POSTER SUMMARY

AN INVESTIGATION OF IPM PRACTICES FOR PEST CONTROL IN SUGARCANE

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Abstract

Integrated Pest Management (IPM) covers a wide range of control methods available to growers to mitigate the impact of pests on yields and quality. However, some control methods are not suitable for emerging farmers, an increasingly important sector of the industry. This study, comprising six stages, addresses the current status of IPM in the South African sugar industry and highlights gaps that might warrant future research. First, a list of industry pests was compiled. This included five weed categories, 11 arthropod, 11 pathogen, and three nematode species. Current control methods were then identified. This list included 15 agronomic, three biological and four chemical control methods, together with three regulatory approaches. The applicability of these practices was tabulated for each of 30 pests, and their suitability for adoption by emerging farmers identified. The results were analysed and summarised to identify trends. Agronomic methods were shown to be the most widely applicable for pest control in sugarcane. While regulatory and biological control options were applicable to all farmers, some methods in the agronomic and chemical control categories were not suitable for emerging farmers. The reasons for this were mainly cost-related, e.g. application of agrochemicals. Research gaps were identified, and eight pests were regarded as potential bio-security risks requiring future research efforts. Nine potential pest control methods were identified that may add value to further enhance existing IPM strategies in sugarcane. As the final stage of this study, IPM was demonstrated on a whole-farm scale.

Keywords: sugarcane, IPM, pest control, emerging farmers

Introduction

Sugarcane may be affected by insect, pathogen, weed and nematode pests (Leslie, 2004). Pests in this paper include weeds and pathogens (Sanyal _et al_. 2008). Some pests have serious economic consequences, reducing the value of crops to below economic thresholds. For example, eldana (_Eldana saccharina_ Walker) can totally destroy the crop (Leslie, 2009), rust (_Puccinia melanocephala_ H&P Sydow) and smut (_Ustilago scitaminea_ H&P Sydow) reduce yields on average by 30% (Rutherford _et al_., 2003), _Cynodon dactylon_ (L) Pers can reduce yields by up to 50% (Campbell _et al_. 2007), and high nematode populations can cause 60-80% yield losses (Spaull & Cadet, 1990). Control methods are available for these pests, but are often used in isolation rather than being integrated in an optimum manner. In this paper, the feasibility of an integrated management approach is investigated. Integrated Pest Management (IPM) is the knowledge-based integration of all methods that reduce pest levels in crops (Conlong & Rutherford, 2009). As such, IPM covers a wide range of pest control methods, including chemical, biological, agronomic, and regulatory practices that growers can use to mitigate the impact of pests on yields and quality. However, some control methods are not readily adopted by emerging farmers, an increasingly important sector in the industry (Eweg, 2005). This should be quantified to determine how well the needs of this sector are currently being addressed, and to guide future research. The aims of this study were (i) to produce comprehensive lists of the current and potential pests in the industry, (ii) to list the available control methods, (iii) to analyse the suitability of control methods for each pest, and (iv), to illustrate the use of IPM on a whole-farm and area-wide scale.

Methods and Materials

This study comprised six stages. 1) researchers drew up a list of industry pests; 2) current control methods affecting pest levels were identified; 3) the control methods were tabulated for each pest, highlighting the suitability for emerging farmers; 4) a matrix was developed that indicated the control methods applicable for each identified pest. Scores were then allocated for each control method depending on the number of pests that could be controlled by the method; 5) research gaps were identified; 6) IPM was demonstrated on a whole-farm and area-wide scale.

Results and Discussion

A list of 11 arthropod, 11 pathogen, three nematode species and five weed categories was compiled (Figure 1). For stage 2, 15 agronomic methods, three biological control methods, four chemical control methods, and three regulatory approaches were identified (Figure 1).

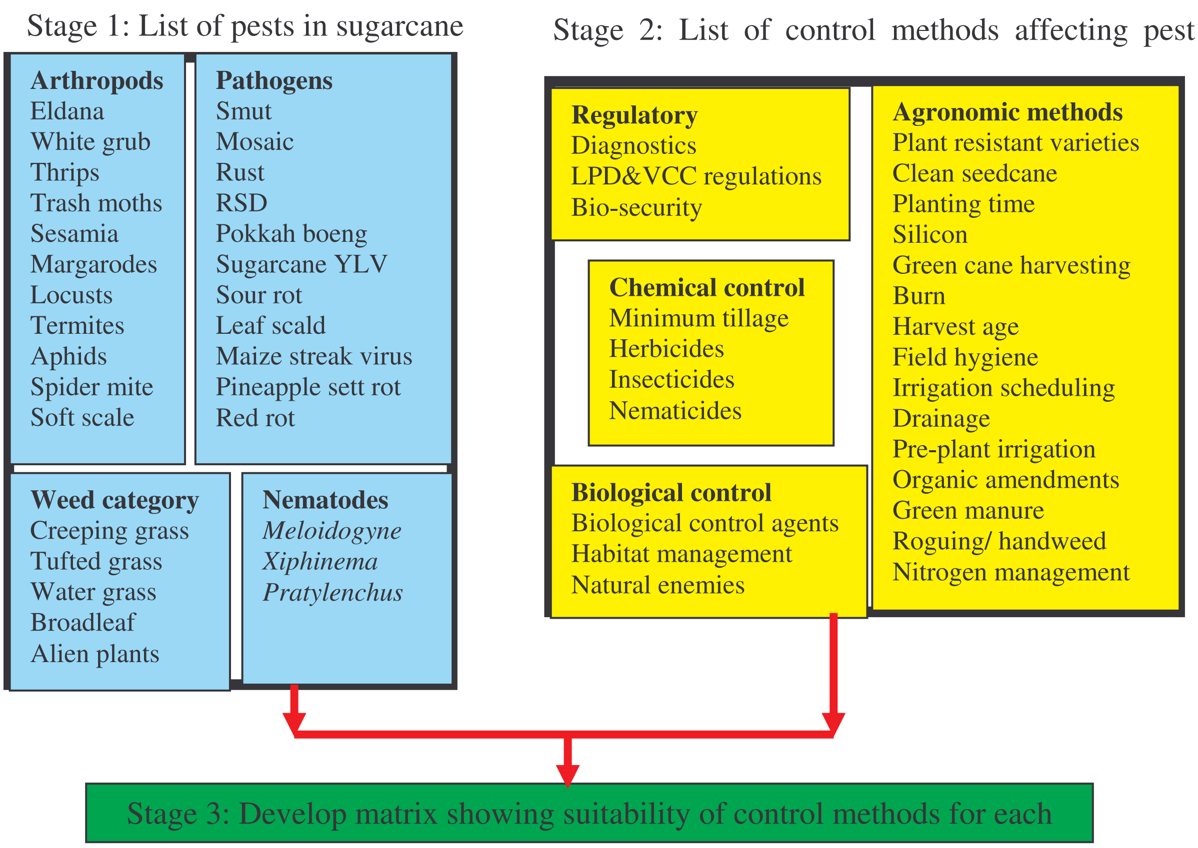

Figure 1. Lists of identified pests and control methods used to develop a suitability matrix.

Agronomic methods include those that improve soil health, thereby increasing crop resistance to pests such as weeds and nematodes (van Antwerpen, 2005; Berry and Rhodes, 2006; Rhodes *et al*., 2009). Regulatory approaches by Local Pest, Disease and Variety Control Committees (LPD&VCCs) include diagnostics (threshold values and surveillance) and regulations governing orders for plough-out and seedcane transport, as well as bio-security (prevention of the introduction of new pests). For the latter, imported varieties are screened before permitting external sugarcane consignments from being planted, thereby becoming a control method that prevents pests spreading into the local industry (van Antwerpen *et al*., 2005). Biological control methods include release of agents for alien plant control, natural enemies (e.g. parasitoids) for eldana, and habitat management. The latter includes the judicious planting of 'push-pull' species (BT maize, *Melinis minutiflora, Cyperus dives*) that attract or repel eldana away from sugarcane (Conlong and Rutherford, 2009). Chemical control methods include application of herbicides to control weeds (Campbell, 2008) or for cane stool eradication (minimum tillage), fungicides to control diseases such as smut and sett rots, Fastac® for eldana control in carry-over sugarcane (Leslie *et al.*, 2006), and nematicides to control root-feeding nematodes in sugarcane (Donaldson, 1985).

A summary of scores from the pest x control method matrix tables is presented in Table 1, highlighting their applicability to commercial and emerging farmers. Agronomic methods were the most frequently used approaches to pest control in sugarcane. Highest scoring agronomic practices used to control all 30 listed pests in sugarcane were: planting of pest-resistant varieties, practicing field hygiene, selecting the best planting time, and planting clean seedcane. Regulatory and biological control methods were applicable to all farmers, whereas seven agronomic and eight chemical control methods were not currently suitable for emerging farmers. This was primarily cost-related, e.g. chemical control.

Table 1. Summary of total scores from the pest x control method matrix tables.

Control method	Commercial farmer	Emerging farmer	Difference
Agronomic	79	72	**-7**
Regulatory	34	34	**0**
Chemical	18	10	**-8**
Biological	6	6	**0**
Total	**137**	**122**	**-15**

For stage 5, research gaps were identified. Here, eight pests were regarded as potential bio-security risks, requiring future research efforts. These included one pathogen (orange rust, *Puccinia kuehnii* EJ Butler), three arthropods (*Chilo sacchariphagus, Sesamia* spp., *Busseola* spp.) and four weeds (*Digitaria* spp., *Conyza*, *Parthenium* and *Cyperus rotundus*). Nine potential control methods were identified for possible future research; four agronomic, four chemical and one biological approach. It was recognised that further research efforts should consider suitability for use by emerging farmers.

An integration of methods for seven important industry pests was illustrated with a whole-farm scale map, based on its land-use plan, with timetables for action (e.g. harvesting). For example, the damage from eldana was expressed as percentage stalk length red (%SLR) on a per field basis (Figure 2a). Recommended treatments for eldana control were related to the severity of the damage (Refer to Figure 2b). Options were to (a) leave the field (eldana levels were below the economic threshold), (b) harvest the field (agronomic control) rather than 'carrying over' the sugarcane after mill closure, (c) habitat management (biological control) or (d) aerial application of Fastac® (chemical control) to carry-over fields (Figure 2b). Use of such recommendations need to be adapted to local conditions, as discussed by McElligott (2008). Some control methods would not be restricted by farm boundaries, and are well suited to area-wide use, e.g. release of biological control agents, habitat management, diagnostics and LPD&VCC regulations (Conlong and Rutherford, 2009). Refer to Figure 2b.

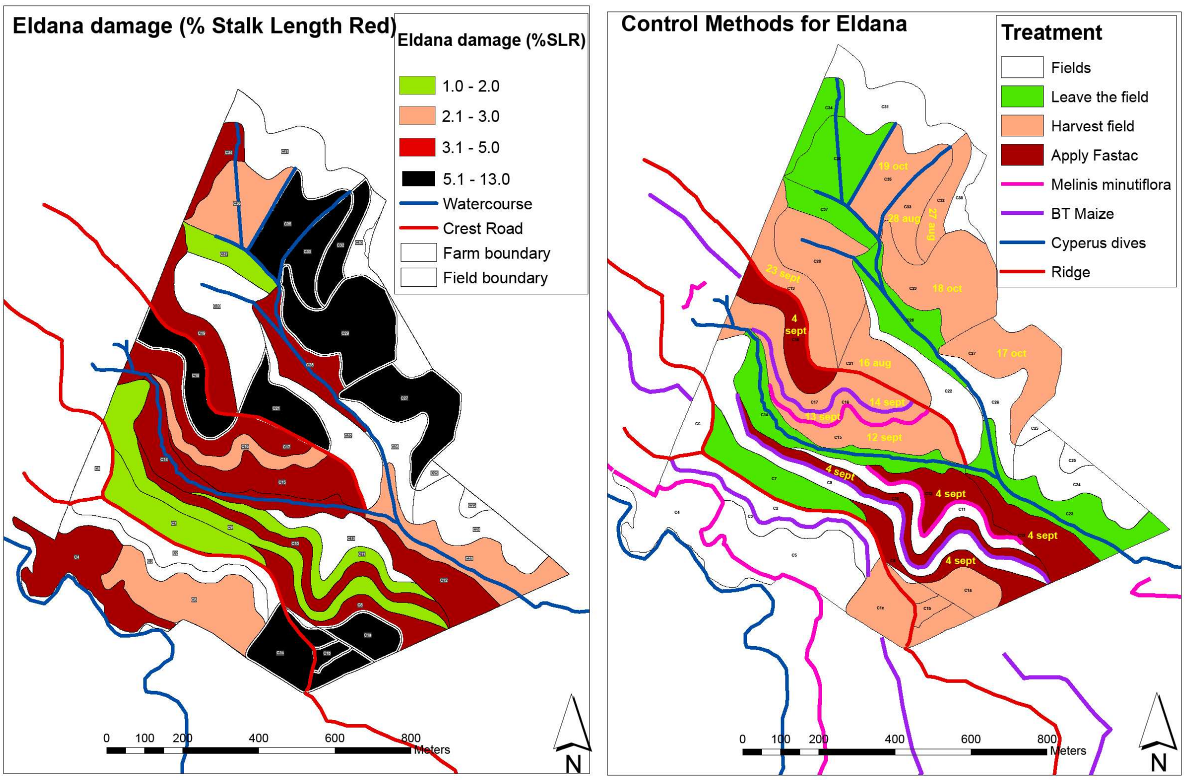

Figure 2. A) Eldana damage in sugarcane, B) IPM recommendations for eldana.

Conclusions

- While many of the control methods presented can be adopted by emerging farmers, suitability for adoption was constrained largely by cost, for example, chemical control. Future research should consider this factor, as this is recognised as an increasingly important industry sector.
- High-ranking pests do not always have a commensurate number of control options. For example, white grub, rust, purple water grass.
- Pests identified as potential bio-security risks will require timely research effort.
- Agronomic methods of control were shown to be the most widely applicable to control pests in sugarcane. Highest scoring agronomic practices for pest control were: planting of pest-resistant varieties, practicing field hygiene, selecting the best planting time, and planting clean seedcane.
- An holistic approach that implements IPM for all pests on a farm-scale and even area-wide scale is considered to be more cost-effective, more environmentally friendly, more sustainable, and more easily adopted by all farmers.

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