

## THE TOLERANCE OF FOUR FIJIAN SUGARCANE VARIETIES TO PRE-EMERGENT AND POST-EMERGENT HERBICIDES

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*Summary.* Field studies tested the tolerance of Mana, Kaba, Mali and Ragnar sugarcane varieties to varying rates of 3 pre- and 3 post-emergent herbicides commercially available in Fiji.

Pre-emergent treatments with 5, 10 and 15 L/ha of Cane Spray 333 (7.5% dicamba + 30% 2,4-D) or with 2, 4 or 6 kg/ha of Diuron 80 (80% diuron) or Velpar K4 (13.2% hexazinone + 46.8 % diuron) caused little or no damage to any variety. Kaba and Ragnar showed slight susceptibility to 15 L/ha of Cane Spray 333 but recovered within 4 weeks, but no herbicide or rate significantly affected yield when harvested at 14 months.

Post-emergent treatments with 4, 8 or 12 L/ha of Asulox 40 (40% asulam) caused no significant damage except at the higher rates to Mali and Kaba. 1, 2, or 3 L/ha of Actril DS (10% ioxynil + 60% 2,4-D) only caused damage to Ragnar at the higher rates. 2, 4, or 6 L/ha of Tota-col (10% paraquat + 30% diuron) caused severe damage to all varieties.

Most weeds (apart from grasses with Velpar K4) can be safely controlled at these rates by either the pre- or post-emergent herbicides tested.

### INTRODUCTION

Early in the 1950, Nolla found different Sugarcane varieties to have different response to 2,4-D (2), therefore, he classified the Sugarcane varieties into four categories, susceptible, moderately susceptible, slightly susceptible and resistant. Rochecouste discovered in Mauritius that there were significant differences among sugarcane varieties in the resistance to the herbicide Dalapon, hence, he sorted the sugarcane varieties highly susceptible, susceptible and moderately susceptible into three categories (3). Millhollon and Matherne (1) cited that sugarcane variety N: Co 310 was more resistant to Diuron than C.P. 44-101 and C.P. 52-68. Herbicide application in cane field was not so common in many of the Fiji Sugarcane farmers. However, it is the tendency that chemical weed control will be the major measurement due to its cheapness and shortage of labour in the situation of Fiji cane belt.

### METHODS

Field trial was conducted in Drasa Lautoka, Fiji, from May 1989 to July 1990 on an oxisol soil. The four commercial sugarcane varieties were Mana, Mali, Kaba and Ragnar.

Ten treatments involving three herbicides, Cane Spray 333, which is the mixture of 7.5% Dicamba and 30% 2,4-D, Diuron 80, which contains 80% of Diuron and Velpar K4, which is the mixture of 13.2% Hexazinone and 46.8% Diuron. The application rates were 5, 10 and 15 L/ha, in Cane Spray 333 and 2, 4, and 6 kg/ha for Diuron and Velpar K4. In addition, one control treatment without herbicide application was also included. The pre-emergent chemicals were sprayed one week after sugarcane planting.

## Weeds in crops

Three products, Asulox 40 containing 40% Asulam; Actril DS, which is the mixture of 10% Ioxynil and 60% 2,4-D and Tota-Col which contains 10% paraquat and 30% Diuron were used in the post-emergent herbicide trial. The application rates were 4, 8 and 12 L/ha of Asulox 40, 1, 2 and 3 L/ha of Actril DS and 2, 4 and 6 L/ha of Tota-Col. The post-emergent chemicals were applied 6 weeks after cane planting.

The experimental design was two-fold split plot design with three replicates, each plot contains of 4 rows (1.37 row spacing) in a length of 5 metres.

## RESULTS AND DISCUSSION

### Tolerance of varieties to pre-emergent herbicides

Table 1 indicates that all three pre-emergent herbicides caused no or very low phytotoxicity in four varieties tested even in high rate.

Table 1. Tolerance (A) and the recovery time from phytotoxic effect (B) of sugarcane varieties to pre-emergent herbicides in Fiji

| Variety | Cane Spray 333 |      |         |   |         |   | Diuron 80 |   |         |   |         |   | Velpar K4 |   |         |   |         |   |   |   |
|---------|----------------|------|---------|---|---------|---|-----------|---|---------|---|---------|---|-----------|---|---------|---|---------|---|---|---|
|         | 5 L/ha*        |      | 10 L/ha |   | 15 L/ha |   | 2 kg/ha   |   | 4 kg/ha |   | 6 kg/ha |   | 2 kg/ha   |   | 4 kg/ha |   | 6 kg/ha |   |   |   |
|         | A              | B    | A       | B | A       | B | A         | B | A       | B | A       | B | A         | B | A       | B | A       | B |   |   |
| Mana    | 1**            | -    | 1       | - | 1       | - | 0         | - | 0       | - | 1       | - | 1         | - | 1       | - | 1       | - | 1 | - |
| Mali    | 1              | 4*** | 2       | 4 | 2       | 4 | 1         | - | 2       | 4 | 2       | 4 | 1         | 4 | 1       | 4 | 2       | 4 | 2 | 4 |
| Kaba    | 1              | -    | 2       | 4 | 3       | 4 | 1         | - | 1       | - | 2       | 4 | 1         | - | 1       | - | 1       | - | 1 | - |
| Ragnar  | 1              | -    | 2       | 4 | 3       | 4 | 1         | - | 1       | - | 1       | - | 0         | - | 1       | - | 1       | - | 1 | - |

\* Rate in quantities of product per hectare.

\*\* O = Resistant; 1, 2, 3 = Slightly susceptible; 4, 5, 6 = moderate susceptible; 7, 8, 9 = Highly susceptible; 10 = Dead

- No phytotoxic effect

\*\*\* Number of weeks for the recovery

Varieties KABA and RAGNAR were slightly susceptible to Cane Spray 333 at high rate of 15 L/ha but recovered at 4 weeks after application (Table 1). Yeh (4) cited that for the 2,4-D injury in the F series (F146 to F178), the recovery period for pre-emergence was 8 weeks, while only 4 weeks for these Fiji commercial varieties. The weed control effect of the three products was also observed (Table 2), both Cane Spray and Velpar K4 could control effectively the broadleaf and the creeper weeds at least 6 weeks. Less effectiveness was observed from Cane Spray and Diuron when used for control of the gramineae weeds.

Pre-emergent herbicide application neither affect stalk population nor stalk length in all four varieties tested. As a result, no significant differences between treatments in cane and sugar production have been found (Tables 3 and 4). For Kaba variety, significant differences between treatments were found in herbicides tested, however, the differences could not be attributed to toxicity effect.

## Weeds in crops

Table 2. Efficacy of common pre-emergent herbicides on weed control at 6 weeks after application

| Herbicides | Rate    | % Control |          |           |
|------------|---------|-----------|----------|-----------|
|            |         | Broadleaf | Creepers | Gramineae |
| Cane Spray | 5 L/ha  | 73        | 76       | -         |
| Diuron     | 2 kg/ha | 56        | 52       | 19        |
| Velpar K4  | 2 kg/ha | 70        | -        | 46        |

Table 3. Effect of pre-emergent herbicide application on cane yield (t/ha) of four varieties planted in an oxisol soil

| Variety | Cane Spray 333 (L/ha) |     |     |     |       | Diuron 80 (kg/ha) |     |     |     |       | Velpar K4 (kg/ha) |     |     |     |       |
|---------|-----------------------|-----|-----|-----|-------|-------------------|-----|-----|-----|-------|-------------------|-----|-----|-----|-------|
|         | 0                     | 5   | 10  | 15  | CV%   | 0                 | 2   | 4   | 6   | CV%   | 0                 | 2   | 4   | 6   | CV%   |
| Mana    | 165                   | 179 | 188 | 146 | 15 NS | 165               | 149 | 162 | 153 | 29 NS | 165               | 127 | 145 | 132 | 35 NS |
| Mali    | 141                   | 150 | 148 | 134 | 18 NS | 141               | 117 | 134 | 143 | 20 NS | 141               | 169 | 130 | 164 | 18 NS |
| Kaba    | 128                   | 97  | 143 | 121 | 18 5% | 128               | 98  | 172 | 130 | 18 1% | 128               | 155 | 129 | 145 | 9 5%  |
| Ragnar  | 126                   | 121 | 117 | 126 | 16 NS | 126               | 106 | 136 | 121 | 13 NS | 126               | 111 | 130 | 116 | 12 NS |

Table 4. Effect of pre-emergent herbicide application on sugar yield (t/ha) of four varieties planted in an oxisol soil

| Variety | Cane Spray 333 (L/ha) |    |    |    |       | Diuron 80 (kg/ha) |    |    |    |       | Velpar K4 (kg/ha) |    |    |    |       |
|---------|-----------------------|----|----|----|-------|-------------------|----|----|----|-------|-------------------|----|----|----|-------|
|         | 0                     | 5  | 10 | 15 | CV%   | 0                 | 2  | 4  | 6  | CV%   | 0                 | 2  | 4  | 6  | CV%   |
| Mana    | 22                    | 24 | 27 | 20 | 19 NS | 22                | 21 | 21 | 22 | 13 NS | 22                | 17 | 20 | 18 | 34 NS |
| Mali    | 18                    | 14 | 16 | 14 | 16 NS | 18                | 12 | 15 | 16 | 21 NS | 18                | 16 | 14 | 16 | 18 NS |
| Kaba    | 20                    | 14 | 14 | 27 | 17 NS | 20                | 14 | 19 | 25 | 18 1% | 20                | 21 | 19 | 20 | 9 NS  |
| Ragnar  | 19                    | 19 | 17 | 17 | 15 NS | 19                | 17 | 21 | 20 | 13 NS | 19                | 18 | 18 | 18 | 11 NS |

### Tolerance of varieties to post-emergent herbicides

Due to Tota-Col containing Paraquat which is non-selective, very serious phytotoxicity up to grade 9 was observed in all four varieties under test (Table 5). Most of the young Aillers were destroyed permanently by Tota-Col. Next to Tota-Col, Ragnar variety was also moderate susceptible to Actril DS when application rate was in medium to high level. Mali variety was also slightly to moderate susceptible to Asulox. Most of young cane was killed by Tota-Col which destroyed the crop establishment permanently. However, replanting for these plots for maintaining enough surviving number of sugarcane for the trials. Despite severe damage to sugarcane by Tota-Col, Mana, Kaba and Ragnar recovered from phytotoxicity at 4 weeks after application, while it took 8 weeks for Mali to recover (Table 5).

Yeh (4) reported that for F varieties in Taiwan, it took 6 weeks in post-emergent chemicals application for all injury symptoms to recover in the sensitive varieties.

Weeds in crops

Similar to pre-emergent herbicides, the cane growth neither in stalk population nor in stalk length was affected by any of the post-emergent herbicides. The plant crop of this trial was harvested at 14 months. The subsequent cane and sugar yield data indicated that except Mana variety applied with Actril DS, no adverse effect of herbicide application was observed (Tables 6 and 7). The highest rate of Actril DS of 3 L/ha applied on Mana tended to suppress yield. However, further verification is needed.

Table 5. Tolerance (A) and the recovery time from phytotoxic effect (B) of sugarcane variety to pre-emergent herbicides in Fiji

| Variety | Asulox 40 |      |        |   |         |   | Actdriol DS |   |        |   |        |   | Tota-Col |        |        |
|---------|-----------|------|--------|---|---------|---|-------------|---|--------|---|--------|---|----------|--------|--------|
|         | 4 L/ha*   |      | 8 L/ha |   | 12 L/ha |   | 1 L/ha      |   | 2 L/ha |   | 3 L/ha |   | 1 L/ha   | 2 L/ha | 3 L/ha |
|         | A         | B    | A      | B | A       | B | A           | B | A      | B | A      | B | A        | A      | A      |
| Mana    | 0**       | -    | 2      | 4 | 3       | 4 | 0           | - | 1      | 4 | 3      | 4 | 9        | 9      | 9      |
| Mali    | 3         | 8*** | 3      | 8 | 4       | 8 | 1           | 8 | 2      | 8 | 3      | 8 | 9        | 9      | 9      |
| Kaba    | 1         | 4    | 3      | 4 | 5       | 4 | 1           | 4 | 2      | 8 | 3      | 8 | 9        | 9      | 9      |
| Ragnar  | 1         | 4    | 2      | 4 | 2       | 4 | 2           | 4 | 4      | 4 | 5      | 5 | 9        | 9      | 9      |

\* Rate in quantities of product per hectare.

\*\* O = Resistant; 1, 2, 3 = Slightly susceptible; 4, 5, 6 = moderate susceptible; 7, 8, 9 = Highly susceptible; 10 = Dead

- No phytotoxic effect

\*\*\* Number of weeks for the recovery

Table 6. Effect of post-emergent herbicide application on cane yield (t/ha) of four varieties planted in an oxisol soil

| Variety | Asulox 40 (L/ha) |     |     |     | Actril DS (L/ha) |     |     |     | Tota-Col (L/ha) |     |     |     |
|---------|------------------|-----|-----|-----|------------------|-----|-----|-----|-----------------|-----|-----|-----|
|         | 0                | 4   | 8   | 12  | 0                | 1   | 2   | 3   | 0               | 2   | 4   | 6   |
| Mana    | 149              | 155 | 123 | 150 | 149              | 164 | 147 | 101 | 149             | 169 | 114 | 130 |
| Mali    | 157              | 135 | 149 | 166 | 157              | 165 | 137 | 153 | 157             | 134 | 157 | 137 |
| Kaba    | 150              | 143 | 132 | 100 | 150              | 143 | 137 | 135 | 150             | 141 | 143 | 151 |
| Ragnar  | 140              | 129 | 144 | 128 | 140              | 117 | 137 | 123 | 140             | 110 | 136 | 141 |

Table 7. Effect of post-emergent herbicide application on sugar yield (t/ha) of four varieties planted in an oxisol soil

| Variety | Asulox 40 (L/ha) |    |    |    |       | Actril DS (L/ha) |    |    |    |       | Tota-Col (L/ha) |    |    |    |       |
|---------|------------------|----|----|----|-------|------------------|----|----|----|-------|-----------------|----|----|----|-------|
|         | 0                | 4  | 8  | 12 | CV%   | 0                | 1  | 2  | 3  | CV%   | 0               | 2  | 4  | 6  | CV%   |
| Mana    | 20               | 23 | 15 | 20 | 16 5% | 20               | 23 | 20 | 13 | 20 1% | 20              | 25 | 16 | 18 | 32 NS |
| Mali    | 18               | 15 | 18 | 18 | 22 NS | 18               | 18 | 15 | 16 | 25 NS | 18              | 14 | 19 | 13 | 21 5% |
| Kaba    | 20               | 21 | 16 | 15 | 23 NS | 20               | 22 | 21 | 19 | 18 NS | 20              | 20 | 20 | 22 | 16 NS |
| Ragnar  | 19               | 19 | 20 | 18 | 17 NS | 19               | 16 | 20 | 18 | 18 NS | 19              | 16 | 20 | 20 | 12 NS |

The results obtained from this trial imply that except Tota-Col, the application of some post-emergent herbicides could cause phytotoxicity to growth at the young cane stage, but once the

*Weeds in crops*

crop recovered, the final yield will not be affected. Similar results were found by Yeh (5), he cited that although different varieties responded differently in tolerance to herbicides yet such physiological character was not related to sugar accumulation of cane.

REFERENCES

1. Millhollon, R.W. and Matherne, R.J. 1968. *Weed Science* 16, 300-303.
2. Nolla, J.A.B. 1950. *Proc. Int. S.c. Sug. Cane Technol.* 7, 178-190.
3. Rochecouste, E. 1963. *Rep. mauritius Sug. Ind. Res. Inst.* 1963, 96.
4. Yeh, Houg-Jaan 1977. *Taiwan Sugar Research Institute* 78, 35-44.
5. Yeh, Houg-Jaan 1980. *Taiwan Sugar* 27(6), 196-202.