# PRELIMINARY OBSERVATIONS ON PRE-HARVEST SPRAYS OF GLYPHOSATE TO IMPROVE THE PROFITABILITY OF MINIMUM TILLAGE IN SUGARCANE

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**Abstract**

The chemical herbicide glyphosate, at high doses of 2,9 kg ai and 4,3 kg ai/ha was applied six and four weeks before harvest to fields of sugarcane varieties N8 and NCo 376. Applications were made by means of a knapsack sprayer fitted with two nozzles aiming at the top of the cane canopy and one nozzle aiming downwards to the base of the plant. Most of the leaves and all the young tillers had been killed by the time the crops were harvested. There was no apparent adverse effect on cane growth and the cane quality was better than that in adjacent unsprayed areas. New crops were planted within one week of the previous harvest. After two months, 20% of the stools of the variety N8 grew again while variety NCo 376 showed a slightly higher percentage of stool survival. Nevertheless this method of crop re-establishment represents significant savings in time which leads to increased profits compared with conventional and current minimum tillage methods. Further work is required before these preliminary observations can be confirmed and the conditions necessary for optimum responses need to be determined.

## Introduction

The South African Sugar Association Experiment Station has proved the efficacy of glyphosate for killing young sugarcane ratoons (Iggo[1]). Provided crop growth and climatic conditions were favourable, a potential existed for "chemical ploughing" and the minimisation of the tillage necessary for crop replanting. The concept was further investigated and practical recommendations for minimum tillage were developed. It was stressed (Iggo and Moberly[2]) that advantages would include shorter fallow periods, reduced risks of soil erosion, reduced costs of cultivation and possible gains in yield on certain soils such as the recently formed sands and sandy loams.

The success of the method has been well demonstrated in the ever increasing areas that are now being re-established exclusively by techniques of minimum tillage. However, the escalating costs of chemicals, tractors and fuels are cause for concern. In the effort to reduce costs, alternative methods have been tried where additives and lower rates of glyphosate are used, or by introducing different spraying techniques (Turner[3]).

The results of observations of a suggested alternative method of minimum tillage using glyphosate are presented in this paper. The mature crop was sprayed from beneath the crop canopy prior to harvest, instead of waiting until the ratoon regrowth was sufficiently well developed for conventional sprays to be applied. The mature but dying cane was harvested and immediately after harvesting had been completed, a new crop was planted into what had previously been the interrows of the former crop.

## Experimental

Areas within two existing fields on soils of the Clansthal series were scheduled for replanting. NCo 376 was planted instead of N8 on 0,60 hectares of one field, and on one hectare of another field. Estimated yields were 50 and 60 tons cane per hectare respectively on these extremely weak sand areas.

Glyphosate in the form of Roundup was applied at either 2,9 kg ai/ha or 4,3 kg ai/ha (8 or 12 *l*/ha Roundup respectively) to the foliage of the mature crop. Application was by means of a CP3 knapsack sprayer equipped with a Pamro lance clipped on the back, which gave the operator greater mobility within the cane lines. Two nozzles at the top of the lance directed the spray within the cane canopy at the level of the top dewlap of the tallest cane, and another nozzle placed at waist level was directed downwards to spray the lower tillers. Details of the treatments applied to the two experimental areas are presented in Table 1.

**TABLE 1**
**Experiment details**

| Treatments | Experiment 1 | Experiment 2 |
|---|---|---|
| Variety | N8 | NCo 376 |
| Ratoon | First | First |
| Harvest age | 12 month | 12 month |
| Glyphosate (Roundup) dose | 2,9 kg ai/ha (8 ℓ/ha) | 4,3 kg ai/ha (12 ℓ/ha) |
| Spray volume per hectare | 480 ℓ | 480 ℓ |
| Weeks between treatment and harvest | 6 | 4 |
| Weeks between harvest and planting | 1 | 1 |

In Experiment 1, cane stalks were randomly sampled and assessed for quality to compare sprayed and unsprayed control cane. Table 2 shows that in respect of juice purity and sucrose content, the treated cane was better than cane from the control. Unfortunately the treated and control plots were not harvested at the same time and no direct comparison of the mill analyses could be made.

In Experiment 2 direct comparisons could be made because the treated and untreated crops were harvested at

**TABLE 2**
**Analysis of sprayed and unsprayed crop samples from Experiment 1**

| Analysis/crop | | Period after spraying (Glyphosate 2,9 kg ai/ha) | | |
|---|---|---|---|---|
| | | 10 days | 27 days | 41 days |
| Sucrose % | Sprayed | 12,6 | 14,5 | 14,8 |
| | Unsprayed | 13,2 | 14,4 | 14,1 |
| Fibre % | Sprayed | 18,3 | 15,5 | 14,8 |
| | Unsprayed | 15,5 | 15,1 | 14,2 |
| Juice purity % | Sprayed | 86,3 | 89,2 | 88,5 |
| | Unsprayed | 88,0 | 90,0 | 88,4 |

the same time. Table 3 shows that the mean sucrose content was 1% higher in the treated cane. No comparisons of yield per hectare were made.

TABLE 3

**Mill analysis of sugarcane harvested from Experiment 2**

| Crop | % Sucrose | % Fibre | Juice purity % |
|---|---|---|---|
| Sprayed .. .. .. .. | 13,1 | 17,6 | 82,4 |
| Unsprayed .. .. .. .. | 12,1 | 20,1 | 82,6 |
| Difference from control .. | +1,0 | −2,5 | −0,2 |

*Regrowth of surviving stools*

The newly replanted fields were visited at intervals to count the number of surviving stools. In Experiment 1, where N8 had been sprayed with glyphosate at 2,9 kg ai/ha, the percentage regrowth was one, seven and 21 at 20, 40 and 60 days respectively after the previous harvest. The assessment was based on a maximum regrowth potential of 2,2 stools per metre of row.

The surviving volunteer stools were removed at the first weeding ten weeks after the new crop had been planted. Ten man-days per hectare were required for weeding and volunteer stool removal. A further stool removal treatment was carried out eight weeks later at the end of January. The "sideswipe" technique of wiping a 10% solution of glyphosate onto the cane leaves is by means of a roller applicator with the herbicide solution contained in the handle. A quantity of one litre of Roundup was used per hectare of sugarcane. Slight regrowth was observed at the beginning of March 1982.

In Experiment 2, the regrowth of NCo 376 was initially greater and had reached 20% after 25 days. The area was weeded of natural grasses such as *Panicum maximum*, but no attempt was made to remove the volunteers until six weeks after planting. Two different eradication methods were evaluated. The first involved only chemical treatments which were applied using the "sideswipe" method, in two stages to the shoots of the old stools. Leaves were wiped with a 5% solution of Roundup and again five weeks later with a 10% solution. The field quantities of Roundup used were 3 *l*/ha and 1 *l*/ha respectively.

The second method involved a double pass cultivation with a Tiger Tiller eight weeks after planting. After a further three weeks any subsequent shoot regrowth was wiped with the 10% Roundup solution and the timing of this follow-up treatment coincided with that of the first method.

Both systems gave promising results initially but poor control of the cane regrowth by the light cultivation made the follow-up chemical treatment very difficult. The remaining volunteers and established weeds were removed a month later in both areas by comprehensive hoeing that required 15 man-days per hectare.

## Observations

When the standing cane was sprayed, the progress of the applicator was relatively easy in the N8 plot where the crop was erect. However, in the NCo 376 plot the volume of dry trash and partially lodged cane slowed down the application considerably. At the time of harvest, both N8 and NCo 376 had green leaves within the dried up canopy. The cane samples from the N8 plot had about 20% of the sticks showing the characteristic swelling of the top buds usually found in artificially ripened sugarcane.

In both experiments, regrowth occurred in parts of certain rows and in clusters. This might be attributed to blind lines or to slight depressions in the field where the cane canopy might not have received the full chemical spray. Volunteer regrowth seems to be adequately controlled with one hand hoeing followed by one or two wipes with a 10% solution of Roundup. The wiping of the leaves using the "sideswipe" method can be done at a rate of one hectare per man-day and if done at the right time requires only one litre of Roundup per hectare.

## Conclusion

It is feasible to spray cane with glyphosate before harvesting to stop the ratooning of the stubble and attain a quicker replant. Provided that the cane is erect and that the yield does not exceed 70 tons per hectare, a reasonable kill can be expected and the regrowth should be managed easily.

Should further investigations confirm these observations, the technique of chemical ploughing and minimum tillage will receive additional impetus. A grower will be able to use a pre-harvest spray of Roundup to complete his spring planting programme by November whilst retaining the minimum tillage method for his autumn planting.

The suggested method would be especially useful on hilly terrain and on erodible soils where minimum tillage is presently recommended. It must also be considered for use on soils of low to medium productivity where a rapid replanting is essential to obtain the maximum yields and on such fields the extra crop gained may well cover the costs of the entire replanting.

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