SHORT COMMUNICATION

ROGUING FOR SMUT

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Abstract

The incidence of smut (*Sporisorium scitamineum*) has increased in the sugar industry in recent years. To reduce the risk of premature crop eradication due to high smut levels, regular roguing (the removal of infected stools) is essential in smut-prone fields. While effective, roguing is time-consuming and expensive. This study investigated the comparative costs and efficiency of manual and chemical roguing. Time and motion studies indicated that applying glyphosate (10% v/v) to smut-infected stools was fourfold quicker than physical stool removal. The amount of soil and plant material removed from the field during the chemical roguing operation was substantially lower than when the stool was removed physically; it saves time and reduces the costs associated with the disposal of the infected material. Using this information, a simple calculator was developed to estimate the cost of the two methods in fields with different smut levels. Alternative methods of chemical roguing were also investigated. The decline in leaf chlorophyll content and subsequent stool death was more rapid following the application of glyphosate compared to the use of other chemicals that are registered for the eradication of sugarcane. A hand-held 2-litre sprayer and a 5-litre spot sprayer were convenient and effective in the application of glyphosate, with no evidence of drift to neighbouring stools.

Key words: Sugarcane smut, *Sporisorium scitamineum*, disease management, roguing, chemical roguing

Introduction

The incidence of sugarcane smut (*Sporisorium scitamineum*) has increased in parts of the South African sugar industry in recent years. Surveys conducted in 2020-21 indicated that 21% of the fields inspected were infected, with incidence ranging from a trace to 13% stools infected (Jones *et al*., 2021). While smut is more common in the northern irrigated region, where the disease is endemic, there has been an increase in incidence and prevalence in other regions. The smut situation in Mpumalanga has shown steady improvement since the Local Pest, Disease and Variety Control Committee (LPD&VCC) regulations regarding roguing and crop eradication at area-specific permissible limits (Stranack, 2021) were strictly enforced from 2008, in addition to variety choice and seedcane health (Jones *et al*., 2021; unpublished data). A similar strategy was adopted more recently in the Pongola area and smut levels are expected to decline over time.

Since smut is a systemic disease, and there is currently no cure once the sugarcane stool becomes infected (Bhuiyan *et al*., 2015), roguing is an important management option for removing the infected material from the field. Manual roguing has traditionally been practised in the industry, but chemical roguing, using glyphosate (10% v/v), offers a useful alternative. In this study, the comparative costs and efficiency of manual and chemical roguing were

investigated.

Methodology

A total of 23 growers (10 large-scale, 9 small-scale and 4 miller-cum-planter) were interviewed to gain a better understanding of their roguing practises, particularly in the irrigated north.

Time and motion studies were conducted in six fields (four were done manually, and two were done using chemical roguing) to provide information on the time taken to physically remove or treat the infected stools. A total of 100 time points were collected from each field. An Excel calculator was developed to estimate the time required to rogue different-sized fields that had different infection levels, using manual and chemical roguing.

The efficacy of two formulations of glyphosate (360 g/L and 450 g/L; 10% v/v), fluazifop-p-butyl (150 g/L; 5% v/v) and imazapyr (240 g/L; 5.2% v/v), for killing stools and shoots, were compared in a field trial at Mount Edgecombe. All four chemicals are registered for the eradication of sugarcane in South Africa. The efficacy of glyphosate, with or without an adjuvant, and applied using five different applicators, was compared in separate trials. Drift between the treated and neighbouring stools was also assessed.

Results and Discussion

While the growers that were interviewed were aware of chemical roguing, most preferred the manual method, mainly because of the risk of chemical overspray if the operation was not done correctly. This could partly be attributed to the fact that many growers relied on casual labour for roguing. The surveys provided an insight into the costs incurred by growers and the challenges associated with both manual and chemical roguing.

The manual roguing process was more time-consuming than chemical roguing. It took an average of 18.0 seconds to remove an infected stool with a hoe, compared with 4.8 seconds required to treat a stool of similar size with glyphosate ($P<0.001$) (Fig. 1). The height of the cane influenced the time that the procedure took; it was more efficient when the shoots were approximately 30 cm (from the base to the top visible dewlap), compared to when they were 80-100 cm. While whip roguing (when the infected shoots are plucked from the row at soil level) was a relatively quick process, it is not recommended, since the infected stool will remain and produce new whips throughout the current and subsequent seasons.

Roguing costs were influenced by smut incidence (Table 1), not only because of the increased amount of time that is required to treat or remove the infected stools, but also because of the amount of material that needs to be removed from the field. This was particularly evident during the manual roguing operations, where whole stools, including the roots and soil, were removed in bags. Additional people were required to collect and replace the filled bags in the field, and the transport costs were therefore higher, because of the amount of material that needed to be taken from the field to the dumpsite for burning.

The results of the trial investigating the suitability of selected chemicals for roguing indicated that there was no difference between the two glyphosate formulations (360 g/L and 450 g/L; 10% v/v), with both providing a rapid knockdown effect when applied to the stools. Five days after application, the chlorophyll activity for both treatments was significantly lower ($P<0.001$) than the control and the other two treatments. No chlorophyll activity was recorded in the glyphosate-treated stools four weeks after application, while low levels of activity were still evident in the fluazifop-p-butyl and imazapyr-treated stools.

A hand-held 2-litre sprayer and a 5-litre spot sprayer were convenient and effective for the application of glyphosate, and there was no evidence of drift to neighbouring stools. The

addition of an adjuvant to glyphosate did not result in a consistent improvement in efficacy. There was evidence of drift to the neighbouring stools when glyphosate was applied with an adjuvant using a knapsack fitted with a flat tip or brass hollow cone nozzle, designed for increased droplet size.

References

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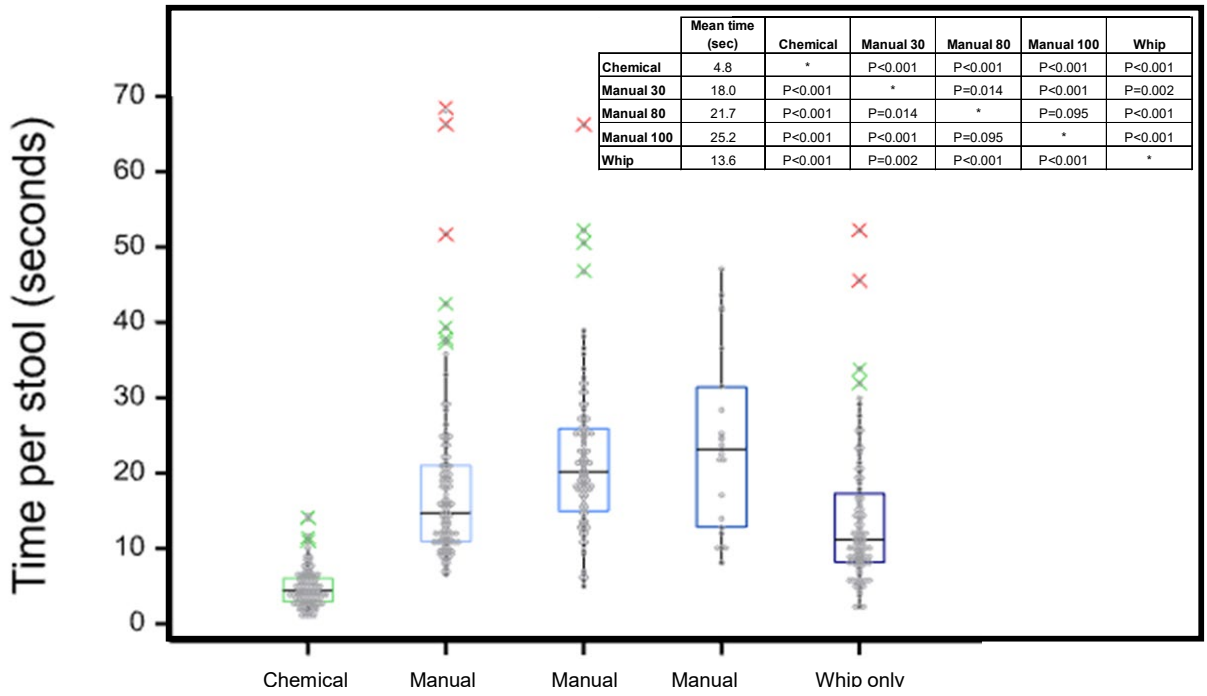

	Mean time (sec)	Chemical	Manual 30	Manual 80	Manual 100	Whip
Chemical	4.8	*	P<0.001	P<0.001	P<0.001	P<0.001
Manual 30	18.0	P<0.001	*	P=0.014	P<0.001	P=0.002
Manual 80	21.7	P<0.001	P=0.014	*	P=0.095	P<0.001
Manual 100	25.2	P<0.001	P<0.001	P=0.095	*	P<0.001
Whip	13.6	P<0.001	P=0.002	P<0.001	P<0.001	*

Figure 1: Time taken to manually remove or chemically treat smut-infected stools. Boxplots: Each point indicates one stool (n=100), centre lines denote median values. Boxes contain the 25th to 75th percentiles of the dataset and whiskers mark the minimum and maximum values. Crosses indicate outliers. The inserted table indicates the mean time taken for each treatment and the significant differences between treatments

Table 1: Estimated cost of one manual and chemical roguing operation in a 1-hectare field with different smut incidence (one team, two people)

Smut incidence (%)	Labour costs (R)		Transport costs (R)		Chemical cost (R)	Total costs (R)		
	Manual	Chemical	Manual	Chemical		Manual	Chemical	Diff / ha
1	433	266	14	3	34	447	303	144
2	479	274	27	6	69	506	349	157
3	525	283	41	10	103	566	396	170
4	572	291	55	13	138	627	442	185
5	618	299	69	16	172	687	487	200
10	850	340	137	32	344	987	716	271