CONTROL OF CREEPING GRASSES IN SMALL GROWER CANE IN THE UMBUMBULU DISTRICT

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Abstract

The severe effect that creeping grasses, specifically *Cynodon dactylon* (Ngwengwe), *Cynodon plectostachyus* (Giant star grass), and *Digitaria longiflora* (False couch finger grass), have on cane growth has necessitated quick and positive measures to prevent small growers from having to abandon the growing of cane or, at best, having to replant their cane fields before an acceptable return on capital can be achieved. Various techniques and herbicide treatments were investigated to control these grasses, initially in ratoons using shields of various forms. A battery driven sprayer based on the commercial CP3 knapsack sprayer was constructed, with plastic shields to protect both the operators and the ratooning cane. A programme of minimum tillage was undertaken where the grasses were sprayed with glyphosate as a pre-planting grass eradication and land preparation technique. Cost saving on planting was over 50%, and estimated plant cane yield was almost doubled when compared with that obtained by conventional methods of land preparation. Successful control of creeping grasses can therefore be expected to give the small grower substantial increases in yield and projected nett income.

Introduction

The cane growing area of the Umbumbulu district consists of the high lying areas from the Mbokodweni river in the north to the Mkomazi river in the south. The incidence of creeping grasses (*Cynodon dactylon, Cynodon plectostachyus* and *Digitaria longiflora*) is mainly in the more fertile and humid areas where Inanda, Cartref and Glenrosa soil forms predominate. In these areas dense stands frequently cause poor yields, cane desiccation, and the need to replant before an acceptable return on capital has been achieved. Current land preparation techniques rejuvenate instead of eliminating these grasses, and the situation is aggravated by a residual herbicide programme which effectively eliminates other weed competition, but leads to more vigorous growth and spread of existing grass stands (Figures 1a and 1b).

It was necessary to address the situation urgently and effectively, remembering that current herbicides which can eradicate these grasses are phytotoxic to cane. Initially the investigation concentrated on ratoon cane, but the crux of the problem is at cane establishment. A drive to introduce minimum tillage (Iggo and Moberly, 1976), using the savings on mechanical seedbed preparation to fund the cost of the herbicides required for killing grasses before planting, has achieved some success. All fields planted during the 1992/93 season were sprayed with glyphosate (Roundup at 8 l/ha) wherever these grasses occurred. This paper reports various techniques and herbicide treatments that were used in an attempt to control creeping grasses.

Materials and methods

Previous work in the Umbumbulu district indicated that various combinations of hexazinone, diuron, paraquat, MSMA and ametryn failed to provide satisfactory control.

FIGURES 1a & b Comparative growth of four month old first ratoon cane (variety N12), overrun with and free of *C. dactylon*.

Subsequent control was therefore based on a programme of Roundup (359 g/l glyphosate) interrow sprays, in which various shields were used to protect the cane. Certain treatments included the herbicide Gramoxone (paraquat 200 ml/l).

Initially a conical shield fitted to the lance of a CP3 knapsack sprayer was used (Figure 2). This proved to be unsatisfactory because the shield became entangled and twisted out of alignment by striking cane lodged or hanging into the interrows. Subsequently a sled was used (Figure 3), pulled by a labourer with a kidney belt strapped to his waist, followed by a knapsack operator with the nozzle of the sprayer inside a semi-circular shield with a skirt which dragged along the ground.

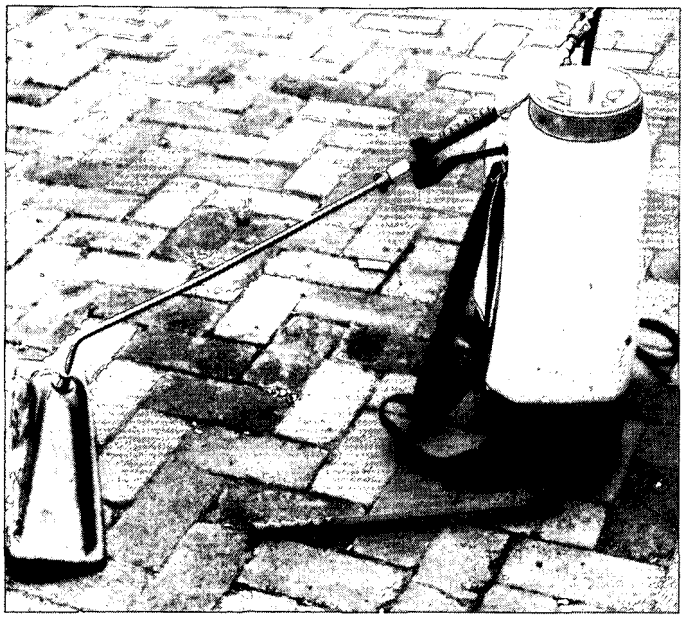
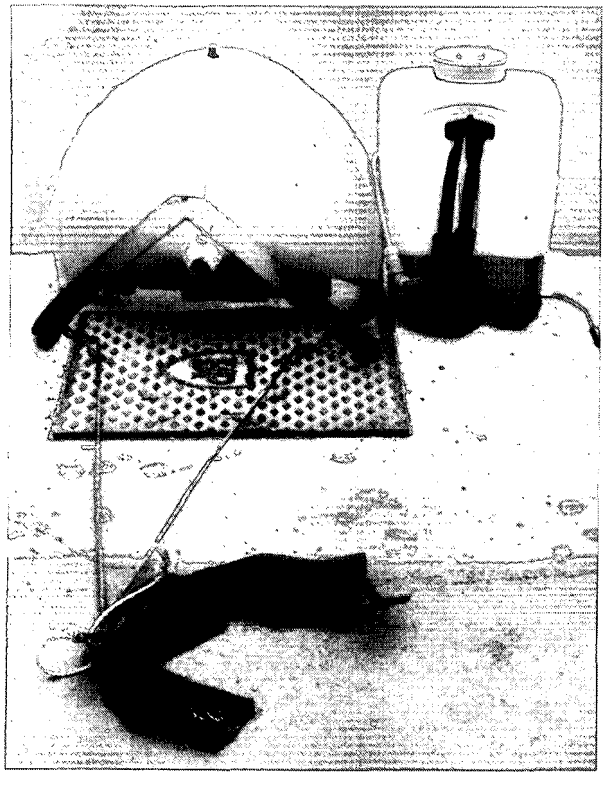


FIGURE 2 Conical shield fitted to the lance of a CP3 knapsack sprayer.



Finally a rig designed to be carried by two labourers was tested (Pez'Kwomkhono sprayer -Figures 4a and 4b). Based on an aluminium frame with a battery driven electric pump and a CP3 tank, the rig has skirts to protect the labourers and the cane. The rig is fitted with adjustable shoulder straps to enable the skirts to be carried about 100 mm off the ground (grass surface) to allow the spray to penetrate the cane rows.

FIGURE 4 The Pez'Kwomkhono sprayer a) carrying position b) pump and container details.

Field trials

Trials were conducted at six sites. Except for site 4 where the Pez'Kwomkhono sprayer was used, CP3 knapsack sprayers fitted with Albuz blue nozzles were used to apply herbicides. Soils of the Cartref form were present at all sites except site 2, where an Inanda form soil was identified (Anon, 1984). Ratings for chemical weed control efficacy at all sites were expressed as percentage kill.

Site 1 consisted of a pure stand of *D. longiflora* (False couch finger grass) growing in first ratoon cane (variety NCo376). The grass sward, where supported by cane stalks, was up to 300 mm tall and covered the cane field, verges and infield breaks in a dense mat. The treatments used at this site are given in Table 1. The thick sward caused slightly higher rates of glyphosate to be sprayed than targeted, as indicated in Table 2.

Table 1

Treatments used at site 1 for *D. longiflora* control

Treatment 1 (0,2 ha)	Treatment 2 (0,04 ha)	Treatment 3 (0,02 ha)
* cane cut to ground level and removed * cut cane allowed 5 days to dry (seal) * full cover spray with Roundup on 27/2/91	* six interrows in undisturbed cane sprayed with Roundup on 22/2/91 using shield shown in Figure 2	* full cover spray of Roundup onto verges and infield breaks on 22/2/91

Table 2

Variance in Roundup rates at site 1

Target	Treatment 1	Treatment 2	Treatment 3
8 l/ha	9,6 l/ha	9,8 l/ha	9,3 l/ha

Site 2 consisted of an almost pure stand of *C. dactylon* (Ngwengwe) in one metre high plant cane (variety NCo376). At this site, the effectiveness of paraquat compared with glyphosate, as a single spray for the control of *C. dactylon*, was evaluated in early spring. Treatments applied were Gramoxone at 3 l/ha onto 10 cane interrows, and Roundup at 6 l/ha onto 12 cane interrows. A section of the field was left as an unsprayed control.

At site 3 two separate areas of pure stands of *C. dactylon* and *D. longiflora* in one metre high cane were spot sprayed with 8 l/ha Roundup.

Site 4 consisted of a field of well grown (300-500 mm high) first ratoon cane (variety N12) with the normal spectrum of broadleaf weeds and annual grasses, plus a large area of *C. dactylon* and a smaller area of *C. plectostachyus*. The broadleaf weeds and annual grasses were successfully controlled with a Velpar/diuron mixture at 3 + 1 l/ha. However, the *C. dactylon* and *C. plectostachyus* regrew vigorously. The grower hand weeded these grasses and, although *C. plectostachyus* was removed from the field, weeding was ineffective.

The Pez'Kwomkhono sprayer (Figure 4a) was used to apply all glyphosate treatments (Table 3). The terrain in treatments 1, 2 and 3 was difficult to negotiate and consisted of rows (± 120 m long) of a medium stand of *C. dactylon*. Treatment 4 consisted of 20 m of interrow in a vigorous pure stand of *C. dactylon*, while the stand of *C. plectostachyus* in treatment 5 was so vigorous that the cane was severely stunted. Treatment 6 was sprayed onto cane suffering from wet feet and severe competition from vlei and veld grasses.

Table 3

Treatments applied at site 4

Treatment No.	Grass species	Herbicide	Remarks
1	*C. dactylon*	Roundup 8 l/ha (5 interrows) Roundup 8 l/ha + Agrowett (2% by volume) (5 interrows)	Treatment of 10 interrows were split into 2 sub-treatments of 5 interrows each, one of which was treated with Roundup + Agrowett (2% by volume)
2	*C. dactylon*	Roundup 6 l/ha	As per treatment 1
3	*C. dactylon*	Roundup 4 l/ha	As per treatment 1
4	*C. dactylon*	Roundup 4 l/ha	
5	*C. plectostachyus*	Roundup 4 l/ha	
6	various	Roundup 8 l/ha	Wet vlei area

Site 5 was an area of 1,2 ha that had been used to demonstrate the technique of minimum tillage. The plant population was a mixed spectrum of broadleaf weeds and annual grasses, including *Panicum maximum* (Ubabe), *Tagetes minuta*, *Lantana camara*, *Chromolaena odorata* and seedlings of *Eucalyptus* spp. There were stunted cane stools and a significant amount of *C. dactylon*. The area was given a full cover spray of Roundup at 10 l/ha. A small area of about 0,1 ha was left unsprayed, where conventional rip, harrow and ridge land preparation was used. Variety N12 was planted early in March 1991.

Site 6 was a 4,0 ha cane field which had to be replanted because it had become overrun with perennial grasses and *Cyperus* spp. Roundup at 8 l/ha was applied as a full cover spray in September 1991 and the field was planted to variety N12 in November 1991.

Results

At site 1 the kill achieved by glyphosate was very satisfactory, especially in areas where full cover spray was applied (Table 4). In treatment 1, regrowth of cane cut before spraying was vigorous and uniform, with no evidence of glyphosate phytotoxicity. In treatment 2 where the cane was left undisturbed there was an unacceptable level of damage to the cane and little or no control of *D. longiflora* in the cane row. The grass soon recolonised the interrows, and the dense grass sward made chemical application very difficult. In treatment 3 where verges and breaks were sprayed, the kill was similar to that in treatment 1, but areas with a very dense sward began to recover after three to four months.

Table 4

Visual evaluation of treatments at site 1

Treatment	Grass kill	Regrowth	Cane kill
1	100%	2%	nil
2	interrow 100%, cane row nil	15%	45%
3	100%	10%	nil

The initial die-back from both herbicide treatments at site 2 was similar, but after about six weeks the plot sprayed with paraquat began to regrow, and eventually *C.dactylon* re-established itself, whereas the glyphosate treatment gave a permanent 90-95% kill (Table 5).

Table 5

Visual evaluation of treatments at site 2

Treatment	Grass kill	Regrowth
Gramoxone	98%	100%
Roundup	95%	nil

As site 3 was sprayed almost at the point of canopy the results were unsatisfactory. The kill at all rates of glyphosate at site 4 was more than 90%. The addition of the surfactant Agrowett did not enhance the efficacy of the chemical (Table 6). The kill achieved on the dense stands of *C. dactylon* and *C. plectostachyus* was 100%, and after six weeks there was no noticeable regrowth.

Table 6

Visual evaluation of treatments at site 4

Treatment	Roundup (l/ha)	Grass kill, Roundup	Grass kill, Roundup + Agrowett	Cane scorch	Grass regrowth after 6 weeks
1	8	95%	95%	10%	2%
2	6	92%	93%	7%	10%
3	4	90%	91%	10%	15%
4	4	100%	n/a	10%	nil
5	4	100%	n/a	20%	nil
6	8	100%	n/a	30%	nil

After 22 months in the treated area at site 5, the cane yield was estimated at 85 tc/ha, and there was no evidence of *C. dactylon* regrowth. However, across the road in the untreated area there was a mat of *C. dactylon* under the cane, and in some places the cane had died or was severely stunted. Here the yield was estimated at only 45 tc/ha. The cane at site 6 is in excellent condition and should yield 100-110 tc/ha at harvest at 18-20 months. There is no evidence of the grass problem having persisted.

Costs

Conventional land preparation costs for the small grower, compared with those for minimum tillage, are given in Table 7.

A plant crop and two ratoons only can be expected by the small grower with the extent of creeping grass infestation experienced in many Umbumbulu district cane fields. Only 50 tc/ha per crop could be expected over the three crops. However, if the infestation can be successfully controlled, a plant crop and five ratoons could be expected with an estimated yield of 75 tc/ha per crop. This would lead to a substantial increase in projected nett income per hectare for the grower.

Table 7

Comparison of costs for conventional land preparation vs minimum tillage (Rand per hectare)

Operation	Conventional*	Minimum tillage
Ripping	400,00	Nil
Harrowing × 2	447,91	Nil
Furrowing	175,00	175,00
Roundup @ 8 l/ha	Nil	297,15
Total land preparation	1 022,91	472,15
Saving on planting operation		**550,76

* SASA Small Growers' Financial Aid fund rate
** Compounded over four years at 12% = R696

The construction costs of the Pez'Kwomkhono sprayer are given in Table 8.

Table 8

Construction costs of Pez'Kwomkhono sprayer

Materials	Rands
Aluminium frame	790,60
Canvas	115,80
Pump - 12V/7A electric	450,00
Battery 12V/45 amp/hour low maintenance	175,31
Control valve	135,00
Container, straps, terminals, hose, nozzles, etc	440,60
Labour - 20 hours @ R45,00/hr	900,00
Total cost	R3 007,31

Discussion

To date glyphosate and minimum tillage have been shown to be the most effective long term solution to the severe creeping grass problem in the Umbumbulu district. Planting costs were halved, whereas estimated plant cane yield was almost doubled when compared with that obtained by conventional methods of land preparation.

However, a major problem in ratoon cane remains. The difficulty lies in timing sprays, there being a delicate balance between the stage of cane growth and the growth and susceptibility of the grasses to glyphosate. It is generally accepted that the best period for spraying grasses with glyphosate is between January and April, but the suppression of cane growth by January, if the grass is not controlled, is unacceptable. To avoid phytotoxic effects it is recommended that cane should be sprayed when it has more than 150 mm of stick, with the lowest leaves no longer actively contributing to the growth of the plant. These conditions are usually found in plant and ratoon cane between February and April, providing an ideal opportunity for follow-up glyphosate sprays. However, spraying at less suitable times must be done to prevent unacceptable yield loss, while risking damage to cane and an incomplete kill of the grasses.

Consequently, the optimum time to spray is when cane growth is still vigorous and there is a good grass sward with maximum leaf area for uptake and translocation of the chemical. To minimise cane scorch, especially in recumbent varieties such as N12, and to achieve an acceptable kill in the interrow it is necessary to use some type of shield. However, unless controlled by follow-up hand weeding or directed sprays, grass remaining untouched in the cane row will recolonise the interrows. In practice, single sprays seldom succeed completely and follow-up spot sprays are therefore necessary to maintain control by eliminating any regrowth of creeping grasses.

Results show that the most opportune time to act against stoloniferous and/or rhizomatous creeping grasses is at planting, using the minimum tillage technique which incorporates a glyphosate spray. This provides effective control of creeping grasses at reduced cost and increased return, by allowing the cane to achieve maximum growth without being suppressed.

The second opportunity to act against creeping grasses is at the ratoon stage, which provides for continuous follow-up treatments in the fields. Between February and April, relatively small infestations can be detected and effectively controlled, before they become so widespread that they reduce yield and the number of ratoons. In these situations the use of either the Jumloot or Perby Brush shielded sprayer will increase the safety of glyphosate applications in ratoon cane.

The larger the area of creeping grass infestation and the ranker the growth, the more difficult it is to apply glyphosate, and the greater the risk of damaging the cane. In these situations it is sometimes necessary to slash cane to the ground, apply an overall glyphosate spray, and allow the cane to regrow. Badly affected areas can also be isolated, sprayed out, and then replanted. This can save the cost of replanting the entire field.

Conclusions

For effective management and control of creeping grasses in sugarcane, it is necessary to develop a comprehensive management programme that uses the most effective control measures at the optimum time. This must become a key part of the overall management system because, if creeping grasses become established in fields, the potential for economic loss is extremely high. The presence of creeping grasses must be considered when fields are replanted, and when planning ratoon management.

When fields are due for replant they should be assessed for creeping grass infestation. If infested, fields should be scheduled for minimum tillage with a glyphosate spray. From January to April plant cane fields should be checked for grass regrowth and, where this occurs, should be spot sprayed with glyphosate using shields. Judicious spraying with glyphosate in ratoons is an important aspect of creeping grass control. Spraying should start as soon as practically possible, and the period from January to April should be devoted to the detection and eradication of regrowth. Where regrowth occurs, the grass should be spot sprayed with glyphosate using shields. Field verges should also be sprayed with glyphosate at this time to prevent reinfestation.

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