GLYPHOSATE AS A GROUND-APPLIED CANE RIPENER

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Abstract

The 1979, 1980 and 1981 seasons saw the introduction and semi-commercial use of MON 8000 or POLADO as a ground-applied ripener. Seventy-two growers in eight different mill group areas used Glyphosate on 1 660 hectares during the seasons mentioned. Various methods of ground application, including motorised, mechanized and manually operated systems, were tested. Terrain, area and shape of fields, length of lines, infield drains, lodged and tall cane, operator fatigue, water supply and labour availability had to be considered in an attempt to provide an even application with a low amount of drift. Testing, calibration of equipment and training of applicators were completed in March 1979. Interested growers were encouraged to treat half or parts of suitable fields so that a comparison could be drawn between treated and untreated areas within the same field. The procedures followed, the equipment used and the results are presented in this paper.

Introduction

Growers with cane growing actively during the milling season were asked to experiment, on a semi-commercial scale, with the glyphosate known as MON 8000 when it was a coded compound and as Polado when it became a commercial product. A delay of five to eight weeks was required between application and harvesting, and therefore the expected harvesting dates of the various fields has to be estimated when the mill's opening date became known.

These fields were then assessed with reference to age, growth and the amount of green top present. These criteria were sufficient for cane which was irrigated or growing on alluvial flats with a high water table, but following the treatment of cane on a light sandy soil that resulted in a severe set-back of the following ratoon, later criteria included the soil type and its moisture holding capacity and availability, expected air temperatures and the probability of rainfall in the period between spraying and harvesting. In spite of taking these precautions, several fields treated in April 1981 suffered stress in the following ratoon due to unseasonable hot, dry windy conditions during the period between spraying and harvesting.

Recommendations during March, April and May are the most difficult to make because of the advent of drier, cooler weather. These conditions quickly slow the rate of cane growth and cause a lesser effect from the chemical and a greater effect on the following ratoon.

If a field was considered suitable for treatment the average row width was determined and the number of interrows to be opened to coincide with the boom swath width of 7,5 metres was calculated. A row width of 1,2 metres would require every seventh interrow to be opened whilst a 1,4 metre row width would require every sixth interrow being opened. The labourers required to open these rows were provided by the grower and varied from 0,9 men per hectare in young straight cane to 8 men per hectare in heavily lodged cane. The average was 3,4 men per hectare.

The opening of the rows was found to be the most important factor influencing even application. Badly opened rows resulted in slower and uneven walking speeds as well as accentuated boom movement as operators battled to move through over-hanging or lodged cane.

Growers were encouraged to treat half or parts of fields, sufficient in area for at least four days of harvesting and not more than three weeks of harvesting. It was intended to harvest the smaller areas as near to six weeks after treatment as possible. It was recommended that larger areas be started five weeks after treatment and completed within eight weeks after spraying. Comparisons between treated and untreated areas were to be made from mill returns of pol % cane, fibre % cane and juice purity %, or the Central Board returns where sucrose % could be used.

This procedure enabled the grower to observe the treatment on a semi-commercial scale, during the ripening process, the harvesting operation and the ratooning period and to assess his own results soon after the cane was milled.

The rate at which chemicals were used in 1979 was 400 g ae per hectare. This rate was reduced to 300 g ae per hectare during 1980 and 1981. Application accuracy varied by 8% during the three seasons.

Materials

The method of application involves two operators, one walking ahead with a CP3 knapsack containing the chemical mixture, and the other following behind carrying the boom apparatus. This system shares the work load and thereby ensures minimum operator fatigue, resulting in a more even walking speed.

The boom apparatus is made in three parts for ease of transportation. A metal frame from the Spray King knapsack is worn on the front of the operator to allow the boom to be supported on the shoulders and the hips. The operator has much better balance when the boom is in front of him rather than behind him, and less boom movement occurs, particularly when cane stalks have to be pushed aside.

A galvanised, hollow, upright tube, 1,5 metres long and 20 mm in diameter, is welded to the front of the frame and supports an aluminium extension that is connected to the boom. Three height settings on this upright tube allow the boom to be raised or lowered as necessary. Two on/off switches are attached to the top of the tube approximately at the operator's eye level.

The boom is made of aluminium, 15 mm thick and 5 metres long. Three TK1 floodjet nozzles, 2,5 metres apart facing almost vertically upwards, are clamped to the boom and produce a total swath width of 7,5 metres. Two nozzles are connected to one spray line and the outside nozzle is independent.

A cross with 300 mm extensions is placed towards the centre of the boom and wire is threaded through the end of the extensions from one end of the boom to the other. This braces the boom and prevents excessive movement.

The chemical mixture is pumped from the forward operator through a hose which is three metres long and 10 mm in diameter. It passes through the switches on the frame up to the nozzles. The pressure at the switches is 175 kPa according to Hardy[1] the pressure at the nozzles should be approximately 150 kPa.

The boom is held 500 mm above the cane and on an operator 1,75 metres tall it can be operated at a height between 3,6 m and 4,7 m above the ground. An average walking speed of 70 to 80 metres per minute gives an application rate of 40 to 50 litres per hectare.

Results

1979 *Season*

The total area treated was 1 100 hectares. Fifty-five growers in eight mill group areas used glyphosate during the season. The results recorded in Tables 1 and 2 are commercial mill data for treated and untreated areas in the same fields. The crops were harvested 5,7 to 7,5 weeks after spraying.

In general the effects of the treatment were strongly positive and they were economically rewarding. Several growers nevertheless obtained small and disappointing results in terms of pol % cane, although good ripening symptoms were apparent. It was discovered that the effect of the chemical in reducing the amount of green canopy encouraged the cutters to top at a higher level, and gains were thus made in the truck or bundle weights rather than in pol % cane. An increase in tons sucrose per hectare was therefore still achieved.

TABLE 1

Average results obtained throughout the industry in 1979

	Untreated	Treated	Difference
Pol % cane	11,52%	13,00%	+ 1,48
Fibre % cane	13,61%	13,67%	+ 0,06
Juice purity %	84,22%	86,64%	+ 2,42

TABLE 2

Results of comparison of pol % cane at different times of year in 1979

Harvest month	Untreated	Treated	Difference
June	11,72%	13,11%	+ 1,39
July	10,82%	11,98%	+ 1,17
August	11,82%	12,81%	+ 0,99
September	12,75%	13,32%	+ 0,57
October	12,45%	14,04%	+ 1,59
November	12,25%	13,50%	+ 1,25

The interpretation of results was complicated by this factor and results in 1980 were recorded as tons of sucrose per hectare rather than pol % cane.

1980 Season

The total area treated was 480 hectares. Due to the poor growing conditions only 29 growers supplying four sugar mills used glyphosate during the season. Results recorded in Table 3 were from treated and untreated areas in the same fields. The crops were harvested 6 to 7,5 weeks after spraying.

The effects of treatment were again considerable. They were obtained in spite of the drought by selecting suitable fields that were to be harvested in June, July and August. Little or no spraying was done later in the season because growing conditions were poor and the mills closed early.

1981 Season

The total area treated was 80 hectares. A reduced area in which operations were to be carried out, drought, and the effects of eldana resulted in only 80 hectares in three mill group areas being treated with glyphosate. Applications were made in April and the cane was harvested in June when the sucrose % cane was increasing.

TABLE 3

Average results obtained in 1980 season

	Untreated	Treated	Difference
Tons sucrose/ha	13,23	14,24	+ 1,01

Assessments were based once again on sucrose % cane because too much time was required to measure the treated areas accurately so that the results in terms of tons of sucrose per hectare could be calculated. The results are recorded in Table 4.

The crops were harvested 6,3 to 7,0 weeks after spraying.

The results were relatively disappointing but they were achieved on carryover crops yielding about 120 tons per hectare. Unseasonably dry weather occurred between spraying and harvesting, causing slower growth and a poorer response to the chemical treatment. In spite of this an economic gain was achieved.

TABLE 4

Average results obtained in 1981 season

	Untreated	Treated	Difference
Sucrose % cane	12,07%	12,72%	+ 0,65
Fibre % cane	15,83%	16,66%	+ 0,83
Juice purity %	79,11%	80,33%	+ 1,22

Cane symptoms following application

No difference in symptoms between varieties was noted. Two weeks after treatment :

The green leaf sheaths show a colour change towards a burnt orange/red and begin to loosen on the stalk.

Three to four weeks after treatment :

Bud swelling and side shooting begins on fast growing cane. Slower growing cane sometimes produces only bud swelling five to six weeks after treatment. Stressed or slow-growing cane exhibits yellowing of the leaf canopy and a browning of the buds.

Five to six weeks after treatment :

The reduction in the number of green leaves makes the canopy resemble a fan or palm tree in some cases. Bud swelling and side shooting becomes more advanced.

At time of harvesting :

A cleaner burn is achieved on treated cane, causing labour to top sometimes higher than normal. The effect on sucrose tons per hectare is noticeable but it is not apparent if one compares pol % cane for treated and untreated areas.

After harvest :

Two to three weeks later :

Ratoon growth begins, exhibiting chlorotic shoots in inverse proportion to the rate of cane growth at the time of

and following spraying. Fast growing cane has very few and rapidly disappearing chlorotic shoots whilst slower growing cane exhibits more chlorotic shoots that can take as long as six to eight weeks to disappear. The elongation rate of chlorotic shoots does not appear to be any slower than that of the normal green shoots.

Cane under stress at the time of or after spraying shows symptoms of slow ratoon growth and a high incidence of chlorosis. Increased tillering does seem to occur but the cane takes six to ten weeks to recover, and even longer if the stress was severe.

Three to four weeks later :

Errors made when applying the treatment now become visible, ie striping, slow ratoon growth or defined areas of set-back due to over-application.

Two rows of cane, spaced every seven to eight metres and depending on the swath width used, may be taller than those on either side. It was recently discovered that these lines were the rows opened for application paths. The reason may be that the open rows received more sunlight, air and moisture than other areas in the field, and bud growth may have begun during the six to eight weeks between row opening and harvesting.

Eight to ten weeks later :

Only severely stressed cane exhibits symptoms beyond this period.

Requirements for the successful use of Glyphosate

Results during the 1979-81 seasons indicated that sustained growth must be maintained for three to four weeks after treatment. The best results were obtained when air temperatures were high and a plentiful supply of moisture was maintained up to the time of harvesting.

Ratoon chlorosis and ratoon set-back were invariably associated with the lack of moisture or poor weather conditions during the three to four week period after treatment.

TABLE 5

Relationships between crop growth, ripening effect and ratoon effect

Cane condition	Sucrose response	Ratoon effect
Young actively growing	Very good	Nil
Reasonable growth ..	Good	Some chlorosis but minimal effect
Slow growth	Fair/Poor	Delay in ratooning
Stressed cane	Nil	Severe delay in ratooning – possible reduction in yield of next crop

A summary of the relationship between crop growth, ripening and ratoon damage is given in Table 5.

Check list prior to decision on treatment

1. A minimum of a third of the plant height should comprise green leaves.
2. The new leaves at the top of the canopy should be curled over at the ends rather than erect and rigid.
3. There should be 22 to 30 cm of immature stalk.
4. The age of cane has an effect on the rate of growth, and this should be taken into account.
5. Determine the time of harvest.
6. The soil type and its moisture content or the height of the water table should be established. Will there be sufficient moisture in the soil to sustain good cane growth for three to four weeks if no rain falls? This is more important during the April/September period than in November/December when the likelihood of rain is greater. Light soils and fields on slopes should be very carefully considered before a decision is made.
7. Temperatures likely to be experienced should be considered.

Conclusion

It has been possible and practical to apply glyphosate with ground-operated equipment. Appreciable economic returns were achieved when cane in a suitable condition was treated. Care should be taken when selecting cane for treatment particularly in the April to September period. Damage to the following ratoon, except in rare cases of freak weather conditions, is the result of poor field selection or bad application techniques and should not be attributed to the performance of glyphosate as a ripener.

Acknowledgements

Thanks are due to the growers who co-operated with cane to treat and who supplied the figures published in this paper; to Messrs. Norman King and Carl Ziervogel of Triomf Farmers' Organisation who assisted in the development of the application equipment; to Mr. Ric Millard of Monsanto who convinced me that a ground application system was possible and then assisted in the early development work; and to Mr. Mike Clowes of the SASA Experiment Station for his encouragement.

REFERENCES

1. Hardy, J. G. (1981). Results of investigations into nozzle distribution pattern with reference to ground application of a sugarcane ripener. *SASTA Proc* **55**: 161–164.