SHORT COMMUNICATION

INTEGRATED WEED MANAGEMENT FOR SUGARCANE FIELD VERGES: *MELINIS MINUTIFLORA* AND *CYNODON DACTYLON* ENCROACHMENT

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Abstract

Creeping grasses are considered the most costly weeds in the South African sugar industry, drastically reducing yields and, in extreme cases, even killing the sugarcane crop. *Cynodon dactylon* commonly encroaches into fields from surrounding areas, e.g. cane breaks and roadsides, requiring frequent and costly encroachment control. Measures for controlling the weed involve mechanical mowing and/or repeated chemical treatment with glyphosate, paraquat plus diuron, and imazapyr. An innovative solution may involve planting of a non-invasive, strongly aromatic tufted grass, *Melinis minutiflora*. In previous work in habitat management field trials against *Eldana saccharina*, a potential added benefit of this grass was the observed strongly competitive interaction between it and *C. dactylon*, especially where a *M. minutiflora* 'barrier hedge' was planted on field margins. Following this, more detailed work involved comparing biomass of these two grass species where they occurred together. In trials at Port Shepstone and Mount Edgecombe, results indicated that biomass of *C. dactylon* was severely or completely suppressed under *M. minutiflora*, which had formed an effective barrier against this weed and prevented encroachment into the field. *M. minutiflora*, in return, did not encroach into the adjacent sugarcane. Recommendations are being formulated to include using *M. minutiflora* as part of an integrated strategy to better manage *C. dactylon*.

Keywords: sugarcane, *Cynodon dactylon, Melinis minutiflora,* weed control, grass weeds

Introduction

In agricultural crops, weed control using herbicides is costly. Sugarcane is no exception. For example, in Louisiana sugarcane growers spend in the region of $1.7 billion on herbicides each year. However, the impact of perennial and annual weeds that occur in the crop, particularly in the later ratoons, can reduce yields by 40-80% if not controlled (White and Richard, 2005). In addition, herbicide resistance is a real threat in sustained herbicide use. Hurley *et al.*(2009) state that in the United States in 1996, no weed species were known to be resistant to glyphosate. However, by 2008, resistance to glyphosate had been confirmed for 16 weed species worldwide. In Heap's (2010) interactive website, herbicide resistant weed species now number 195. This potential risk of herbicide resistance developing in South African sugarcane is demonstrated in control efforts against three creeping grass species, *Cynodon dactylon, Cynodon nlemfuensis*, and *Digitaria abyssinica.* Because of historically repeated applications of glyphosate, current practical field application rates are higher than stated label rates.

However, in recent years in South Africa, considerable success has been achieved with more ecological and sustainable weed management using green manure crops. An unusual finding in a project using a stimulo-deterrent approach to manage the sugarcane stem borer, *Eldana saccharina* Walker (Lepidoptera: Pyralidae), was that where the grass *Melinis minutiflora* was planted, weed suppression of up to 79% was recorded (Barker *et al.,* 2006). This paper reports on trials in different parts of the South African sugar industry to investigate this further. These observations could have major impacts on the management of sugarcane field margins to prevent encroachment of the creeping grass *C. dactylon* into sugarcane stands.

Materials and Methods

Sites where *M. minutiflora* was established at Port Shepstone and Mount Edgecombe were used in this study. Plugs of *M. minutiflora* were planted 25 to 50 cm away from the cane row and 50 cm apart. When the grass was mature, at Mount Edgecombe 50 x 50 cm quadrats were placed adjacent to each other, the first butting onto the sugarcane at the edge of the field, the second next to it, but coming away from the cane row at right angles. Smaller 25 x 25 cm quadrats were used at Port Shepstone, with the first one positioned similar to that at Mount Edgecombe, i.e. butting onto the cane, the next butting onto the side of this quadrat furthest from the cane. The third quadrat butted onto the second, again on the side furthest from the cane. Five quadrats were positioned in this fashion until the roadway was reached. The above-ground vegetation in each quadrat was cut to ground level using secateurs, and the above-ground vegetation biomass was divided into '*M. minutiflora'*, '*C. dactylon'* and 'other plants'. Each of these categories were placed in labelled separate brown paper bags, brought back to the laboratory and oven dried at 80ºC, until constant mass was recorded. Five sets of such quadrats were taken at Mount Edgecombe and six at Port Shepstone.

The individual masses of each plant category in each quadrat was recorded and summed. Percentage contribution of each was calculated by dividing the above-ground biomass of the individual plant category into the total biomass recorded in each quadrat. These measurements were then averaged for the quadrats closest to the sugarcane row, the quadrats adjacent to that, and then the quadrats moving onto the road side. This allowed the determination of the major contributors to the above-ground biomass moving away from the sugarcane, through the row of *M. minutiflora* onto the road side of the fields.

Results

Table 1 shows that at all sites, *C. dactylon* biomass declined to almost nothing from the road side quadrats, through the *M. minutiflora* into the quadrat adjacent to the sugarcane row.

Table 1. Percentage above-ground biomass contribution of the *Melinis minutiflora, Cynodon dactylon* and other plant components in the contiguous quadrats from the sugarcane row through the fringing *M. minutiflora* onto the road side.

Distance from cane row (cm)	Mount Edgecombe (% above ground biomass)			Port Shepstone (% above ground biomass)		
	Cynodon dactylon	*Melinis minutiflora*	Other plants	*Cynodon dactylon*	*Melinis minutiflora*	Other plants
0-25	9.5	90.5	0	1.1	98.9	0
25-50				0.5	99.2	0.3
50-75	100	0	0	4.4	95.6	0
75-100				8.3	90.6	1.1
100-125				86.0	12.3	1.7

Discussion

As initially demonstrated by Barker *et al*. (2006), it is clear that *M. minutiflora* impacts on plants that are shorter when these are growing in the same environment, and/or where this grass established before the other plants in that environment. Once it has established, it forms a dense above-ground biomass sward (Figure 1).

Figure 1. A dense stand of *Melinis minutiflora* with its red flower heads adjacent to a mature sugarcane stand. Note the absence of other plants in the *M. minutiflora* sward.

It is not clear whether the competitive advantage of *M. minutiflora* comes wholly from the shading effect it has on the other plants, or whether this advantage is also partially due to allelopathy. The latter has been demonstrated by Khan *et al.* (2001) with another plant used in stimulo-deterrent trials emitting the same volatiles as *M. minutiflora.* In this case the legume (*Desmodium uncinatum*) caused suppression of witchweed (*Striga hermonthica*) when it was planted in maize fields to manage maize stemborers and their parasitoids. These modes of action still need investigation.

Recent observations show that *M. minutiflora* also shows promise in controlling two other serious creeping grass species, *Cynodon nlemfuensis* (stargrass) and *Digitaria abyssinica* (digitaria). Further work is planned to quantify responses between these species.

Conclusion

Irrespective of its mode of action, *M. minutiflora*, when planted as a row along a sugarcane field edge, prevents encroachment of creeping grasses such as *C. dactylon* and other weeds into sugarcane. It thus provides an additional low cost and sustainable management option to prevent encroachment of weeds from roadways, and other breaks in sugarcane. This adds to the published benefits it has in management of *E. saccharina* populations, and as a good pasture grass.

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