

WEED CONTROL ON A NEWLY DEVELOPING ESTATE AT MAZABUKA, ZAMBIA

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Introduction

In view of the high capital cost of a raw sugar factory, it is considered essential to produce the highest possible output right from the first season. The Tate & Lyle Groups' new Nakambala Estate will be commencing its first crop at full production level in 1968, which means that 90 per cent of the acreage at that date will be in plant cane. Labour requirements on the plant crop are always considerably higher than on subsequent ratoons and in order to reduce the peak demand on labour at planting, provision is being made for the use of herbicides for weed control on a large scale. Herbicide trials were carried out on the existing 300 acre trial block at Nakambala and at the nearby Kafue Pilot Polder during the summer seasons of maximum weed germination in 1964 and 1965.

Herbicide Trials

1. Soil Types and Weed Flora

(a) Previously cultivated Sandy Clay Loams

The most serious weed problem occurs on areas of old arable land on Sandy Clay Loams at Nakambala which are liable to heavy infestations of grasses, the dominant species being *Eleusine indica* and *Rotboellia exaltata*, together with occasional broad-leaved "dicot" weeds.

(b) Montmorillonitic Clays (Polder Soils)

Heavy, wet Montmorillonitic clays at the Kafue Pilot Polder are also liable to massive infestations of grass weeds. *Eleusine indica* is present in abundance, together with sedges of *Cyperus* spp.

(c) Virgin Sandy Clay Loams

The potential weed growth on virgin lands at Nakambala is less severe than on the old arable areas, and the weed flora consists largely of broad-leaved "dicots".

2. Herbicides Tested

The following herbicides have been evaluated on the two major soil types and at different timings with respect to planting and irrigation:

(a) For pre-emergent control

- (i) Prometryne at 4 and 6 lb/acre
- (ii) Prometone at 4 and 6 lb/acre
- (iii) 2, 4-D at 1 lb a.e./acre every 3 weeks
- (iv) Diuron at 4 and 6 lb/acre
- (v) Atrazine at 4 and 6 lb/acre
- (vi) Ametryne at 4 and 6 lb/acre
- (vii) Atraton at 4 and 6 lb/acre.

(b) For post-emergent control

- (i) Paraquat at 2 pints/acre
- (ii) Dalapon/2, 4-D at 3 lb Dalapon + 1½ lb acid equivalent 2, 4-D per acre.

The chemicals were applied by hand operated knapsack sprayers at a volume of 30 gallons per acre.

3. Trial Results

The most *satisfactory* results were obtained from the following treatments:

(a) Pre-emergent treatments

On Sandy Clay Loams

- (i) Prometryne at 4 lb/acre
- (ii) Prometone at 4 lb/acre
- (iii) 2,4-D at 1 lb acid equivalent per acre repeated at 3 weekly intervals.

On heavy Montmorillonitic Clays

- (i) Atrazine at 6 lb/acre
- (ii) Prometryne at 6 lb/acre
- (iii) Ametryne at 6 lb/acre.

(b) Post-emergent treatments

On both of the above soil types — Paraquat at 2 pints/acre.

4. Detailed Assessment of Pre-emergent Herbicides Tested

The preliminary assessment of each chemical tested is as follows:

(i) and (ii) *Prometryne* and *Prometone*. These chemicals both gave very good results, lasting up to 8 weeks after spraying, against a wide range of weeds on the Sandy Clay Loams. Somewhat better control was obtained from applications of 6 lb/acre, but at this rate neither material would be an economic proposition.

On the heavy clays of the Kafue Pilot Polder *Prometryne* gave good results at 6 lb/acre, though not comparable to those obtained from *Atrazine*. The effect of *Prometone* was disappointing on the Polder soils.

(iii) *2,4-D (Amine)*. Repeated applications of 2,4-D (amine salt) at 1 lb acid equivalent per acre, at 3 weekly intervals, gave very good results indeed on the sandy clay loams. All broad-leaved weeds and a fairly wide range of grasses were kept under good control by this treatment, the only species showing any resistance being the grass *Eleusine indica*. This 2,4-D treatment was not included in the Polder trials and was only evaluated on the sandy clay loams.

(iv) *Diuron*. This chemical gave excellent results both at Nakambala and on the Polder when applied at 6 lb/acre but was very disappointing at the 4 lb/acre rate.

At 6 lb/acre this costly material is not an economic proposition.

(v) *Atrazine*. This chemical, applied at 6 lb/acre, proved to be the best pre-emergence herbicide of all on the heavy Montmorillonitic clays. At 4 lb/acre results were variable, and on the lighter soils *Atrazine* generally failed to give any control at either 6 or 4 lb/acre.

(vi) and (vii) *Ametryne* and *Atratone*. These chemicals gave fair degrees of control on the Heavy Clays when applied at 6 lb/acre, but were still inferior to *Prometryne* and *Atrazine*. They were not successful on the Sandy Clay loams.

5. Timing of Application of Pre-emergent Herbicides

The timing of pre-emergent herbicide spraying in relation to irrigation water application was found to be important. All of the pre-emergence herbicides tested have been most effective when applied between the first and second irrigations of newly planted lands.

Both spraying and the second irrigation need to be carried out within a week of planting and before any emergence of weed seedlings occurs. Spraying on to dry land immediately following planting and before any irrigation, has generally resulted in very poor weed control.

6. Detailed Assessment of Post-emergence Herbicides

(i) *Paraquat*. This chemical gave excellent results when used as a post-emergence (contact) herbicide on the inter-rows. One of the drawbacks of this material, in common with most post-emergence herbicides, is that owing to high phytotoxicity to cane it cannot be applied directly to the rows. Even when applied between the rows, there is danger of damage to cane by

spray drift. Such damage occurred, in varying degrees, on most of our trial plots, however this was confined to localised scorching of the outer leaves and recovery was fairly rapid.

(ii) *Dalapon/2,4-D Mixtures*. The application of a mixture containing 3 lb *Dalapon* plus 1½ lb acid equivalent 2,4-D (amine) per acre gave good post-emergence weed control on the inter-rows at approximately half the cost of using *Paraquat*. However, damage occurred, and it is considered that phytotoxicity hazards associated with the use of the cheaper *Dalapon* are liable to be serious. This chemical is translocated within the affected plant, and can have long lasting deleterious effects which may not become apparent for some considerable time after spraying.

7. Timing of Application: Post-emergence Herbicides

Both *Paraquat* and the *Dalapon/2,4-D* mixture were found to be most effective when applied to weeds at the early post-emergence stage when weeds are no taller than three inches, and before they are allowed to become well established. One well timed application was found to be capable of giving good control for 6 to 8 weeks. Where applications were delayed and a heavy cover of weeds had become established, then a second application was necessary at 2 to 3 weeks after the initial one. This applied to both *Paraquat* and *Dalapon*.

Future Planning

A proposed scheme of weed control, combining the three basic methods of chemical, mechanical and hand weeding, each to its best advantage, is shown in Table I:

Table I

Area	Initial Treatment		Follow-up Treatment	
	Rows	Inter-rows	Rows	Inter-rows
(a) Virgin lands	2, 4-D (overall spray by aircraft)	2, 4-D (overall spray by aircraft)	Hand Weeding	(i) Tractor cultivation. (ii) <i>Paraquat</i> (spot spray)
(b) Old arable lands	<i>Prometryne</i> or <i>Prometone</i> (band spray)	Nil	Hand Weeding	(i) Tractor cultivation (ii) <i>Paraquat</i> (spot spray)

(a) Virgin Land

The use of 2,4-D is advocated for the main block of virgin land, where experience to date has shown that the potential weed growth is not only less severe than on the old arable lands of the property, but is also comprised largely of broadleaved "dicots". An overall pre-emergence spray could be applied by aircraft at 3 weekly intervals. Any weeds getting away in the rows would be dealt with by the available manual labour, and in the inter-rows by tractor cultivation. A more expensive alternative in case of continuous rain will be by limited "spot spraying" with *Paraquat*.

(b) Old Arable Land

Areas of old arable land, which are liable to heavy infestation of the grasses *Rottboellia exaltata* and *Eleusine indica*, will receive a pre-emergence "band" spray over the cane rows using either *Prometryne* or *Prometone* at 4 lb per acre sprayed. The choice of materials here will depend largely on availability and costs at the time required. At present, although *Prometryne* has given slightly better results than *Prometone* at the 4 lb rate, the cost is 18 per cent higher. Follow-up treatment of both rows and inter-rows will be as for the 2,4-D treated areas. Some tractor cultivation of the untreated inter-row spaces will be essential.

Table II

Treatment	Pre-emergent			Post-emergent
	Virgin Lands	Old Arable Lands		Virgin and Old Arable Lands
Herbicide used	2, 4-D	Prometryne	Prometone	Paraquat
Type of Application	Overall spray by aircraft	Band spray by knapsack or tractor	Band spray by knapsack or tractor	Spot spray by knapsack
Spraying Rate	1 lb a.e. per acre	4 lb. per acre	4 lb per acre	2 pints per acre
No. of Applications	3 at 5s.	1	1	1
Cost of Chemicals per acre treated	15s. = R1.50	38s. = R3.80	32s. = R3.20	50s. = R5.00

Cost of Spray Materials

Approximate costs of herbicides used per acre treated under the foregoing recommendation, and at current prices, are summarised in Table II above:

Summary

Results of trials carried out over the past two years have shown that the most promising herbicides are:

(a) For pre-emergence control on the lighter red soils — Prometryne at 4 lb per acre and Prometone at 4 lb per acre.

(b) For pre-emergence control on heavy Montmorillonitic Clays — Atrazine at 6 lb per acre.

(c) For post-emergence control on all soil types — Paraquat at 2 pints per acre (taking into account phytotoxicity hazards associated with the use of the cheaper Dalapon).

A proposed scheme of field scale weed control combining the three basic methods of chemical, mechanical and hand weeding is given.

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