SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

ANNUAL GENERAL MEETING

Date : 23 November 1989
Venue : Conference Room, SASA Experiment Station, Mount Edgecombe

PROGRAMME

General Theme: Agronomic practices in sugarcane and the environment.

8.45 - 9.00	Chairman's report	
9.00 - 9.30	Issue management techniques in relation to environmental challenges	B Gibson
9.30 - 10.00	CG Smith Sugar and the environment	S Rau
10.00 - 10.30	Streambank revegetation	D McCulloch and M Barendse
10.30 - 11.00	**TEA**	
11.00 - 11.30	Endangered species	Dr D Johnson
11.30 - 12.00	Conservancies and the cane grower	B MacNeillie
12.00 - 12.30	Wetlands - value and rehabilitation	Dr G Begg
12.30 - 2.00	**LUNCH**	
2.00 - 2.40	Sugarcane field ecology and chemicals	P Johnson
2.40 - 3.10	Vegetation corridors and biotic diversity	Prof M Samways
3.10 - 3.40	Invader plant control	Dr R Kluge and Dr D Erasmus
3.40 - 4.00	Attitudes to environmental conservation and agriculture	P Turner

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

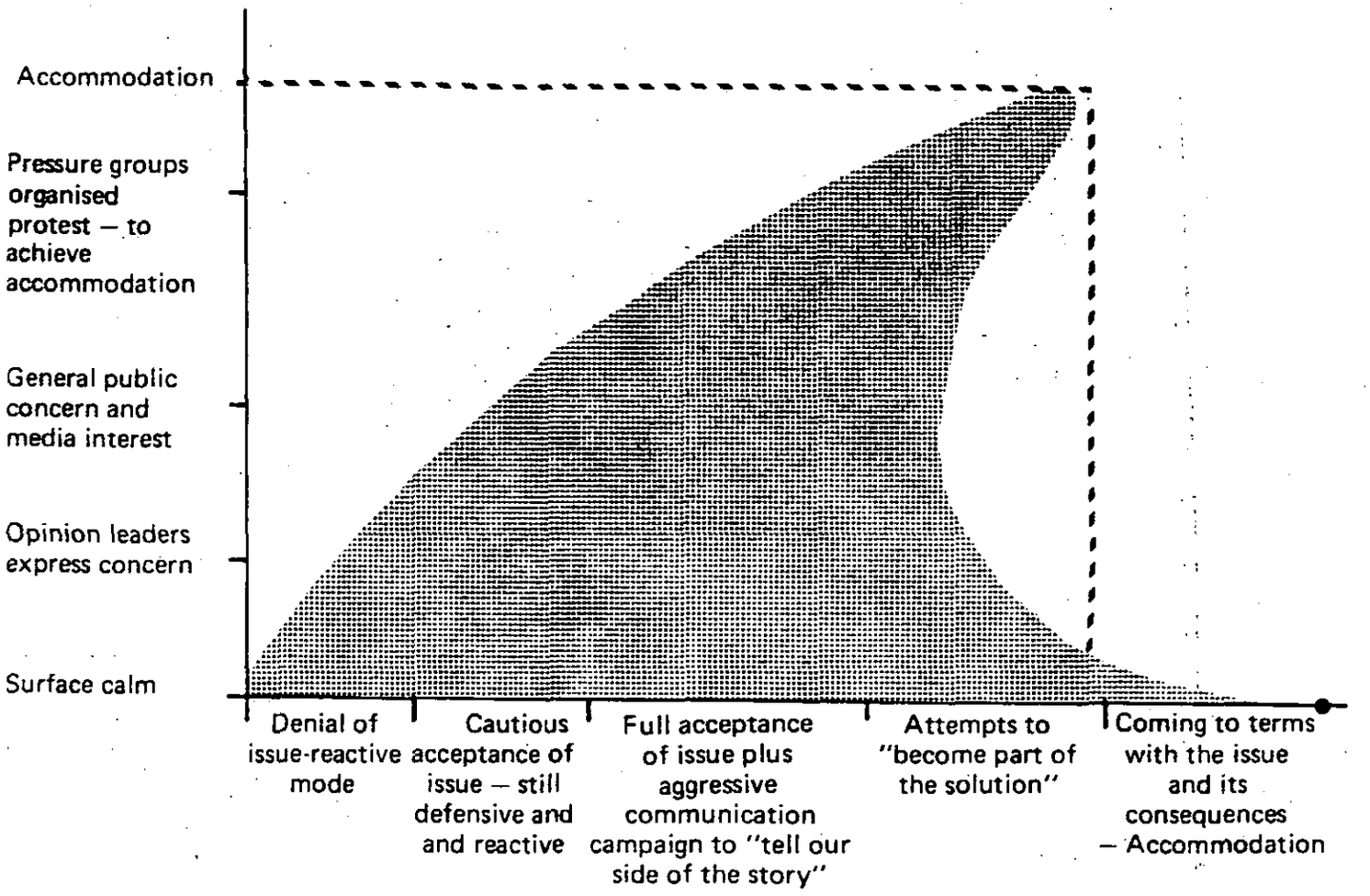
Issue Management Techniques in relation to environmental challenges

Issue Management

- "Issue" : Point in question submitted jointly for decision.

- "Issue Management" : Anticipating and resolving issues of concern.

- "Crisis Management" : Damage containment


Accommodation
Pressure groups organised protest – to achieve accommodation
General public concern and media interest
Opinion leaders express concern
Surface calm
Denial of issue-reactive mode
Cautious acceptance of issue – still defensive and and reactive
Full acceptance of issue plus aggressive communication campaign to "tell our side of the story"
Attempts to "become part of the solution"
Coming to terms with the issue and its consequences – Accommodation

Golden Rule No. 1

Assume the worst!

- Listen for the "weak signals of change"
- Over-react rather than under-react. Pro-action wins time
- Cover all probabilities - never say never

Golden Rule No. 2

Control and acknowledge the facts!

- Perceptions may be dominant but you must still control the facts if you want to get on top
- Get the skeletons out of the cupboard and build defences for each

Golden Rule No. 3

Credibility is your strongest suite!

- Even when under attack you can win credibility by your personal actions; your concern and caring
- Take the emotional high ground - why should critics have ownership over caring about societal issues?
- Never tell even a small lie

Golden Rule No. 4

Listen to your critics, not your friends and family!

- Don't allow yourself to be told what you want to hear
- Learn the art of empathetic listening

Golden Rule No. 5

Never make personal attacks - even if they do!

- Personal attacks on your critics signal a weak defence. Remain above mud slinging
- Insults increase the heat
- Radicals need personal attacks to sustain a weak case - David and Goliath syndrome

Golden Rule No. 6

Don't point fingers at others!

- It's not really important if others have done worse things - concentrate on resolving your issue
- Who needs to be seen in the company of other wrongdoers?

Golden Rule No. 7

Seek consensus - not cession!

- Few people are natural trouble-makers - generally there is a real problem that needs solving
- Acknowledge your own weaknesses but look also for flaws in your opponent's argument
- Establish a courtroom atmosphere in debate

Golden Rule No. 8

Acknowledge and correct your own mistakes!

- Critics are often won over with small victories - quickly concede and correct genuine mistakes
- Disarm armchair observers with your reasonableness

Golden Rule No. 9

Build alliances!

- Critics often make fine allies and can be partners in problem solving
- Consult acknowledged experts. They may give you a hard time but they have the answers and add to credibility
- "Creative tension" can be good for you

Golden Rule No. 10

Speak with one voice!

- Co-ordinate your utterances
- Develop an agreed document of record
- Concentrate on the opinion formers - avoid public debates where clichés and ideologies dominate

Issue Management and the Environment

Environment is the major issue at present (at last)

1984-89: 80 980 news stories on environment
40 000 on aids
16 000 on crack
(Nexus news monitor)

Sugar Industry and the environment

Fertile ground for long time critics
Industry has real problems:

* Soil and water conservation
* Damage to rivers/estuaries (62% of Natal wetlands wiped out!)
* Decline in natural vegetation/increase in alien vegetation

Managing the Issue

Problem acknowledged
Some mistakes being corrected - but need industry wide commitment
Credibility delicate - public suspicious
Focus on key threats but don't let new problems in through the back door
Do something dramatic (and sincere) to win the high ground
Become an environmentally-friendly industry. It makes good business sense
Show by your daily actions that you care as much as the next man.

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

CG SMITH SUGAR AND THE ENVIRONMENT

The environment and its protection is a key component of every manager's responsibility in Smith Sugar. This commitment is prominently featured in the mission statement of our Company which shapes the activities of all business enterprise in the sugar division.

A number of successful projects have been launched in the company that focus on the preservation of 3 natural resources, namely the :

- Land
- Water
- Air

A) PRESERVATION OF THE LAND

Minimum tillage techniques, using either Roundup to kill the old crop or hand labour to dig out the old crop, are the preferred means of re-establishing cane on these steep hillsides. On our MCP's the majority of the crop is re-established in this way.

Only the very flat, wet valley bottom areas are now ploughed by mechanical means. Ploughing is usually confined to the winter months where the risk of flash floods is minimal.

A recent innovation in the company has been the re-afforestation of the natural valley lines and river courses. The MCP estates have created indigenous tree nurseries in order to propagate young tree seedlings for transplanting into these erosion susceptible areas. This programme is targeted at righting the balance of nature by removing noxious invader plants (and, in some cases, sugar cane) from within 10 m of the natural river courses and re-introducing the climax vegetation into these areas.

The natural stream bed of a well-designed cane field is a major erosion pressure point. It is critical, therefore, that such areas are fully protected by well grown natural vegetation. The unique concept of these tree nurseries will more than adequately provide the MCP estates with the necessary plant material to stabilise these areas. We have come to regard indigenous trees and shrubs as key resources in the management of a sugar cane field.

B) PRESERVATION OF WATER RESOURCES

Natural water resources play an important role in the levels of sugar factory management since many sugar mills are situated on or very near to major rivers and estuaries. Historically, these rivers and estuaries provided a ready supply of cheap water for the factories while also serving as a convenient dumping ground for factory effluent. Today these rivers and estuaries are among the cleanest and most protected water resources in Natal. These achievements have required the full commitment of everyone in the factory - from Plant Operator to the Company Directors.

Perhaps the most acclaimed environmental success story in the Group is that of the Sezela lagoon. Five years ago this estuary was totally destroyed by the prolonged discharge of industrial effluent into the estuary. A metre deep layer of anoxic vegetable matter from the factory had been deposited on the estuary bed and acted as blotting paper for oxygen - literally sucking it from the water. Massive fish kills resulted and the estuary soon started generating H_2S gas which pervaded the countryside with the familiar rotten egg stench.

In 1984 Sezela management embarked on a major resuscitation programme which focused on removing the harmful anoxic vegetable deposit on the estuary bed by regular flushing of the lagoon into the sea. Considerable re-design of the factory drainage system channelled factory effluent into a newly constructed effluent treatment plant which ensured that only clean, treated water returned to the lagoon.

The result after four years of protection was unparallelled success and the first known successful restoration of an estuary system. We were amazed at the rapid recovery rate of the lagoon and today this lagoon teams with fish and bird life. We are proud to show visitors our resident pair of fish eagles.

Opportunity for further environmental innovation has presented itself at Smithchem. This plant currently discharges - legally - 120 tons per hour of reactor water into the sea. This water contains very small amounts of acetic and formic acid which renders the water suitable for downstream factory use. Recently developed technology will extract this acid commercially from the reactor water for sale on the local market. This technology, developed within the CG Smith Group, is the first of its kind in the world and has widespread industrial implication worldwide.

Notwithstanding the considerable economic advantages of this strategy, the recycling of the purified water within the Sezela complex will reduce the complex's water demand by almost 1 million kilolitres per year. Indeed the most exciting spin-off from this innovation is the fact that the Sezela complex will become totally environment friendly. There will be absolutely no pollution of the land, water or atmosphere at Sezela.

C) PROTECTION OF THE ATMOSPHERE

Sugar factories, if poorly designed and managed, can discharge thousands of tons of ash and soot into the atmosphere each season. Perhaps the most significant anti-pollution development at our factories has been the installation of wet scrubbers on our factory chimneys. The scrubber programme was a programme initiated in the early 1970's. The Gledhow Mill was one of the first sugar factories in South Africa to install a wet scrubber and to utilise a smuts dam for the disposal of its wet ash.

In essence boiler exhaust gases pass through a shower of water which removes acid forming sulphur and soot. A clean plume of harmless water vapour discharges into the atmosphere. These plumes of white steam bear proud testament to the success of the factory engineers in their endeavours to clean up our atmosphere.

The ash, soot and sand from the factory boilers is pumped in slurry form to settling dams near the factory where the solids settle out and the clean water is then recycled back to the factory. In time, this sand and ash deposit will be planted to sugarcane, thereby converting a previously valueless stretch of land into an economically active cane field. Despite the reasonably high water temperatures in these settling dams the profusion of wild life attracted to the area is quite unbelievable. Even the Egyptian Geese have developed a liking for the spa bath effect of these settling dams!

At Umzimkulu the filtration properties of the sand/charcoal mix from the factory smuts has been exploited in a unique and innovative effluent treatment concept known as a "Wet Lands System". Essentially, the factory and local village effluent is introduced into the factory scrubber slurry at a point where the high temperatures destroy the harmful coli-form bacteria. At the settling dam the sand and activated carbon from the scrubber work to purify the effluent water to a standard acceptable for a re-use in the factory.

The high nutrient content of the introduced effluent encourages prolific plant growth which further aids the purification of the water. The system is both simple and effective and is the only one of its kind in the Sugar Industry. By eliminating the need for a costly effluent treatment plant at a sugar factory, this concept will save our industry considerable capital investment. Once again we have come to realise that industrialisation and the protection of the environment are not mutually exclusive events.

Two technical papers on the design and use of smuts dams were presented at the ISSCT Congress in Brazil earlier this year.

CG Smith Sugar is proud of its involvement and achievements in the environment and recognise that we still have much to do but with the enthusiasm and dedication of all our people we believe we will remain as leaders in this important area of endeavour.

S RAU

PETT/cvp
20 November 1989

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

STREAMBANK RE-VEGETATION

by MA Barendse and D McCulloch

INTRODUCTION

In the past riverine vegetation was cleared to plant cane on the Darnall estates, leaving some of our water courses totally denuded of vegetation. This paper deals with the practical aspects of determining which water courses should be re-vegetated and the techniques used.

Where to plant

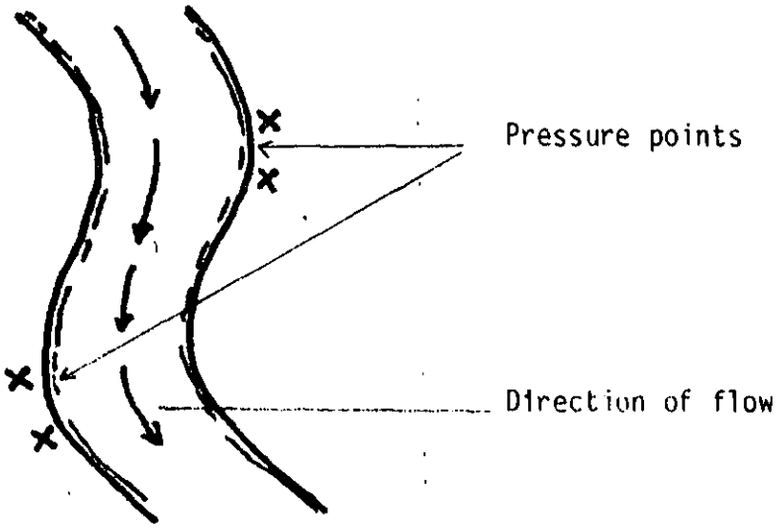
The question of which drainiage line should be re-vegetated is easily answered by saying all perennial streams should have some protection along the banks. The difficulty comes in defining a perennial stream and deciding how far up the catchment we should be re-vegetating the banks. On the Darnall coastal area, as a rule of thumb, streams resulting from a catchment of over 40 ha, or water courses that flow for ± 70% of the year should be re-vegetated. Other determining factors would be the erodibility of the soil, drains below runoff from a tar road and wet lands such as 'sponges'. It was noted that many of our wider grassed waterways , from slightly smaller catchments stood up to the floods. Some of the areas we are planting are not riverine forest situations, but water courses that we feel require more protection than grass. Where streams have widened due to erosion and silting, we have re-routed the water flow to the original bed by digging a drain through the silted area, thus enabling us to site trees on the banks nearer the water and hope that this will make the stream narrow and swift flowing as it would have been in it's natural state.

Preparation

Before planting, an edge road is constructed on both sides of the stream banks, and noxious (alien) weeds eradicated. Selective slashing is done taking care to leave any small trees that may be present, so as to give the trees to be planted less competition from weeds. Due to the different methods necessary for the eradication of noxious weeds we have found it practical to remove one species at a time. Chromolaena is pulled out by hand and Bug Weed and Lantana are removed by using a mattock.

Planting

We have found it practical to plant trees of over a metre tall in early Spring and to site them in moist areas, thus reducing the amount of attention required to establish the tree. The faster growing precursor trees are planted i.e. Wild Plum, Natal Mahogany, Pigeonwood and Cape Fig. These trees attract wild life, such as birds, that assist in propagating other indigenous trees endemic to the area. As a priority pressure points are determined and trees with extensive roots such as Date Palm or Bridelia are sited above the faster moving water on the outer bends.



Experience has shown us that even when planting trees of over a metre tall, there is still a percentage that die. As a result of this we now plant trees approximately two metres apart in the steep areas and four metres apart on the flatter profiles. Duiker can be a problem as they eat the meristem of the smaller trees.

On discussing tree planting techniques with conservationists, we realise that we have tended to slash our water courses too often, thus inhibiting the growth of any small trees that may have germinated. We now agree that it is better to leave a stream totally unslashed with "Baabi" Grass and other weeds present. All that is required is to remove noxious weeds and spray the spots for tree planting with Roundup. The mowable edge road above the banks will give a 'clean' break before the cane edge.

CONCLUSION

It is pleasing to see our immediate neighbours re-vegetating their stream banks, as these areas link our streams both above and below. In order to manage and control the flow of water it is important for the whole catchment to be protected. We are confident that given time the improved vegetation will not only provide protection of the river bed and banks, but assist towards a natural balanced river system.

/1b
20 November 1989

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

CONSERVANCIES AND THE CANE GROWER

(Summary of talk to be given at the S.A. Sugar Industry Agronomist's Association's Annual General Meeting to be held 23rd November, 1989 at the Experiment Station).

What is a conservancy?

Interesting conservancy statistics not only regarding Natal, but the other Provinces as well. The Natal Parks Board's role in the formation of the conservanceis, and the management thereof. (The formation of the Natal wildlife Conservancies Assn.)

The conservancy concept very much in its infancy, particularly in the Sugar Industry where we have been slower to participate. Our contributions are and will be in the future more meaningful. The Sugar Industry's initiative very recently in prompting more awareness amongst growers, has led to the formation of Environmental - conservation committees which will find themselves operating very closely with conservancies. The commitment of the Industry and growers seems to have renewed momentum.

The day by day operation of a conservancy :

1) Finance (Housing)

2) Patrols

3) Management of guards

4) Uniforms

5) Weapons

6) transport etc.

The farmer naturally requires some value for money. Monzi conservancy has a dual role - one as security and the other, conservation. Participation (Particularly communicating) of the farmers is essential to the effective operation of the conservancy.

The rural community plays an important role - to get the black community co-operating and realising the conservancy's benefit to everyone is half the battle. Occasional meetings with leaders of the blacks is very beneficial.

The importance of the conservancy as a representative of the area in matters of regional importance i.e. - The Dukuduku squatter problem. Communication with the Defence Force also important.

Conservancy's role in the future not only of the community but the country.

B. MAC NEILLIE

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

Abstract of proposed presentation on Wetlands

at

South African Sugar Industry Agronomist's Association Meeting

on

23 November 1989 (SASEX)

Discussion will be deliberately confined to freshwater (i.e. non-tidal) wetlands largely within the coastal lowlands of Natal.

With the aid of a few slides, the discussion will touch on the following aspects:

- Wetland types
- Distinguishing features of wetlands
- Geographical extent
  (wetland inventory, wetland loss)
- Wetland functions and values
  (water storage; streamflow regulation, flood attenuation, water purification, soil erosion protection, drought relief, wildlife protection, including Eldana!)
- Implications of wetland alteration
  (converse of wetland functions and values)
- Wetland restoration
  (prospects : approach)
- Policy decisions at provincial level
  (implications for Sugar Industry).

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

THE POSSIBLE EFFECTS OF SUGARCANE AGRONOMIC PRACTICES ON WILDLIFE AND THE ENVIRONMENT

Brief synopsis of earlier project

Project background

In the late 1970s, fears expressed by farmers and conservationists about the effects of pesticides on the environment prompted the Agricultural Chemicals Division of Union Carbide to initiate and fund an independant study which would examine the effects of Temik, used in the sugar industry, on wildlife occurring in the coastal sugarbelt of Natal. The study, under the auspices of the Institute of Natural Resources, began in September 1981 and continued until the end of 1986.

Study objectives

1 To determine whether the extensive use of carbamate nematicides in the past had resulted in a reduction in the diversity and abundance of species in and around canefields, and

2 to determine whether the application of a carbamate nematicide in sugarcane results in any detectable adverse changes in invertebrate and lower vertebrate communities present in canefields.

Study Area

The study was conducted on coastal sugar estates situated between the Mhlali and Tugela Rivers.

Methods

Monitoring experiments were conducted in both sugarcane fields and in adjacent natural vegetation. Emphasis was placed on the invertebrate and the reptile and amphibian (herpetofauna) communities occurring in the area.

Invertebrates - pitfall traps

Herpetofauna - a combination of drift fences, pitfall traps and funnel traps
- field collecting

Some major conclusions of the study

1 Canefields support a far greater abundance and diversity of both invertebrate and vertebrate life than was expected, disproving the adage of canefields being a `faunal desert.'

2 The initial clearance of indigenous vegetation for cultivation has probably had the greatest long-term effect on the

terrestrial vertebrate fauna than any current management practice, further clearance of vegetation continuing to do so.

3 Temik does appear to have an adverse effect on certain invertebrate populations, particularly herbivores. This effect is probably biologically insignificant.

4 No adverse effects on the herpetofauna occurring in cane-fields from the correct use of Temik were detected.

The known and possible effects of certain sugarcane agronomic practices and indigenous vegetation clearance on wildlife and the environment

Plantcane vs Trashed ratoon

The invertebrate fauna is many times more diverse in trashed ratoon. Some groups or species of invertebrate can be many times more abundant in plantcane.

Although frogs are more abundant in fields of plantcane, there are fewer species. Snakes are five times more abundant in trashed ratoon with more than twice the number of species, while lizards are both more common and diverse in trashed ratoon.

Plantcane is a hostile environment for all vertebrates studied, any animals being caught usually having moved around at night. Some frog species would preferentially use plantcane fields at night.

As plantcane grows, it becomes more attractive to vertebrates, but not to the same extent as trashed ratoon cane.

Trashed ratoon vs Burnt ratoon

Burnt ratoon has similar implications to the invertebrate and herpetofaunas as plantcane, this being more a reflection of the bare nature of the surface of the ground.

It is very likely that the burning of cane has **very severe repercussions** for the herpetofauna, particularly the reptiles. Many reptiles, such as some snakes and lizards, would use the ideal conditions offered by mature cane to breed. Burning of this cane, particularly in the spring and summer months, would result in the probable destruction of that season's (ie. year's) recruitment.

Sugarcane vs Coastal Forest

As expected the communities in these two habitats differ considerably, sometimes in unexpected ways.

Frogs are more abundant in the forest, but a similar number of

species are found. Snakes are many times more common in trashed ratoon, with similar numbers of species. The composition of the frog and snake faunas in the forest and the cane, however, differ in their make-up. Lizards were both more diverse and fifty times more abundant in trashed ratoon.

In other words, although the removal of forest would severely affect the resident herpetofauna, the resulting herpetofauna in sugarcane fields is very diverse and abundant in its own right - providing!! (see below).

The removal of forest and the planting of the land to sugarcane has allowed predominantly grassland species to extend their range.

Presence of adjacent coastal forest vs no adjacent coastal forest

The presence of adjacent indigenous vegetation is probably **the most important factor** as regards what and how much wildlife occurs in sugarcane fields.

Comparisons between the two estates (one (A) with much adjacent forest and the other (B) with very little) has shown the great influence that the lack of indigenous vegetation has on the fauna present in sugarcane. The frog, snake and lizard faunas of sugarcane were both less diverse and less abundant on Estate B. This is a reflection of the removal of suitable breeding and overwintering sites of many species. Increases in the numbers of some species on Estate B is probably a reflection of the removal of forest-based predators.

One of the main recommendations of the study was to **preserve at all costs any remaining indigenous vegetation**. Such areas are **vital as reservoirs for wildlife** inhabiting sugarcane. If these were to be removed or altered adversely, it is likely that sugarcane areas would become a faunal desert.

Application of carbamate nematicides

Differences in the susceptibility of certain free-living invertebrates to Temik were shown, with the herbivorous groups being most affected. The study highlighted the importance of choosing the correct level of indicator groups.

Although the results of this study were somewhat inconclusive, the study did show that the **correct** use of nematicides does **not** result in **massive** die-offs of wildlife as is often suggested and that any effect due to the chemicals is unlikely to have a biologically significant effect on wildlife in the area.

Application of herbicides

Although this study did not look at herbicides in any depth, it is likely that herbicides would have an effect on the lower forms of wildlife in sugarcane. The removal of vegetation cover by herbicides would have a direct effect on many invertebrates with

a probable indirect effect on the lower vertebrates and smaller mammals.

The subject of herbicides, sugarcane and wildlife is a field that warrants study.

Drainage of wetlands

The drainage of wetlands would have a severe effect on the frog fauna. A large number of frog species rely solely on wetlands for breeding purposes during the spring and summer months. Some also overwinter in wetlands. Certain snakes also rely on wetlands for food supply.

Advantages of sugarcane over other agricultural crops and land-use practices

Although sugarcane is a monoculture, the crop itself and the method by which it is farmed have distinct advantages for wildlife over other crops and land-use practices.

Sugarcane is not an annual crop. At no time during the year, therefore, is there a situation present where very large areas of land are bare. I could almost guarantee that the fauna of wheat fields, for instance, is extremely poor in comparison. A typical sugar estate has a mosaic of canefields of different ages, so supplying the resident fauna with a variety of habitats throughout the year. The practice of contour cultivation means that fields are generally long and narrow, never really being a severe barrier to movement of animals. Sugarcane also provides good vegetational cover both at ground level and canopy level throughout the year. The humic layer is particularly good, allowing for a diverse invertebrate fauna. In comparison to many other crops, sugarcane requires relatively little application of agricultural chemicals. This can only benefit the resident fauna, which, bar one or two serious pest species, has no adverse effect on the sugarcane at all.

Recommendations

The practice of burning be discouraged. Despite short-term advantages, burning has long-term adverse effects on the soil and wildlife, some of which may be distinctly useful.

Closer and more regular checks on the application of granular nematicides to sugarcane be made, with emphasis placed on the correct disposal of empty containers. Worldwide, the vast majority of wildlife deaths attributed to carbamate pesticides have been caused by incorrect/illegal application or disposal of containers.

Any further removal of indigenous vegetation, no matter how small in area, should cease. Even the smallest patch of forest or

wetland is of ecological importance to the area.

The planting of canelands to commercial forests should be discouraged. Such monospecific forests will rapidly have adverse and longterm effects on local wildlife populations.

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3200

November 1989

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SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

ALIEN INVASIVE PLANT CONTROL IN THE SUGAR GROWING AREAS OF NATAL

by R.L. Kluge

Plant Protection Research Institute, Weeds Lab, Private Bag X 9059, Pietermaritzburg 3200.

INTRODUCTION

According to (MacDonald & Jarman 1985) the most important alien invader plants in the sugar growing areas are probably triffid weed (Chromolaena odorata), lantana (Lantana camara) and guava (Psidium guajava). Also important are Barbados gooseberry (Pereskia aculeata), inkberry (Cestrum laevigatum), bugweed (Solanum mauritianum) and red sesbania (Sesbania punicea). To these can be added plants which are becoming increasingly important such as: balloon vine (Cardiospermum grandiflorum), Mexican sunflower (Tithonia diversifolia), Mauritius thorn (Caesalpinnia decapetala), peanut butter cassia (Cassia didymobotrya), Indian laurel (Litsea sebifera) and syringa (Melia azedarach).

I should like to consider four aspects relating to the control of these alien invader plants: chemical and mechanical control, biological control, the biology of the target plant, and attitudes towards the control of alien invader plants. In conclusion I should like to make some proposals regarding the most important problem areas that need to be addressed.

CHEMICAL AND MECHANICAL CONTROL

Great progress has been made with the development of cost-effective chemical methods for the control of the alien invaders in Natal. Apart from guava, herbicides are now registered for all the most important alien invasive plants occurring in the sugar growing areas (Table 1) (Vermeulen & Grobbelaar 1988). Although most of the registered control methods are considered effective, research is ongoing. Work is presently being done at the Cedara Weeds Lab to improve the existing chemical control of pereskia and syringa.

Triclopyr, glyphosate and imazapyr form the basis of chemical control of alien invasive plants in Natal (Table 1). The most commonly used application methods include foliar spraying particularly on coppice and seedlings, cut stump and basal bark treatments.

Although it is still widely practiced, mechanical control on its own is not a cost-effective control method in most situations. For example, a work study showed that at approximately R13 per man day for unskilled labour, the cost of clearing dense infestations of Chromolaena by first slashing and then uprooting the stumps is over R1000 per ha (Erasmus 1988). This excludes the cost of

follow-up treatments.

Despite the progress made with the development of effective chemical control methods, progress with the actual control of alien invasive plants using these methods has been disappointing. There are a number of possible reasons for this.

No proper planning

Alien invader plant control is usually done on an ad hoc basis if and when time and resources become available. It has always been understandably low on the priority list of the land-user. Alien invader plant control is therefore not subjected to the same careful planning which is done for other operations on the farm such as planting and harvesting.

Disregard for common sense aspects

Many common sense "rules" which would greatly increase the effectiveness of alien invader plant control measures are disregarded. These include for example: start by removing infestation foci wherever they occur, controlling the weed where it occurs in low density patches and then working towards the more densely infested areas (which cannot get any worse), and in a riverine situation starting at the top of the catchment and working downstream to prevent re-infestation from higher up.

Lack of flexibility in the approach to control

An important feature which distinguishes alien invasive weeds from agronomic weeds is the wide variety of situations in which they occur with regard, for example, to topography, vegetation and the density and age structure of the weed populations at a particular site. This is rarely taken into account. Effective control of alien invasive plants requires flexibility, improvisation and the wise integration of all available control methods (Kluge et al. 1986).

Poor application of the available control methods

In a recent survey in the United States to determine research needs in weed science, improvement in applicator training ranked third (McWhorter & Barrentine 1988). There is good reason to believe that the wrong application of the available control methods is also a big contributory factor to poor alien invasive plant control in Natal.

No follow-up

Initial clearing of an area should be followed up for at least three years or until the threat of re-infestation seems unlikely. No new area should be cleared until then. This is a particularly costly mistake, since the cost of follow-up operations are normally only a fraction of the initial clearing costs.

BIOLOGICAL CONTROL

The contribution of biological control to the control of alien invasive plants along the Natal coast has been disappointing. Since the 1960's a great deal of effort has been put into the biological control of lantana. Although five biological control agents have been established on lantana at various localities along the coast (Cilliers 1983), they have not yet made a recognized impact on lantana control in Natal. This is largely due to the large number of hybrid varieties of lantana (Spies 1984). Because of the high degree of specificity of the biological control agents many of these hybrid varieties are not attacked by the particular biological races of the insects that have been introduced.

Together with Prof. C.H. Stirton of the Department of Botany, University of Natal an attempt is to be made to draw up a distribution map of the various forms of lantana occurring along the Natal coast. This information could help to determine which the most important hybrid varieties are. Exploration for biological control agents can then be concentrated on these forms.

The most successful biological control programs in the Natal coastal region have been on sesbania and two aquatic weeds. The weevil, Trichapion lativentre, feeds on the foliage of sesbania plants and the larvae develope in the buds. Besides reducing seed production, the weevil causes a massive reduction in the biomass of all the above-ground parts of the plant. Growth of the plant is severely retarded (Hoffmann & Moran 1988). Trichapion is widespread throughout Natal. Two further weevils, a seed-feeder, Rhyssomatus marginatus, and a stem-borer, Neodiplogrammus quadrivittatus, are also to be distributed on sesbania in Natal in the near future.

The introduction of two weevils, Cyrtobagous singularis (Cilliers 1987), and Neohydronomus pulchellus, have resulted in the dramatic control of Kariba weed, Salvinia molesta, and water lettuce, Pistia stratiotes, respectively, in various water bodies in the area. Work is continuing on the biological control of water hyacinth.

Last year a biological control program was initiated at the Cedara Weeds Lab on triffid weed. An arctiid moth, Pareuchaetes pseudoinsulata, which has been introduced to good effect in some countries in Asia, has already been released around Durban and along the south coast. Establishment has yet to be confirmed. Work is continuing on other insects and fungal pathogens.

Consideration is also being given to using a fungal root pathogen which has recently been devastating guava orchards in the eastern Transvaal for the biological control of guava in Natal (D.J. Erasmus personal communication).

Although biological control is a potentially powerful means of control, experience has shown that it is not a miracle solution. It would therefore be a unwise to relax chemical and mechanical control with the expectation that biological control will eventually solve the problem.

THE BIOLOGY OF THE TARGET PLANT

The importance of understanding the biology of the target plant was overlooked in earlier control work. For example, after almost 40 years of lantana control nothing is still known about the longevity and survival of its seeds in the soil.

It is now appreciated that the most cost-effective control programmes can ultimately only be based on a sound understanding of the biology of the target plant. The knowledge, for example, that Chromolaena seed only remains viable for three years and that it has a shallow seedbank has prompted the successful use of fire to reduce the problem of re-infestation of cleared areas by seedlings (D.J. Erasmus, unpublished report).

At the Cedara Weeds Lab work is presently being done on the seed biology of balloon vine and Mauritius thorn as a first step towards research into their control.

THE ATTITUDE TOWARDS ALIEN INVADER PLANT CONTROL

The battle against alien invader plants is often lost long before control measures are applied in the field. This is because of some fundamental errors in the thinking about the problem.

A wrong perception about alien invader plants

Alien invaders are generally viewed as invincible and triffid-like. This image probably owes as much to the long history of half-hearted and ineffective control as to any qualities of the alien invasive plants which have made them so successful. The state of the vegetation and its vulnerability to invasion is however overlooked.

Alien invasive plants should rather be seen as successful opportunists capitalising on the conditions created for them mostly by disturbance (i.e. overgrazing, too frequent burning) and/or neglect. It would make for more effective control if an alien invader plant was not regarded as a problem in itself, but rather

as a symptom of a problem existing in the vegetation. The solution to the problem therefore would not only depend on the removal of the alien plants but also on the management and conservation of the vegetation.

Species based approach rather than land unit based approach

Implicit in the species based approach has been the idea that, starting with a list of priorities, the alien invader plants could be eradicated one by one. Experience has shown that the eradication of an alien invader plant is impossible. There is no precedent for this.

A more realizable goal therefore is to aim to reduce all the alien invasive plants within a well-defined unit of vegetation at a level where they do not present a problem. This unit may be a paddock, a patch of natural forest in between canelands or a whole farm.

Short-term rather than long-term thinking

Land-users tend to become disillusioned if their control efforts do not show dramatic progress after perhaps four or five years. They forget that the problem confronting them has very often taken fifty or more years to develop. If alien invader plant control were to be seen as an integral part of vegetation management, land-users would come to accept that it is going to be an ongoing process.

Little incentive to control alien invasive plants

Alien invaders are primarily an aesthetic and ethical problem relating to conservation areas, with little direct financial benefit in controlling them. This coupled with the enormity of the problem has prompted many land-users to expect some assistance from the State. With the increasing environmental awareness people are fortunately beginning to have a more charitable attitude towards alien invasive plant control.

CONCLUSIONS

Chemical and mechanical control

The research emphasis in chemical and mechanical control should be shifted from the development of control methods to optimizing the existing control methods in the field.

It is hoped that this can be done with field-scale trials as part of a so-called "whole farm" approach. This research has now been started at the Cedara Weeds Lab. In practice a survey will be made of all the alien invasive plants occurring on a unit of land e.g.

a farm. An alien invasive plant control programme will then be drawn up taking into consideration such factors as the existing variety, density and age-structure of the alien invasive plants on the farm, the financial commitment the land-user is able to make, and all the operations on the farm throughout the year e.g. to determine the availability of labour.

The farm will then be divided up into suitable blocks for control purposes. Specific treatments such as initial clearing and follow-up, will then be assigned to each block on a time schedule. The treatment for each block will be adapted to suit the unique requirements of that particular block, and will be based on the best available scientifically derived knowledge and good common sense. On-going adaptations will be made to the initial programme as and when required. All input costs and the results of the prescribed control practices will be monitored. Problems which become apparent during the application of the programme will help to identify areas requiring further research.

Biological control

Biological control should not be seen as the ultimate solution to the problem, but as a facet of the existing integrated control programme.

The attitude towards alien invasive plant control

The daunting image that alien invasive plants have acquired must be broken down. The whole-farm approach outlined above will hopefully contribute to this. It is however also important that alien invader plant control must not be seen in isolation, but as an integral part of vegetation management. By implication this means that:

a. Alien invasive plants are never going to be eradicated and will always have to be controlled in some way.

b. Alien invader plant control is long-term.

c. Alien invaders plants are possibly a symptom of poor vegetation management, in much the same way as soil erosion is.

It is clear that progress towards alien invasive plant control is going to require a much more holistic approach our thinking.

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TABLE 1. HERBICIDES REGISTERED FOR USE AGAINST THE MOST IMPORTANT ALIEN INVASIVE PLANTS IN THE SUGAR GROWING AREAS

ALIEN INVASIVE PLANTS	HERBICIDES				
	triclopyr (Garlon)	glyphosate (Round-up)	imazapyr (Arsenal/ Chopper)	tebuthiuron (Graslan)	picloram (Tordon)
triffid weed	X	X	X	X	
lantana		X	X	X	X
guava	a				
bugweed	X	X	X	X	
pereskia	Xa				
inkberry	X				
sesbania	X	X		X	
Indian laurel	X	X	X	X	
syringa	Xa				
ballon vine					
Mauritius thorn	X	X			
Mexican sunflower					
p-butter cassia					

a = Research in progress to improve efficacy of chemical control.

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No topics - cannot do all.

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

Attitudes to Environmental Conservation and Agriculture

1. Background (Tala Valley saga)

Vegetable Damage

In December 1986 severe and obvious damage occurred to vegetable crops due to drift of hormone herbicides which had been applied to sugarcane nearby. Hormone herbicides ie 2,4-D, MCPA and Actril DS etc were banned from use in the Tala Valley as a result but in spite of this damage apparently continued and emotional reporting occurred in the newspapers laying the blame on long distance movement of hormone herbicides.

Health Aspects

In August 1987 several deformed babies were born in Durban hospitals and inspite of statements from the Medical Authorities that the incidence was no higher than normal, an **exceptionally emotional** campaign was launched in the news media establishing links between **hormone** herbicide damage to vegetables and baby deformities and laying the blame on cane growers for using hormone herbicides. The evidence for this link was very questionable as shown by the the following excerpt from a report in the Sunday Tribune of 30 August 1987 "....During the first weeks of her pregnancy in December, she and her husband had spent a holiday at Salt Rock, during the height of the sugarcane spraying season. "I also remember eating plenty of tomatoes, lettuce and fresh salads during that time".

Action

A government research committee was formed to investigate these claims of vegetable damage while a South African Sugar Industry Task Force was formed to investigate and clarify the health issues. After some months and the collection of a considerable amount of toxicity data on 2,4-D, statements were issued by this Task Force and Medical Practicioners allaying fears about the possible effects on human foetuses.

With a few exceptions reports linking hormone herbicides and these health effects ceased but those in regard to vegetable damage have continued unabated and considerable research effort is ongoing in order to unravel the real causes of crop damage.

2. Attitudes to Environmental Conservation in the USA

Structure for Environmental Protection

The US Environmental Protection Agency is a government body mandated by law to regulate all aspects of pesticide use. It is an extremely large bureaucracy and is bound by statutory procedures which makes for slow response times. Decisions must be made on a risk-benefit basis.

The EPA faces severe pressure and critisism from public groups and chemical companies for either being too lenient or too stringent in their requirements e.g. residue limits.

Pressure Groups

Groups such as the Natural Resources Defence Council (NRDC), Greenpeace, National Coalition Against the Misuse of Pesticides etc are numerous and very vociferous in their calls for a safer environment. However the methods used to get their message across may sometimes be open to question and even the organisers motives may be questionable. For instance all these organisations, although non-profit making, have some full time employees and all appeal to the public for funds. There is no doubt that the system can be easily abused to line the pockets of a few.

Publications from these groups are quick to point out that you cannot believe anything a chemical company says since they are inherently biased on issues involving chemicals. In short, there appears to be extremely little if any trust in anyone else and everyone is fully open to suspicion for the slightest reason. This means that the credibility of EPA and the Chemical Companies is suspect in the eyes of the pressure groups and vice versa.

In practice although decisions must be made using a risk-benefit method the continual public pressure may mean that products are withdrawn from use without good scientific reasons. This pressure also manifests itself in that limits of residues in vegetables or ground water become more and more stringent as to be unrealistic. At present there are moves to alter the legislation such that the benefits are taken out of the equation when assessing the registration of any chemical.

The normal response of the EPA to suspicions raised by public groups is to request further scientific studies from the chemical companies. These are then assessed and if there is no problem further studies are requested. If there is a problem a full blown investigation involving a recall of all data and re-evaluation is called for. The chemcial company may appeal against this and depending on the situation may be allowed to continue selling the product during the investigation period. In other words, there is a considerable amount of red tape which has to be negotiated before any **decision** is made on any product.

Some Further Points

5:90:5

In any population there is likely to be a normal distribution of opinion on issues. In regard to environmental problems this is probably no exception and there are obviously going to be those few who will never accept that any agricultural chemcial is worth having on the market, those few who will carry on using all the products no matter what is said about them and the great majority 90% who could be influenced one way or another.

Does the end justify the means?

Because of the problem of the apathetic majority it could well be agreed that sensationalism might be necessary to goad people into action. But how do we feel when sensationalism takes the form of an accusation against the sugar industry for causing birth deformities - based on totally unscientific evidence?

Science and Proof

Is there any such thing as proof in agriculture? If we are only 99% sure that hormone herbicides will not cause birth defects then it is **definitely possible** (1%) that they could. Non-scientists want 100% proof of safety and until they can be educated into accepting less (ie some risk) a problem will continue.

"Any fool can ask a question which will take a wise man a life time to answer".

It seems not only are scientists and public groups playing by different rules but they are also playing different games!

We are all "environmentalists"

Perhaps the previous paragraph over-simplified the situation. In fact most of us feel strongly about some issue regarding the environment and we are therefore in that public group. For instance most scientists who disagreed with NRDC or Greenpeace attitudes to chemicals agreed with them when it came to saving whales. The difference is probably that we are not intimately involved and our main source of information is the newspapers (which means its open to question). But the point here is that we must not regard the "environmentalists" as them - because we are then automatically labelling ourselves anti-environment!

3. **Possible response or actions**

Invite participation in an effort to solve a common problem. Set some ground rules in terms of decision making. Risk benefit analysis is probably still the most valid but all participants need to be educated in its use.

Set research priorities based on the most limiting factor. That is in terms of potential for damage to the environment eg do not do research on methods of detecting chemical x at low levels when another ingredient of the treated crop may be more toxic even if it occurs naturally.

Be prepared to see the goal posts move. As society becomes more comfortable and well fed, the standards of environmental safety demanded by the public might be tightened.

We face the problem of living in both 1st and 3rd worlds - need to improve the lot of 80% of population while achieving standards set by a small minority.

Set your mind free

As guardians of a fair proportion of the landscape we need to actively explore all other possible methods of achieving the same objective with less impact on the environment. Ten years ago genetic engineering was a vague concept - today it is a reality and it opens previously unenvisaged alternatives for weed control and disease resistance etc.

Objectives

Attempt to confidently address the task of ensuring that our practices are environmentally acceptable - without the unnecessary complications of questionable and emotional coverage in the media.

PETT/1b
21 November 1989