Information Sheet

8.6 Integrated Pest Management (IPM) of eldana

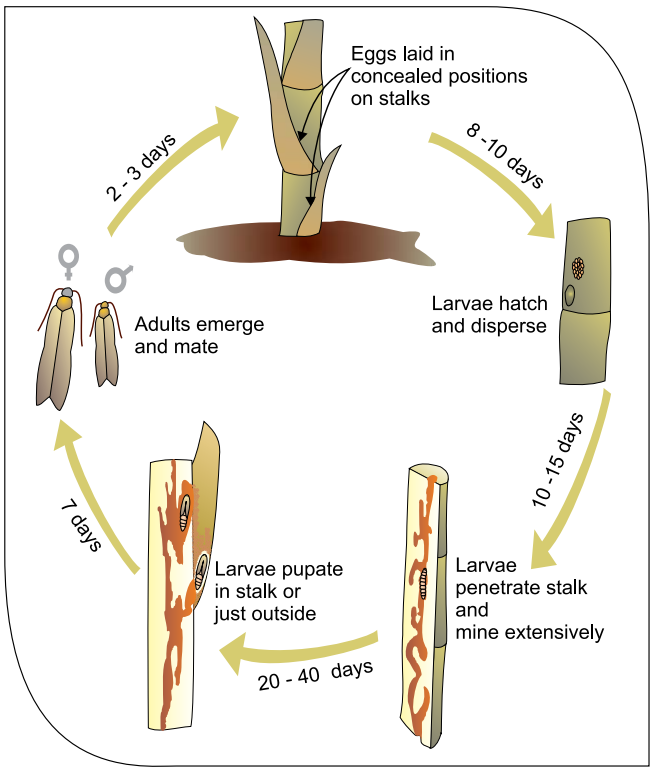
IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms and sustainable control measures. However, it does not exclude the use of well researched and known pesticides that fit into the sustainable use category.

With the above in mind, the approach in this information sheet, based on the booklet "IPM for Eldana Control: An Integrated Pest Management (IPM) approach for the control of the stalk borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae)" focuses on best crop management practices which reduce plant stress – thereby reducing the potential for insect, which includes eldana, damage. These, in conjunction with well researched sustainable control measures, can be integrated into an IPM programme for eldana control. When applied as an entire package, in an area-wide approach, eldana damage can be greatly reduced.

In following this approach, the grower will become aware that best management practices for sugarcane production contribute significantly to eldana IPM, simply by ensuring that the crop is healthy, and stress is minimised.

About Eldana

Eldana is an African moth, living in large indigenous sedges (*Cyperus papyrus* and *Cyperus dives*) and grasses (several *Sorghum* spp.) which provide food for its larvae, predominantly in wetland situations.



Eldana larvae feed extensively inside sugarcane stalks. In addition, stalk tissue surrounding borings is infected by a fungus (*Fusarium*) which is beneficial to the insect. The combination of borer and fungal infection causes a severe loss in cane quality that extends beyond the internode being bored.

Crop stress and eldana

Various factors impacting the growth of sugarcane are associated with increased risk of eldana damage. An appreciation of these factors will assist in developing the various components of an IPM strategy against eldana. Crop stress is normally either a manifestation of a lack of water or in some cases too much water. Soil is the reservoir from which the crop obtains the water and nutrients it needs, as it is the crop roots that take up these essential factors for crop growth. Growers can identify fields that are more prone to water stress and therefore also eldana damage using soil survey information.

Eldana damage increases when excessive nitrogen fertilisation and drought combine.

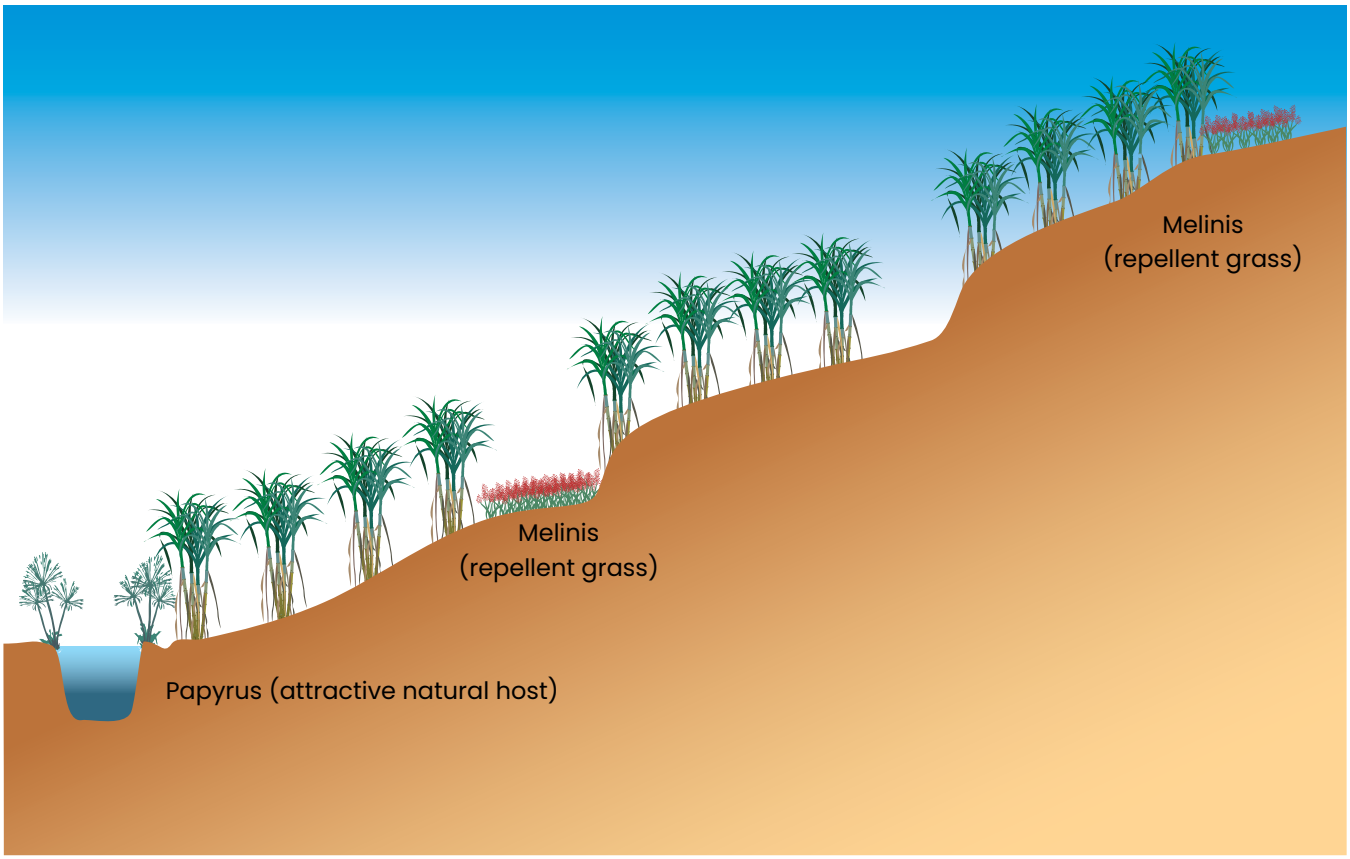
Eldana is *Nitrogen (N)*-limited in sugarcane stalks where there is an excess of carbohydrates (sugar) rather than protein and amino acids. Excessive N use under conditions of water stress can greatly increase survival and reduce the generation time of eldana. This appears to be due to increased storage of amino acids in the stalk under drought conditions which may be exacerbated by sub-optimal potassium (K) and calcium (Ca) nutrition.

Pest control interventions

Habitat Management

The technique involves intercropping melinis (molasses) grass *(Melinis minutiflora)* with sugarcane as a "push" plant. Melinis has the unusual property of being able to continually emit a volatile scent blend (SOS volatiles) that summons natural enemies of insect herbivores even though it is not damaged. These same scents act as a signal to the borer moths in adjacent crops that parasitisation of their offspring is likely and that movement away from the area (the "push" effect) would be advantageous to them. Eldana prefers wetland sedges (*Cyperus dives* and *Cyperus papyrus*) for laying eggs in and for food and these can be considered "pull" plants for this reason. Furthermore, eldana is controlled in sedges by its natural enemies (creates a population 'sink'). Field trials and growers' experiences have shown that well-managed sugarcane adjacent to sedges growing in wetlands has lower infestations of eldana than sugarcane that is not adjacent to sedges, and that when melinis is intercropped with sugarcane, eldana populations and damage can be halved compared to sugarcane not intercropped with melinis.

A Push-Pull system for sugarcane



Nitrogen Management

Avoiding over-application of N, particularly in plant cane, or following a drought (when residual N from the previous crop can be present), is essential if eldana numbers are to be kept in check.

N applications should be split when N losses are likely, particularly on eldana prone sandy soils or soils prone to waterlogging. For example, heavy spring/early summer rains leach nitrogen beyond the root zone leading to accelerated soil re-acidification and a need to reapply N. Split N reduces the resultant acidification and the amount of N that would need to be reapplied.

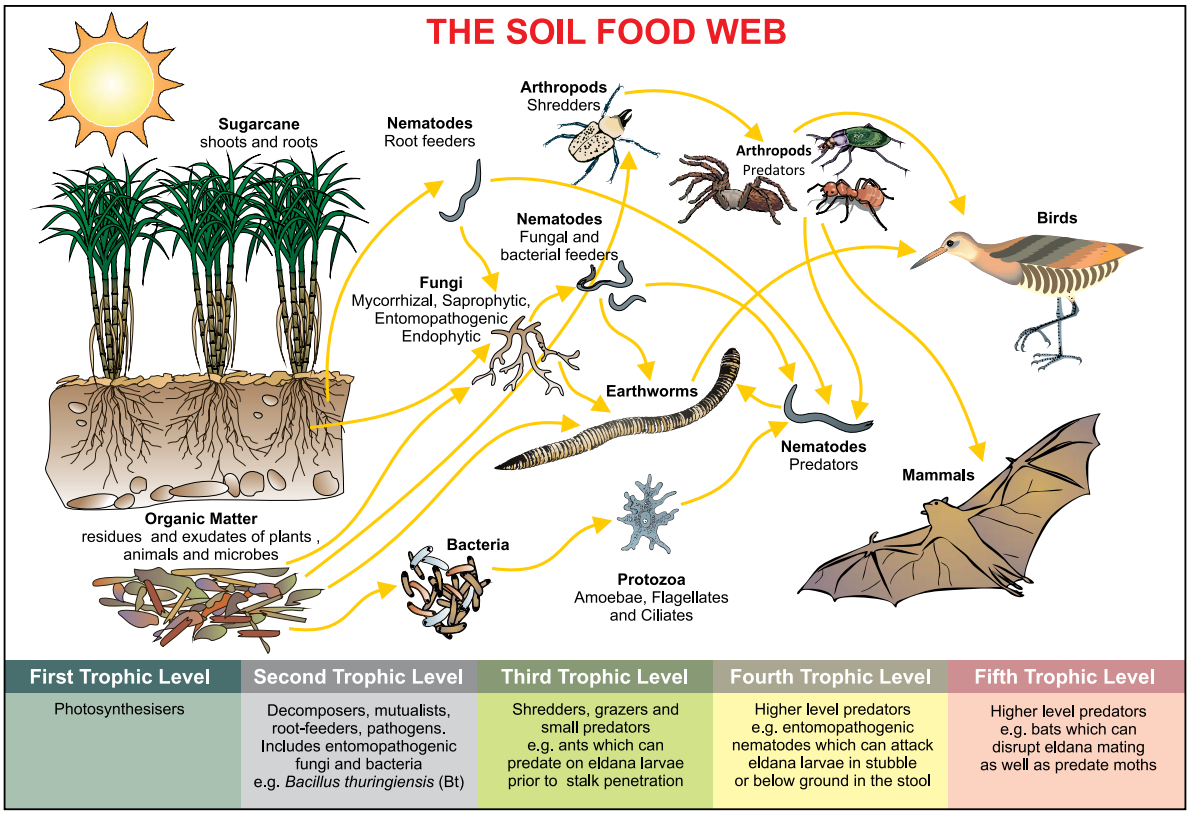
Splitting N application also allows the grower to reassess the yield target of a field based on short to medium-term rainfall forecasts. In the case of the second half of summer being predicted to be drier than expected, less N could be added in the second application in line with a decreased yield target. This reduces eldana risk.

Similarly, if drought is predicted, split N can accommodate the possibility that the drought does not materialise. An increased amount can be added to the second application. Again, eldana risk is reduced.

Soil Biological Activity

Increasing soil biological activity promotes natural eldana control. Acid soil conditions impact negatively on soil biological activity. Evidence of this is retardation in the breakdown of surface applied organic matter (e.g. crop residues) on acid soils. The best ways of improving soil biological activity are to make sure that your soils are treated for excessive acidity, that they are not compacted, and that they have enough organic matter.

The addition of organic matter alleviates several eldana risk factors. It reduces soil bulk density, helps prevent compaction, increases silicon availability, increases water infiltration and retention, and can lead to increased root growth. Organic matter increases soil biological activity and maintains the soil food web that includes predators of eldana.



A diverse range of life forms exist in a healthy soil. Soil organic matter is the storehouse for the energy and nutrients used to fuel the soil food web. Bacteria, fungi, and other soil dwellers transform and release nutrients from organic matter. Predaceous arthropods and nematodes are supported by the web and these prey on pests reducing their impact. (Adapted and re-drawn from http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology.)

Crop residues create a stable environment in which the soil food web can thrive and predation of eldana larvae and adults is increased. If practiced during spring and early summer, conserved predators can impact the spring moth peak and any larvae present in the stubble. There is also evidence that a residue blanket increases the uptake of silicon by the cane plant. Higher stalk silicon content delays eldana larval penetration, thereby increasing exposure to predation.

Varietal resistance

Growing resistant varieties is the most cost-effective component of IPM systems for managing pests and diseases. SASRI plant breeders take into consideration several pests and pathogens when making the crosses and selections that lead to the release of superior varieties.

Seedcane quality

The benefit of good quality seedcane produced in a well-managed nursery is varietal purity and reduced transmission of pests and diseases. Even under these carefully controlled conditions, there are instances where seedcane can become infested with eldana. Ideally, sugarcane should not be used for seed if eldana is present. If the use of damaged seedcane is unavoidable, follow the procedure below:

- Strip the dead leaf material off the stalks. Attempt to select stalks that show no sign of borer attack (particularly if a hot water tank is not available).
- Treat the seedcane in a hot water tank at 50°C for 30 minutes. This will kill any larvae, eggs or pupae present.
- Since the seedcane is to some extent damaged, with fungal colonisation of borings by *Fusarium* species beneficial to eldana, treatment with a fungicide becomes essential. Any *Fusarium* present can colonise the new plants internally, increasing susceptibility to eldana. The following available fungicides are registered for 5-minute cold soaks after hot water treatment: Benlate (7.5 g per 10 L water) and Panoctine 40% solution (20 ml in 10 L water).

Insecticides

IPM is not merely a biological or "organic" pest control programme; it does not preclude the use of pesticides. IPM is a decision-making process that considers and utilises all available pest management options to suppress potential pest outbreaks, while reducing risks to human health and the environment. So, before using any pesticide, be sure that it is necessary.

Be reminded though, that Insecticides are designed to be toxic to the pests they target. When used properly, they can protect your crop from damage. However, when the label instructions are not followed correctly, pests may not be controlled, human health may be impaired, and insecticides may contribute to soil, air, or water pollution.

Additionally, the impact on beneficial insects can be reduced (but not eliminated) by adjusting the timing of spraying (to times when the beneficials are at low population numbers), or formulations used. Also, as beneficial insects often use natural areas surrounding sugarcane as refuges, it is important that damage to these populations in non-target areas must be avoided by preventing insecticidal drift from the crop being treated.

See Information Sheet 8.6.1 – Insecticides for eldana control.

Cultural tools for eldana management

Detaching dry leaf material from the maturing cane stalk

This practice reduces the dry leaf area in contact with stalks. Larvae hatching from eggs laid on detached dry leaf material are more likely to be predated. Also, exposure of the stalk leads to an increase in toughness of the cuticle just below the wax layer, making it harder for young larvae to penetrate. The optimum timing for this operation is before or at the spring moth peak, during the period August to October. A team of about 25 labourers per hectare is sufficient. It is not necessary to do a thorough cleaning of the stalk, a light cleaning will suffice. The dry leaves should be moved away from the base of the stool.

Burning

Burning is recommended where heavy eldana infestations occur in severely droughted cane. The reasons for this are:
- to ensure good field hygiene by not leaving infested stalks concealed under crop residues,
- to enable cutting at the soil surface, so removing larvae that would have been left in the stubble, and
- to destroy the reservoir of eggs, pupae and adult moths associated with dry leaf material.

Tops should never be burnt and should always be scattered. Eldana does not lay eggs on green leaf material and larvae only very rarely bore the tops. Research trials have shown that a good cover of cane tops can have as much as 70% of the beneficial effects of a full residue blanket.

Droughts are a regular occurrence in the South African sugar industry. It is best to be prepared by paying attention to all aspects of soil and water conservation and basic crop husbandry.

Stalk borer surveys

Conducting regular surveys in the field ensures the following:
- Increased awareness of pest activity, including changes in pest populations.
- Provision of up-to-date information on damage levels.
- Provision of data that can be used to compare damage and pest numbers from season to season.
- Allows for the early detection of problems, resulting in the availability of more management options.

From these surveys, a pattern of pest distribution and intensity will be established. Such information can be used as an aid for decisions on harvesting priorities, plough-out and replant variety selection.

Understanding and conducting eldana surveys

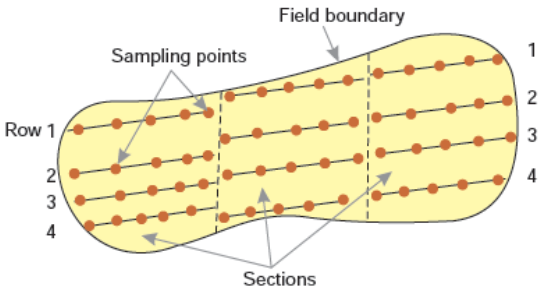
- *Eldana/100 stalks (E/100)* indicates the number of eldana (including pupae) in 100 stalks, and is a measure of the eldana population in the field at the time of the survey. E/100 is used by LPD&VC Committees to assess the eldana hazard in a region. It is also used to set maximum permissible eldana levels in fields to be harvested, as well as fields to be carried over.
  While a value of approximately 5E/100 seems low, this represents a larval population of around 6000/ha.

- *% Internodes bored (%IB)* is a more useful measurement than % stalks bored. This measures the intensity of an infestation and is directly related to crop loss. Losses exceed 1% of RV per 1%IB and can be as high as 4% of RV per 1%IB. For loss calculations shown in this manual, a value of 1.5% of RV per 1%IB has been used.

- *% Stalk length red (%SLR)* is an easier survey measure than %IB. It refers to the measured length of damaged tissue that has turned red as a percentage of the entire length of the stalk. It also tells us the % length of the stalks that has no sugar in it, i.e. 5% SLR means that 5% of the length of all the stalks in the field has no sugar. It should be remembered though that stalk red is not only caused by eldana, but also other stalk borers and pathogens (See IPM Manual page 71 and 72).

Conducting a survey

1. Examine the size and shape of the field. On a diagram, divide the field into several sections each of roughly one hectare.
2. Sample twenty stalks in each section according to a set pattern e.g. walking four rows and sampling five stalks at intervals along each row. Aim to sample stalks so that the whole section is represented in the sample (see diagram). There must be no bias in selecting stalks for sampling.
3. Count the number of internodes and enter this number in the relevant column on the data sheet, and then split each stalk along its length.



Sampling for eldana (20 stalks per one hectare section).

4. For each stalk sampled, count the number of internodes that have been bored (enter in the relevant column and row on the data sheet and count the number of eldana larvae found (if any, and enter in the relevant column and row on the data sheet).
5. From the results, work out the following:

• *%SLR*:

$$\frac{\text{The length of discolouration in a stalk} \times 100}{\text{The total length of that stalk}}$$

• *%IB*:

$$\frac{\text{The number of damaged internodes in a stalk} \times 100}{\text{The total number of internodes in that stalk}}$$

The above calculations give values for one stalk. Take an average for all the stalks by adding all the individual values and dividing the resulting number by the number of stalks sampled.

E/100 stalks:
Divide the total number of larvae recovered by the number of stalks in the sample. This gives the average number of larvae per stalk. Multiply this by 100 to calculate the number of eldana larvae per 100 stalks.

Summarised by D.E. Conlong largely from Rutherford, R.S. (2015). *IPM for Eldana Control. An Integrated Pest Management (IPM) approach for the control of the stalk borer* Eldana saccharina *Walker (Lepidoptera: Pyralidae).* South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe 4300. ISBN 1-874903-41-7.

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