SHORT, NON-REFEREED PAPER

ESTIMATING THE POTENTIAL ECONOMIC BENEFIT OF EXTENDING THE HARVESTING CYCLE OF DRYLAND COASTAL CANE BY CHEMICALLY SUPRESSING ELDANA LEVELS

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Abstract

The recommended age at harvest for coastal rainfed cane on the North Coast was 18 months, until 1978, when eldana's presence became recognised as a significant threat. Various changes in agronomic practices were soon adopted to minimise the impacts of eldana on sugarcane yield and quality, the most effective being a reduction in harvest age to 13-15 months. While effectively minimising eldana damage, a less than optimal crop age at harvest has resulted in increased costs due to the increased area to be ratooned, as well as lower revenues resulting from a reduction in cane quality and yields. However, in late 2015, the registration of new eldana suppression chemicals utilising diamide and oxadiazine chemistries has augmented the opportunity for the lengthening of growing cycles in coastal and hinterland regions. Using Microsoft Excel® modelling, this desktop study estimates the economic cost versus benefit of ageing dryland coastal cane from an average of 13 to 16 months in the presence of chemical eldana suppression. The model considers the costs associated with planting, ratoon management, eldana suppression, and extraction in each scenario as well as the changes in cane yield and quality. The results indicate that, whilst the initial cash flow will be negatively affected, the long-term gains warrant the adoption of a stagey of extending the harvesting cycle of coastal cane. It is envisioned that the modelling developed in this study will be applied to on-farm trial results in the future, taking into account varietal and climatic differences.

Keywords: harvest age, harvesting cycle, area under cane, eldana, economic benefit, North Coast

Introduction

Physical cane damage, which reduces quality and yield, can be regarded as the direct impact of the stalk borer *Eldana sacchrina* Walker (Lepidoptera: Pyralidea) (eldana). This direct impact has been estimated for the South African sugar industry (Rutherford, 2015). Less obvious, however, is the indirect impact of eldana, particularly with respect to dryland coastal farms where eldana is more prevalent. Prior to 1978, when eldana's presence became recognised as a significant threat, the recommended age at harvest for coastal rainfed cane on the North Coast was 18 months (Rutherford, 2015).

Various changes in agronomic practices were soon adopted to minimise the impacts of eldana on sugarcane yield and quality, the most effective being a reduction of harvest age to 13-15 months. While effectively minimising eldana damage, a less than optimal crop age at harvest has been linked with an increased incidence of creeping grass infestations, particularly

Cynodon dactylon ([1]personal communication). The net outcome has been an increase in production costs due to the increased area to be ratooned and replanted, as well as lower revenues resulting from a reduction in Recoverable Value (RV) yields. Indeed, assuming the absence of eldana, a simulation was run through the MyCaneSim model to compare a 12 month cycle with an average 18 month cycle, which showed an average annualised increase in RV per hectare of 36% at the longer cycle (Rutherford, 2015).

Until recently, pyrethroids were the only Mode of Action (MoA) registered for eldana control. In late 2015, however, two new MoAs, diamides and oxadiazines, were registered for eldana control, offering superior eldana control per application and reduced application frequencies. The introduction of these new eldana suppression chemicals has augmented the opportunity for the lengthening of growing cycles in coastal and hinterland regions.

Ramburan *et al.* (2016) analysed a series of trials evaluating RV yields of different varieties harvested at either 12 or 18 months of age. They found that harvesting three 12 month crops of some varieties was more profitable than harvesting two 18 month crops. Importantly, however, all these trials were conducted in the <u>absence</u> of eldana control and therefore this conclusion is both logical and helps explain the reason why, in the absence of eldana control, a 12 month cycle is the recommended practice under coastal growing conditions.

Critically, the authors are unaware of any harvesting cycle trials that have been conducted with the incorporation of chemical eldana suppression, and in particular, utilising the recently registered MoAs. Accordingly, the objective of this desktop study is to model the potential economic benefit of extending the cutting cycle of dryland coastal cane in the presence of the effective chemical suppression of eldana levels using simulated yields for different harvest ages.

Methodology

Using Microsoft Excel® modelling, this desktop study estimates the economic cost versus benefit of extending the harvesting cycle from an average of 13 to 16 months in the presence of chemical eldana suppression under North Coast dryland growing conditions. The model strictly considers the costs associated with planting, ratoon management, eldana suppression and extraction (a term referring to harvest, infield loading, infield haulage, transhipment and haulage of the cane to the mill) in each scenario as well as the changes in cane yield and quality.

For illustrative purposes, a representative North Coast subject farm, to the extent of 250 hectares area under cane (AUC), was analysed under two harvesting cycle scenarios, 13 and 16 months respectively. Table 1 details the subject farm criteria and assumptions applied in the model. Yields under the two scenarios were based on simulated SASRI growth increments under moderate growth conditions on the North Coast – an average monthly growth rate of 3.87 tons (Jones and Singels, 2015). Cane quality, quantified as RV content of fresh cane, for cane at 16 months was assumed to be 0.2 units higher than cane at 13 months – although anecdotal evidence suggests that the increase in RV applied may be conservative. It is also assumed that the baseline costing information for the two scenarios remained the same, except for ratoon management which is assumed to be higher under the 16-month scenario due to an increased nitrogen and potassium requirement for a higher expected yield.

In both scenarios, the model assumes that all carry-over cane is sprayed with eldana suppression chemicals (a combination of the available MoAs). Carry-over cane is defined in this study as the cane which is not harvested in a season and which is carried-over into the

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following season to be harvested; this includes plant carry-over. Since a lower proportion of AUC is harvested annually in the 16-month cycle, the area carried-over, and thus sprayed with eldana suppression chemicals, will be higher than the 13-month cycle. All input cost and pricing figures are estimations for the 2017/18 season.

Table 1. Subject farm criteria and assumptions.

Cutting cycle scenario:	13-months	16-months
Area under cane (ha {AUC})	250	250
Proportion of AUC Cut (%)	**92.31**	**75.00**
Cane yield (tons per ha cut)	**50.31**	**61.92**
RV content (%cane)	**11.90**	**12.10**
RV yield (tons per ha cut)	**5.99**	**7.49**
RV yield (tons per ha AUC i.e. annualised)	**5.53**	**5.62**
RV produced (tons per annum)	**1382**	**1405**
RV Price (R per ton)	R 4 700	R 4 700
Replanting costs (R per ha) (10% of harvest area is assumed per season)	R 25 711	R 25 711
Chemical eldana suppression costs (R per ha) (on all carry-over cane)	R 3 200	R 3 200
Ratoon Management costs (R per ha)	**R 6 690**	**R 7 060**
Extraction cost (R per ton cane) (for farm to mill distance of 20 km)	R 138.46	R 138.46

Results and Conclusion

The results of the Excel® model, based on a subject farm, are reflected in Table 2. Based on the assumptions applied, despite harvesting a reduced area under the 16 month scenario (75% vs. 92% of AUC respectively), the same annual cane tonnage is attained due to higher yields being achieved on the longer cycle. Therefore, total harvesting costs remain unchanged in both scenarios. Since a greater proportion of AUC is carried-over in the 16 month scenario, there are additional costs in the form of higher eldana spray costs. These additional costs, however, are outweighed by savings achieved because of a reduced area being ratooned and replanted per annum. The net savings (or more strictly, foregone costs) achieved by an extension of the harvesting cycle is reflected as R739 per hectare AUC (equivalent to per hectare per annum). Taking into account the additional gross revenue, due to higher RV yields for the longer cycle, results in an improvement in the farm's gross margin of R1 176 per hectare per annum. This represents a 10.6% improvement in annual gross margin (an indication of profitability) when transitioning from a 13 month cycle to a 16 month cycle.

While not reflected in Table 2, the analysis of cash-flow during the transitional phase (i.e. the period in which the farm transitions from a 13 month to a 16 month cutting cycle) is a key consideration. Assuming that a transition from a 13 month to 16 month harvesting cycle is implemented in year one, the model shows that additional cash-flow pressures are experienced within the first three seasons of extending the cycle length, with the most difficult period being at the end of the off-crop in season one. This has particularly important implications for cash-strapped farmers who may not have the financial wherewithal to negate this cash flow 'hole'. Notwithstanding the short-term cash-flow constraints, the model shows that a cross-over occurs in the third season, and by the fourth season, significant differences are seen in profitability that is sustainable into the future.

table 2. Annualised differential cost calculations and gross margin comparisons at 13 and 16 month harvesting cycles

Cutting cycle scenario	13 months	16 months	*Difference (16 vs. 13)*
Production (tons RV per annum)	11 610	11 610	-
Unit cost (R per ton)	R 138.46	R 138.46	-
Extraction cost (R per annum)	**R 1 607 521**	**R 1 607 521**	**-**
Area ratooned	207.69	168.75	*-38.94*
Unit cost (R per hectare) *(additional N & K at longer cycle)*	R 6 690	R 7 060	*200*
Ratoon management cost (R per annum)	**R 1 389 446**	**R 1 191 375**	***-R 198 071***
Area sprayed for eldana control (carry-over cane)	42.31	81.25	*38.94*
Unit cost (R per hectare)	R 3 200	R 3 200	-
Eldana spray cost (R per annum)	**R 135 392**	**R 260 000**	***R 124 608***
Area replanted *(based on 10% of area harvested)*	23.08	18.75	*-4.33*
Unit cost (R per hectare) (additional N & K at longer cycle)	R 25 711	R 25 711	-
Replant cost (R per annum)	**R 593 410**	**R 482 081**	*-R 111 329*
Total extraction, ratoon, eldana spray & replant cost (R per annum)	**R 3 725 769**	**R 3 540 977**	***-R 184 792***
Forgone cost (saving) of extending cycle	***-R 184 792 (-R 739 per ha AUC)***		
Gross turnover (R per annum)	R 6 493 473	R 6 602 607	*R 109 134*
Less: extraction, ratoon, eldana spray & replant cost (R per annum)	R 3 725 769	R 3 540 977	*-R 184 792*
Annual gross margin *(i.e. before deducting overheads & external factor costs)*	**R 2 767 704**	**R 3 061 630**	***R 293 926***
Gross margin (per hectare AUC)	**R 11 071**	**R 12 247**	***R 1 176***

Therefore, while additional cash-flow pressure is faced in the short-term (first three seasons), acting as a disincentive to extend the harvest age of cane, the model demonstrates that overall profitability into the future is far higher at a longer cycle length. Accordingly, a strategy of extending cutting cycle, in the presence of eldana suppression, is certainly justified. An important observation, however, is that for growers with liquidity constraints, the transition to a longer cycle may have to be a gradual one, staggered over a number of seasons, to ensure the strategy's success.

While not quantified in this study, there are additional benefits that must be considered when extending the harvesting cycle of cane. This includes the improved control of creeping grasses, such as *Cynodon dactylon,* owing to a longer period of closed canopy. Supplementary benefits in accordance with lower areas being harvested and ratooned each season under a longer cycle include reduced traffic, and thus soil compaction and improved general soil health. These additional benefits are difficult to quantify and were therefore excluded from the model, the implication being that net benefit of extending cutting cycle stated in this study are conservative.

It is envisioned that the modelling developed in this desktop study be applied to on-farm trial results (real data) in the future, taking into account varietal and climatic differences. For this purpose, it is recommended that on-farm cutting cycle trials that incorporate eldana control, be pursued.

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