

RATOON CLEARING OF PINEAPPLE WITH PARAQUAT AND ROUNDUP GLYPHOSPHATE

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RINGKASAN

Cara-cara kimia yang biasa dijalankan dalam pembersihan 'ratoon' telah dibandingkan. Tiga perlakuan-perlakuan kimia yang dijalankan ialah 'roundup gliposfat' dengan kadar 3.00 kg/ha, paraquat, 0.70 kg/ha dan paraquat 0.28 kg/ha + roundup gliposfat' 0.75 kg/ha.

Perlakuan kimia yang terbaik ialah paraquat 0.70 kg/ha yang menghasilkan pengeringan yang sepenuhnya untuk 81% dari tumbuhan dan daun-daun mudah dibakar selepas 3 minggu.

INTRODUCTION

Pineapple, with an export value of 49 million Malaysian dollars in 1972, occupies an area of about 15,000 ha; of this acreage 11,000 ha are under smallholdings and about 4,000 ha are under estate cultivation.

One of the main operations in pineapple cultivation is ratoon clearing. This operation has become important with the implementation of the pineapple replanting scheme in 1972. About 39% of the holdings are between 2 to 5 years old while 21% are between 5 to 10 years old and 8% more than 10 years old (WEE, 1971).

The traditional method of ratoon clearing is by cutting the plant at its base and leaving it to dry under the sun for three to four months before it is heaped and burnt. However, a chemical method which is cheaper and faster has been reported by the author. With this method, paraquat is sprayed at 0.56-0.84 kg/ha in 1100 litres of water followed by burning 5 weeks later (LEE, 1973). The chemical method was found to be cheaper than the traditional method by 86 dollars/ha.

However, with the chemical method, stumps of about 25 cm high were often left behind, as these could not burn easily at 5 weeks after spraying. It was thought that a translocated herbicide like roundup glyphosphate could perhaps aid in the complete killing of the stump. With this herbicide in mind, a simple experiment was carried to compare roundup glyphosphate, paraquat and their mixtures for ratoon clearing of pineapple.

MATERIALS AND METHODS

The trial was carried out on a seven year-old ratoon pineapple field. The cultivar chosen was Singapore Spanish as an estimated 86% of the total acreage is under this cultivar. The experiment consisted of a control and three herbicide treatments. A randomised complete block design with 3 replications was adopted. The plot size was 3m × 7m; the distance between the plots was 3m and this area was filled with guard rows of ratoon pineapple.

For the control plots (no herbicide), the plants were cut at their bases. The herbicide treatments consisted of roundup glyphosphate at 3.00 kg/ha, paraquat at 0.70 kg/ha, and a mixture of paraquat at 0.28 kg/ha and roundup glyphosphate at 0.75 kg/ha (*Table 1*). Details of the two herbicides are shown in *Table 2*.

TABLE 1. DETAILS OF THE TRADITIONAL AND CHEMICAL METHODS OF RATOON CLEARING

Treatment	Details (Herbicide rates in kg. ai/ha)
T ₀	Plants cut at the base (control)
T ₁	RG 3.00
T ₂	Paraquat 0.70
T ₃	Paraquat 0.28 + RG 0.75

T₀ = Traditional method, T₁ — T₃ = Chemical methods
 RG = Roundup Glyphosphate

TABLE 2. CHEMICAL NAME, TOXICITY, MODE OF ACTION AND FIRMS FOR PARAQUAT AND ROUNDUP GLYPHOSPHATE

	Paraquat	Roundup Glyphosphate
Chemical	1, 1' — dimethyl — 4, 4' bipyridylium dichloride	N-(phosphonomethyl) Glycine
Other names	Gramoxone	MON 2139
Acute Oral	157	4320
LD ₅₀ to rats*	(very toxic)	(slightly toxic)
Main Mode of action	Contact (Fast-acting)†	Translocated (Slow-acting)
Firm	I.C.I.	Monsanto

* mg/kg

† In the presence of light.

The herbicides were sprayed from an 18 litre knapsack sprayer at the rate of 1100 litres/ha. After spraying, evaluation of the rate and severity of scorching was carried out visually. The number of plants that were scorched were counted on the 18th day and classified according to the degree of scorching.

Full-scorching: All the leaves in each plant were scorched.

Intermediate: More than 20 leaves scorched.

Slight: Less than 20 leaves scorched.

After spraying, the period that was required before burning could be carried out was assessed by burning replicates I, II and III at 3, 6 and 9 weeks respectively for treatments

T₁, T₂, T₃. For the control plots (T₀), burning was carried for replicates I, II and III at 9, 13 and 17 weeks. The ease of burning was classified as follows:

- Good: . The plants were easy to burn. Only the stumps remained behind.
 Satisfactory: The plants were slightly difficult to burn.
 Poor: The plants were difficult to burn (*i.e.* leaves still wet).

One week after burning, pineapple slips were planted and visual observations were made on the growth of the plants. For the herbicide treatments, the newly planted slips were checked for phytotoxic symptoms which might result from herbicide residues in the peat soil.

RESULTS AND DISCUSSION

Rate of scorching

Phytotoxic symptoms appeared after 1 week for roundup glyphosphate but for paraquat, the symptoms were visible the following day after spraying. This was attributed to their different modes of action: Paraquat is a contact herbicide while roundup glyphosphate is translocated and is therefore slower in action.

Symptoms of scorching

The symptoms of phytotoxic injury were different for both herbicides. In the case of paraquat, the leaves turned pale yellow initially and the final colour is white whereas for roundup glyphosphate, the scorched portions are brown. Plants sprayed with paraquat showed scorching in the young and old leaves while plants sprayed with roundup glyphosphate showed scorching in the younger leaves (*i.e.* inner group of leaves).

Differences in the symptoms of injury could partially be attributed to the mechanisms of action of the two herbicides. Paraquat is reduced to the free radical in the plant during processes connected with photosynthesis and respiration (HOMER *et. al*, 1960). Application of paraquat causes death of the plant in the light but death also occurs slowly in the dark. In this experiment there was about 4 to 5 hours of sunlight after the spraying and this promoted the action of paraquat.

Glyphosphate, on the other hand, interfered with the biosynthesis of phenylalanine (JAWORSKI, 1972).

Severity of scorching

Paraquat at 0.70 kg/ha produced the best scorching results (*Table 3*). The majority (81%) of the plants were fully-scorched in this treatment as compared to 29% fully-scorched

TABLE 3. PERCENTAGE NUMBER OF PLANTS SCORCHED AND DEGREE OF SCORCHING AT 18 DAYS AFTER SPRAYING

Herbicide (kg/ha)	Degree of scorching		
	Slight	Intermediate	Full
T ₁ RG 3.00	100		
T ₂ Paraquat 0.70	9	10	81
T ₃ Paraquat 0.28 + RG 0.75	21	50	29

plants in plots treated with a mixture of paraquat (0.28 kg/ha) + roundup glyphosphate (0.75 kg/ha). The latter treatment ranked second in effectiveness of scorching.

Roundup glyphosphate at 3.00 kg/ha, which was considered a fairly high rate to use, produced slight scorching only.

Period required for burning

The pineapple plants that were sprayed with paraquat at 0.70 kg/ha could be burnt 3 weeks after spraying (*Table 4*). Those treated with roundup glyphosphate and those treated with a mixture of paraquat and roundup glyphosphate could be satisfactorily burnt after 9 weeks. With the traditional method, burning was good only after 13 weeks.

TABLE 4. EFFECT OF VARIOUS TREATMENTS ON THE PERIOD REQUIRED FOR BURNING

Treatment	Weeks after start of experiment			
	3 (5.1 cm)	6 (31.3 cm)	9 (53.3 cm)	13 (83.1 cm)
T ₀ Control			S	G
T ₁ RG 3.00	P	P	S	
T ₂ Paraquat 0.70	G			
T ₃ Paraquat 0.28 + RG 0.75	P	P	S	

Figures in brackets show the amount of rainfall

P = Poor	}	Ease of burning
S = Satisfactory		
G = Good		

The more complete burn produced by paraquat at 0.70 kg/ha was attributed to its scorching effect or more correctly, its ability to desiccate the pineapple leaves. Muzik (1970) mentioned that the critical physiological process of desiccation appears to be injury to cell membranes that permit rapid loss of water. Paraquat is a desiccant—*i.e.* it kills through a process of accelerated drying (ADDICOTT AND CARNS, 1964).

In this experiment the number of sunshine hours after 3 weeks and 13 weeks were 112 and 483 hours respectively. Rainfall totalled 5.1 cm after 3 weeks and 83.1 cm after 13 weeks.

Observation on phytotoxic residues

All plants planted in plots treated with herbicides grew normally and showed no phytotoxic symptoms. Observations carried out after 12 months did not show any stunting or growth abnormalities.

Little of the herbicides reached the soil as the ratoon plants were close to each other. Again, both paraquat and roundup glyphosphate are generally said to be inactivated on contact with soil.



Figure 1a. Traditional method of ratoon clearing. The plants were cut at their bases 4 weeks ago.



Figure 1b. Chemical method of ratoon clearing. The plants were desiccated with paraquat at 0.70 kg/ha 6 weeks ago.

The effective treatment and costings

This experiment demonstrated that paraquat at 0.70 kg/ha is still the best treatment for ratoon clearing. The addition of roundup glyphosphate increased the cost considerably as it is expensive when compared to paraquat. Again, no advantage in terms of earlier burning was obtained with roundup glyphosphate + paraquat mixture. However, roundup glyphosphate in treatments T₁ and T₃ caused considerable damage to the roots of the smaller ratoon plants and these could be easily detached from the soil.

The traditional method which consisted of cutting the plants at the base followed by heaping and burning costs about 156 dollars/ha; the chemical method which consisted of spraying paraquat followed by burning costs about 70 dollars/ha (LEE, 1973). (Figs. 1a and 1b). Little heaping is required for the desiccated trash and even with the inclusion of this operation in the chemical method, there would still be a saving of between 46 to 66 dollars/ha. The other advantage of the chemical method is that replanting could be carried out earlier.

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SUMMARY

The traditional and chemical methods of ratoon clearing were compared. The three chemical treatments consisted of roundup glyphosphate at 3.00 kg/ha, paraquat 0.70 kg/ha and paraquat 0.28 kg/ha + roundup glyphosphate at 0.75 kg/ha.

The best chemical treatment was paraquat at 0.70 kg/ha which produced full scorching for 81% of the plants and the leaves were easily burnt after 3 weeks.

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