

SHORT, NON-REFEREED PAPER

LARGE-SCALE SUGARCANE FARMERS' KNOWLEDGE AND PERCEPTIONS OF *ELDANA SACCHARINA* WALKER (LEPIDOPTERA: PYRALIDAE) AND PUSH-PULL

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Abstract

Understanding farmers' perceptions of pests and pest management has been shown to improve rates of adoption of pest management strategies, in particular for knowledge intensive area-wide integrated pest management (AW-IPM). A push-pull or habitat management strategy for controlling *Eldana saccharina* is being promoted as part of an AW-IPM programme in the South African sugar industry. Fifty-three sugarcane farmers were interviewed using a semi-structured questionnaire. Results showed that 77% of the farmers have tertiary education, and 42% have farmed sugarcane for over 20 years. Respondents recognised the threat which *E. saccharina* posed, and 83% had heard of push-pull and AW-IPM. Of the farmers who had discussed push-pull and AW-IPM with other farmers, 78% indicated discussions had been positive. They suggested model farms and field days for disseminating information about push-pull. Furthermore, potential barriers to adoption of push-pull would likely be farmers' mindsets, perceived costs and time constraints. These results will be used to formulate future push-pull and AW-IPM dissemination activities amongst large-scale sugarcane growers in South Africa.

Keywords: integrated pest management, AW-IPM, technology adoption, agricultural extension

Introduction

For successful implementation of knowledge intensive pest management strategies such as area-wide integrated pest management (AW-IPM) and push-pull, understanding farmers' perceptions of pests and pest management is important (Röling *et al.*, 2004; Meir and Williamson, 2005; Khan *et al.*, 2008). Despite ongoing control efforts, *Eldana saccharina* Walker (Lepidoptera: Pyralidae) is still the most damaging insect pest of sugarcane in South Africa (Goebel *et al.*, 2005). *Eldana saccharina* is a growing threat to sugarcane production and implementation of effective, sustainable control measures is crucial (Webster *et al.*, 2005; 2009). Push-pull is being promoted as part of an AW-IPM strategy for control of *E. saccharina* (Conlong and Rutherford, 2009; Rutherford and Conlong, 2010; Webster *et al.*, 2005). To facilitate successful implementation of push-pull at farm level, a survey of large-scale sugarcane farmers in

KwaZulu-Natal was completed to determine their knowledge and perceptions of *E. saccharina*, push-pull, AW-IPM, and their pest management practices.

Materials and Methods

Study area and sample selection

The Midlands North region supplies sugarcane to the Illovo Sugar (South Africa) Limited mill at Noodsberg (29°21'38.83"S, 30°41'13.37"E) and to the UCL Company Limited mill at Dalton (29°20'18.07"S, 30°37'41.23"E) in KwaZulu-Natal. Since 1998, large-scale growers (LSGs, or commercial farmers) in this area have been involved in environmentally sustainable sugarcane management practices. Noodsberg Cane Growers Association drew up an environmental management system and farms were grouped into eco-zones with similar climate and potential for producing sugarcane (Maher and Schulz, 2003). Webster *et al.* (2005, 2009) reported on the initial implementation of an AW-IPM management system in the area. Based on these activities, Midlands North was chosen as the study area for further implementation of push-pull, as farmers, extension staff and the Local Pest, Disease and Variety Control Committee (LPD&VCC) have shown commitment to environmentally sustainable management of sugarcane.

Using random stratified sampling 53 LSGs were selected for survey interviews from across all eco-zones in the Midlands North region (30% of LSGs currently registered on the LPD&VCC database).

Survey methodology and analysis

Farmers were interviewed on their farms using a semi-structured questionnaire. Farmers were asked their age, education, whether or not they had attended the SASRI Senior Certificate Course in Sugarcane Agriculture, years of farming experience and their relationship to the farm (manager, owner or owner-manager). The questionnaire included open-ended and closed questions (Fink, 2009) in the following categories:

- Sugarcane management and insect pests
- *E. saccharina*, AW-IPM and push-pull
- Dissemination of information on pests and pest management.

Survey question design followed guidelines from Fink (2009). Closed questions used categorical rank order scales and Likert-type ordinal scales. For rank order scales, respondents were given five to six factors per question: the top ranked was to be assigned number 1, the bottom rank number 5 or 6. In Likert-type ordinal scales, respondents were asked to express their opinions on a specific topic in a range from 'strongly agree' to 'strongly disagree'. Guidelines for effective survey interviews, including pre-testing of the questionnaire, were followed to ensure that reliable, quality data was collected and that correct social research ethics were followed (Babbie, 2010).

Responses to questions were coded prior to analysis. A content analysis was completed on open-ended questions to identify recurrent themes which could be quantified to determine farmers' perceptions (Fink, 2009). Descriptive statistics were used to analyse and report farmers' responses to questions. Due to the non-parametric nature of the ranking data, a Wilcoxon signed

ranks test was conducted to determine whether there was a significant difference between median rank scores for pairs of variables. A Bonferroni correction was applied to the p values from the Wilcoxon signed ranks tests because multiple comparisons inflate the Type I error rate. Significance was set at the 95% confidence level.

Results and Discussion

Respondents' profiles

- Sixty per cent of farmers were aged 41-60 years and 36% were aged 18-40 years old.
- All were men.
- Seventy-seven per cent of farmers completed tertiary education; 53% studied agriculture at tertiary level and 56% completed the SASRI Senior Certificate Course in Sugarcane Agriculture.
- Forty-two per cent of respondents had farmed sugarcane for over 20 years and 28% had farmed for 10 to 20 years.
- Eighty-three per cent of farmers were either owners or owner-managers of their farms.

Farmers in Midlands North have a high level of education and a lot of farming experience. Higher levels of education have been linked to higher adoption rates in other studies (e.g. Waller *et al.*, 1998). Farmers with high land tenure security who own, rather than lease or manage farms, have been shown in some cases to more readily adopt environmentally sustainable practices with long-term benefits (Soule *et al.*, 2000). Knowler and Bradshaw (2007) and Kaine and Bewsell (2008) argue that local context, i.e. agro-climatic and soil factors, such as those which determine the eco-zone delineations in Midlands North, play a more important role in adoption decisions than do demographic and general enterprise factors such as farmer age, experience and land tenure. Thus, experiential learning activities with small, local groups of farmers are suitable for introducing new AW-IPM strategies.

Crop production constraints and pests

When asked to rank rainfall, soil, frost, variety choice, diseases and insects in order of their constraint to sugarcane production, farmers most often ranked rainfall as most constraining and insect pests as least constraining. Farmers ranked *E. saccharina* as the worst, white grub (Scarabaeidae) as the second and *Sesamia calamistis* as the third worst insect pests on their farms (*E. saccharina* median rank=1, white grub median rank=1.5, *S. calamistis* median rank=2, where 1=worst problem, 5=least problem). The difference between the median ranks of these three pests was however not statistically significant (*E. saccharina**white grub $Z=1.82$, $p=0.691$; *E. saccharina***S. calamistis* $Z=0.77$, $p=4.440$; *S. calamistis**white grub $Z=0.97$, $p=3.345$). Thirty per cent of farmers had used insecticides for white grub or nematode control and none had used insecticides against *E. saccharina*.

Eldana saccharina knowledge, perceptions and practices

Responses to questions regarding *E. saccharina* (Figure 1a) indicated that farmers are aware of *E. saccharina* and they do perceive the borer as a threat, which is confirmed by the farmers' ranking *E. saccharina* as the worst insect pest. On average, correct cutting cycle and field hygiene (cultural control) were ranked the most used measures for managing *E. saccharina* (median rank=1, where 1=most used management practice, 5=least used), and insecticides were

the least used measure (median rank=5). The Wilcoxon signed rank test indicated no significant difference between the median rank for cutting and hygiene and the median rank for insecticides ($Z=3.75, p=0.077$).

Knowledge and perceptions of push-pull and AW-IPM

Farmers’ responses to questions on push-pull and AW-IPM (Figure 1b) indicated that most farmers had heard of push-pull and AW-IPM. Many farmers had had positive discussions regarding push-pull and most were prepared to participate in further research on these topics.

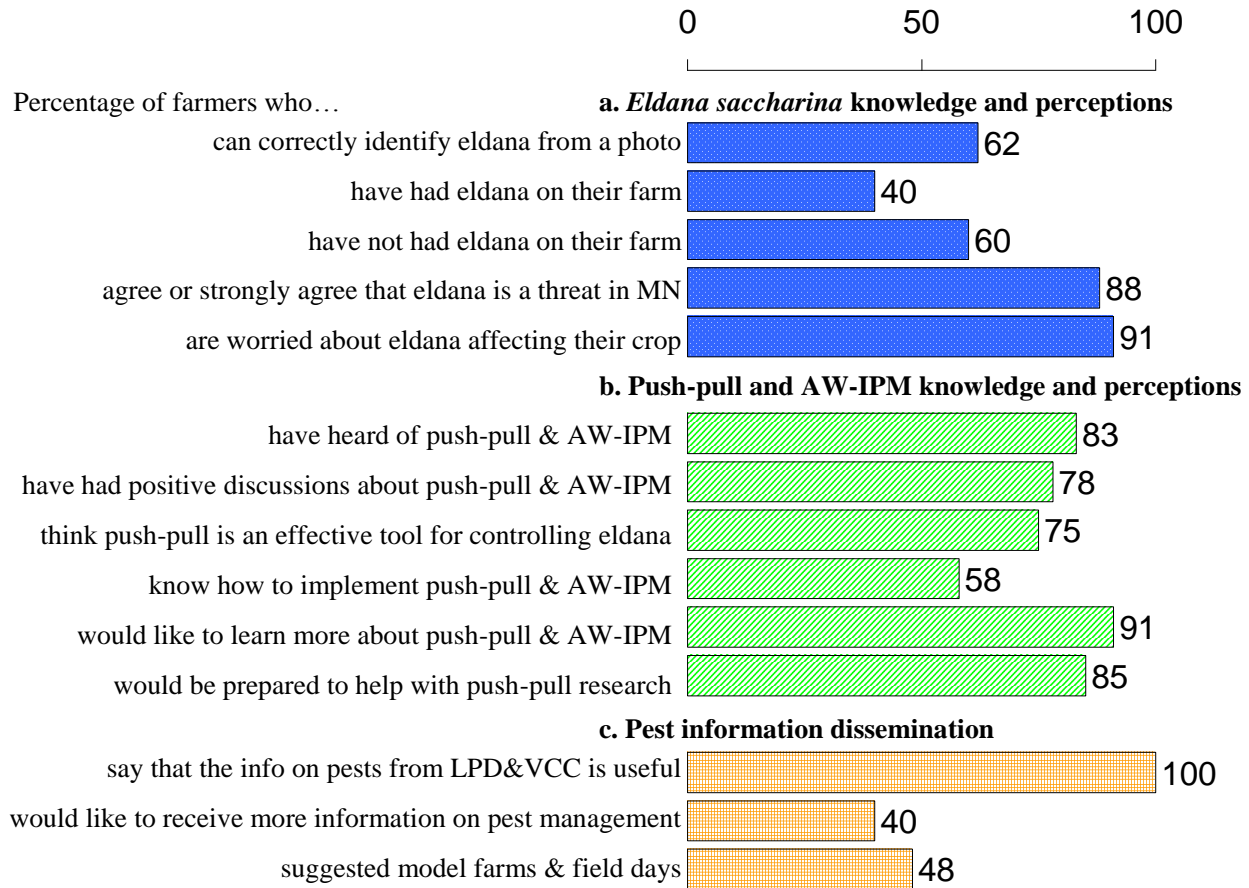


Figure 1a-c. Summary of key descriptive statistics from survey interviews reported in frequency percentages (N=53).

Dissemination of pest management information

Farmers’ responses to questions on dissemination of pest information (Figure 1c) show that farmers found information they received from the LPD&VCC useful, and 40% indicated that they would like to receive more information on pest management. When farmers were asked to rank five different methods of disseminating information on pest management, model farms and field days were ranked highest (model farm median rank=1, field day median rank=1), and pamphlets and workshops lowest (pamphlets median rank=4, workshops median rank=4). The Wilcoxon signed rank test indicated a significant difference between the ranks for both model farms and field days compared to both pamphlets and workshops (model farms*pamphlets

$Z=3.75$, $p=0.002$; field days*pamphlets $Z=4.03$, $p<0.001$; model farms*workshops $Z=4.412$, $p<0.001$; field days*workshops $Z=4.10$, $p<0.001$). This emphasizes farmers' preferences for hands-on, farm-based learning opportunities.

Farmers suggested model farms and field days as appropriate methods for disseminating information on push-pull, which is consistent with literature on effective AW-IPM dissemination practices (Peshin *et al.*, 2009). This highlights the importance of social and experiential learning (Röling and Wagemakers, 2000; Meir and Williamson, 2005). Some farmers indicated that the LPD&VCC should be more directly involved in implementing push-pull. When asked to identify potential barriers to adoption of push-pull, respondents listed farmers' mindsets, cost and time constraints, and insufficient knowledge.

Conclusions

Large-scale sugarcane growers in the Midlands North region are well educated and experienced, and most own the land on which they farm. They are aware of *E. saccharina* and recognise its threat to sugarcane production. Overall, farmers demonstrated a positive attitude towards push-pull and AW-IPM. If farmers' suggestions of farm-based, social and experiential learning activities to disseminate knowledge are incorporated into the implementation activities for push-pull and AW-IPM at a local eco-zone level, the likelihood of farmers in the Midlands North area adopting push-pull and AW-IPM is high.

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