

Weed management in sugar cane: critical periods of weed competition and mechanisms of interference from *Paspalum paniculatum* and *P. urvillei*

By

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DECLARATION

I declare that the thesis, which I hereby submit for the degree of PhD (Agronomy) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature

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LIST OF ABBREVIATIONS

- a.e. - acid equivalent
- a.i. - active ingredient
- AYL - acceptable yield loss
- CPWC - critical period of weed competition
- CV - coefficient of variation
- GDD - growing degree days
- IWM - Integrated Weed Management
- L_w - relative leaf area
- MSIRI - Mauritius Sugar Industry Research Institute
- MUR - Mauritian rupee
- q - relative damage coefficient or relative competitiveness value
- TD - transplanting date
- WAH - weeks after harvest
- WAP - weeks after planting
- WAS - weeks after spraying
- WAT - weeks after transplanting

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ABSTRACT

The aim of this project was to provide sound scientific underpinning for the development of new weed management strategies in sugar cane by exploring competition from the major weeds, and explaining the different mechanisms of weed interference from *Paspalum paniculatum* and *P. urvillei*.

Critical periods of weed control (CPWC) were studied in six field trials. In ratoon cane, CPWC with natural weed infestations started between 228 and 916 growing degree days (GDD), and ended between 648 and 1311 GDD, depending on the site and cane variety. These results represented a maximum CPWC of 12 to 28 weeks after harvest (WAH). In plant cane, the CPWC started earlier (6 WAP) and was longer than those in ratoon cane.

Relative competitiveness 'q' values of eight common weed species showed that sugar cane was a stronger competitor than most of the weeds tested. The adverse effect of weed competition in sugar cane is not experienced before several weeks following weed emergence. Weeds transplanted 10 WAP caused no significant change in cane yield response as compared to those transplanted 4 WAP. *Paspalum paniculatum* was often found to be more competitive than *P. urvillei*, although the latter produced more leaf area and grew taller to intercept more light within the canopy. This indicated that other mechanisms of weed interference were involved and competition for light was more important during the earlier (tillering) growth stages. Root competition was shown to be as important as shoot competition. Root competition effects were observed several weeks after imposing competition, suggesting that it was more important than competition for light in the post-tillering phase. Application of root exudates from the two grasses to sugar cane confirmed an allelopathic effect on the

root biomass of sugar cane. One chemical identified in the leachates from both *Paspalum* species for the allelopathic effects was 2-propenoic acid, 3-(4-methoxyphenyl).

The main implications of the above findings for the Mauritian sugar industry would involve a change in the timing of application of herbicides. A new tank-mix consisting of trifloxysulfuron + ametryn and amicarbazone has been found to meet this objective. This strategy will enable a saving of at least one herbicide treatment per season.

Key words: relative competitiveness, shoot competition, root competition, allelopathy, herbicide