and ratoon number | Q231  
1 R |
| Soil type | Newell  
Humic gley, alluvial plain  
Seasonally wet soils requiring drainage or special management - Hydrosols |
| Date and time sprayed | 27/11/2014 (6:20 am to 7:15 am) |
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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

The soil analysis of the four trial sites reports that soil at Peter Thompson has a CEC <4.5 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 only recommended at reduced rates.
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Soil Analysis Report

SRA Lab Number: 150948-150951
Number of Samples: 4
Sample Description: Soil
Project Description: Developing alternative herbicide strategy for Wet Tropics
Project Code: Project: 2014050, c/o E. Filho, SRA Meringa
Date Received: 16/04/2015
Date Sampled: April 2015
Date Reported: 20/06/2015

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>SRA Lab No.</th>
<th>Ca me%</th>
<th>Mg me%</th>
<th>Na me%</th>
<th>K me%</th>
<th>SEC dS/m</th>
<th>pH</th>
<th>S mg/kg</th>
<th>P mg/kg</th>
<th>AgThU me%</th>
<th>CEC</th>
<th>ESP %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 2014050, Meringa SRA, Bassoquet, 1A</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, Bassoquet, 1B</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. Thompson</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>1.83</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>

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>SRA Lab No.</th>
<th>CaCl2 mg/kg</th>
<th>H2SO4 Si mg/kg</th>
<th>Nitr K me%</th>
<th>Cu mg/kg</th>
<th>Zn mg/kg</th>
<th>DTPA Fe mg/kg</th>
<th>DTPA Mn mg/kg</th>
<th>Dumas Org C %</th>
<th>Dumas Total N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 2014050, Meringa SRA, Bassoquet, 1A</td>
<td>SOIL 150948</td>
<td>11</td>
<td>66</td>
<td>0.63</td>
<td>1.19</td>
<td>0.61</td>
<td>101</td>
<td>52</td>
<td>1.16</td>
<td>0.076</td>
</tr>
<tr>
<td>Project 2014050, Meringa SRA, Bassoquet, 1B</td>
<td>SOIL 150949</td>
<td>14</td>
<td>88</td>
<td>0.73</td>
<td>1.87</td>
<td>0.60</td>
<td>88</td>
<td>68</td>
<td>1.07</td>
<td>0.078</td>
</tr>
<tr>
<td>Project 2014050, North Mossman, P. Thompson</td>
<td>SOIL 150950</td>
<td>11</td>
<td>206</td>
<td>3.05</td>
<td>0.15</td>
<td>0.27</td>
<td>118</td>
<td>4</td>
<td>2.30</td>
<td>0.151</td>
</tr>
<tr>
<td>Project 2014051, Tully, Gilbert</td>
<td>SOIL 150951</td>
<td>29</td>
<td>348</td>
<td>3.69</td>
<td>0.48</td>
<td>0.74</td>
<td>53</td>
<td>17</td>
<td>1.32</td>
<td>0.107</td>
</tr>
</tbody>
</table>

The soil sample Lab No: 150949 (Meringa SRA, Bassoquet 1B) is low in terms of exchangeable Ca and K as well as marginal in available P. However, K reserves in this soil and all soils tested are adequate, with Nitr K well above the deficient level of 0.2me%. The soil sample Lab No: 150950 (North Mossman, P. Thompson) is below the deficiency level for zinc and manganese.

Figure 1: Soil analysis report for the four trial sites.
Results: Trial 3

Weather data

Figure 2: Minimum and maximum temperatures, cumulative rainfall and soil water content recorded at trial 3 (updated since milestone 3). Soil type: Humic gley, alluvial plain.

Weed population in untreated controls

The weed population was mainly composed of grasses (mainly sour grass perennial and paspalum and broadleaves (square weed, sensitive weed and some ludwigia and sida). There was only a small amount of vines (calopo) and sedges.
Herbicide efficacy in this trial was lower than normal because of extreme environmental conditions (flooding, then hot and dry). Diuron high rate still tended to achieve the best weed control whereas herbicides like Amicarbazone, Imazapic and Diuron low rate did not reduce the weed population by more than 60% and Metolachlor and Isoxaflutole efficacy was always less than 40%.
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Figure 4: Mean of percentage reduction of total weed coverage compared to the adjacent untreated controls in trial 3.

**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
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.