VINE WEEDS IN SUGAR CANE: FLUROXYPYR PROVIDES COST-EFFECTIVE POST-EMERGENCE CONTROL IN MAURITIUS

By

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KEYWORDS: Trash Management, Weed Control, Herbicide.

Abstract

VINE weeds are becoming a serious problem in many sugar cane producing countries. In Mauritius, recent changes in some cultural practices such as green cane trash blanketing (GCTB), have favoured proliferation of five vine species, namely Ipomoea nil, I. obscura, Cajanus scarabaeoides, Paederia foetida and Passiflora suberosa. The herbicide fluroxypyr, at rates varying from 0.2 to 0.6 kg a.e./ha alone or tank-mixed with Actril-DS (ioxynil + 2,4-D ester), was compared to the standard Tordon 101 (picloram + 2,4-D amine salt) + Actril-DS treatment applied post-emergence to the five vine species. Fluroxypyr at rates varying between 0.3 and 0.4 kg a.e./ha provided effective control of Ipomoea nil, I. obscura and Cajanus scarabaeoides whereas Paederia foetida and Passiflora suberosa required higher rates (0.4 to 0.6 kg a.e./ha). The addition of Actril-DS to fluroxypyr in a tank mix did not improve the level of control over that of fluroxypyr applied alone. A synergistic effect was observed when fluroxypyr was tank-mixed with atrazine, allowing for lower use rates of fluroxypyr. Fluroxypyr is recommended as a more economical and environmentally ‘friendly’ alternative to Tordon + Actril-DS for the control of vine weeds in sugar cane.

Introduction

Vine weeds are becoming a serious problem in many Mauritian sugar cane fields due to changes in cultural practices during the past decade. Trash left after manual harvest of green cane was lined on alternate interrows in the past. The bare interrows were kept weed-free by applying one or two herbicide treatments. In some cases, interrows receiving the trash were rotated after the next harvest. Since the late 1980s, this practice was gradually abandoned and trash was either left in situ or spread uniformly as a blanket.

Green cane trash blanketing (GCTB) was recommended in the subhumid regions of the island since 1992, and its adoption has led to higher cane yields due to better soil moisture conservation and improved weed control with less pre-emergence herbicides (Seeruttun et al., 1992). Adoption of GCTB has increased dramatically with the increased use of chopper harvesters. More than 12% of the area was harvested green using chopper harvesters in 2002. (MSIRI, 2003).

The advantages associated with GCTB have also been reported in Australia (Phillips, 1996; Holden et al., 1997). Although general weed control is improved by GCTB, this practice favours proliferation of vines. Burgess (1994) reported that cane growers who had switched to GCTB in North Queensland observed a change in the weed flora from grass and low-growing broadleaf weeds to vines. This tendency is being confirmed in Mauritius and some other sugar cane growing countries. Vines have also been reported to be influenced by other factors such as wet growing conditions (Shannon, 1999).

The vine weeds identified as more common in Mauritius include Ipomoea nil, I. obscura, Paederia foetida, Passiflora suberosa and Cajanus scarabaeoides. The standard herbicide treatments recommended locally against vine weeds have been either Garlon (triclopyr) or Tordon 101 (picloram + 2,4-D amine salt) tank-mixed with Actril-DS (ioxynil + 2,4-D ester). These products are generally used for spot-applications because of their relatively high cost. Furthermore, they provide less effective control of P. suberosa and C. scarabaeoides.

Fluroxypyr, a herbicide of the pyridine carboxylic acid family, has been used in Australia for the control of various vine species (Shannon, 1999). Fluroxypyr is less expensive and has better eco-
toxicological characteristics than the other two products available. This paper reports on the evaluation of fluroxypyr as a cost-effective treatment for post-emergence control of vines in Mauritius.

**Materials and methods**

Six trials were conducted, three in ratoon sugar cane at Chebel (var. R 570), Beau Champ (var. M1658/78) and Mon Désert Alma (var. M 3035/66) and three in fallow land at Rose Belle, Case Noyale and Belle Mare.

The predominant vine species was *Paederia foetida* at Rose Belle (Trial I). Treatments were 0.2, 0.3, 0.4 and 0.6 kg a.e./ha of fluroxypyr. The same treatments as Trial 1 were used at Chebel with an additional treatment consisting of a tank-mix with fluroxypyr and atrazine (0.4 + 2.0 kg a.i./ha) included (Trial II). The predominant species present at this location was *Ipomoea nil*.

Trial III was located at Beau Champ where the main vine species was *Passiflora suberosa*. Treatments were fluroxypyr alone at 0.3, 0.4 and 0.6 kg a.e./ha, fluroxypyr at 0.3 and 0.4 kg a.e./ha tank-mixed with Actril-DS at 1.3 kg a.e./ha and fluroxypyr at 0.4 kg a.e./ha tank-mixed with atrazine at 2.0 kg a.i./ha. The treatments were slightly modified at Case Noyale (Trial IV) on *Cajanus scarabaeoides* and consisted of fluroxypyr at 0.3, 0.5 and 0.7 kg a.e./ha; the two lower rates of fluroxypyr were tank-mixed with Actril-DS at 1.3 kg a.e./ha. The trials established at Mon Désert Alma on *Paederia foetida* (Trial V) and at Belle Mare on *Ipomoea obscura* (Trial VI) used treatments of fluroxypyr at 0.3, 0.4, and 0.6 kg a.e./ha, and a tank-mix of fluroxypyr and atrazine at 0.4 kg a.e./ha + 2.0 kg a.i./ha.

In all six trials the standard treatment was a tank-mix of Tordon-101 + Actril-DS (1.0 + 1.3) kg a.e./ha. A non-ionic surfactant was added (0.025 % v/v) to fluroxypyr when used alone and in tank-mixes with atrazine. The experimental design was a randomised complete block at all sites with three replicates. All plots were 42 m²; trials in sugar cane consisted of four cane rows 6.5 m long with an interrow spacing of 1.6 m. Spraying was done using hand-operated knapsack sprayers with double conejet nozzles, delivering 450 L of spray mixture per hectare at a working pressure of 300 kPa. The percentage cover for each vine weed was estimated visually prior to spraying, followed by visual observations at regular intervals. A final weed survey between four to twelve weeks after treatment (WAT) was conducted to evaluate percent control. In Trials I, II and V (established in ratoon cane) visual assessment of any effect of fluroxypyr on cane was also made. Statistical analysis was performed on transformed data (Arc Sine root percentage) (Gomez and Gomez, 1984).

**Results and discussion**

*Paederia foetida* (Trials I & V)

*Paederia foetida* was at a relatively advanced stage of growth (post-flowering) at Rose-Belle (Trial I). Complete defoliation of the weed was observed in all treatments 2 WAT. A final survey carried out five weeks later revealed fair control (50% kill) of *P. foetida* with the lowest rate of fluroxypyr. The level of control improved with an increase in dosage (Table 1). Control with fluroxypyr at 0.6 kg/ha was comparable to the standard Tordon 101 + Actril-DS and achieved approximately 90% control.

**Table 1**—Post-emergence control of *Paederia foetida* (% control) in sugar cane with fluroxypyr.

<table>
<thead>
<tr>
<th>Herbicides</th>
<th>Dosage (Kg a.i. or a.e./ha)</th>
<th>Trial I (Rose-Belle) 7 WAT</th>
<th>Trial V (Mon Desert Alma) 4 WAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tordon 101 + Actril-DS (Standard)</td>
<td>1.0 + 1.3</td>
<td>85.3</td>
<td>100a</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.2</td>
<td>50.0*</td>
<td>NA</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.3</td>
<td>73.0*</td>
<td>71.0c</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.4</td>
<td>80.0</td>
<td>92.4abc</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.6</td>
<td>87.5</td>
<td>89.1bc</td>
</tr>
<tr>
<td>Fluroxypyr + atrazine</td>
<td>0.4 + 2.0</td>
<td>NA</td>
<td>95.5ab</td>
</tr>
<tr>
<td>SE</td>
<td>NA</td>
<td>NA</td>
<td>4.96</td>
</tr>
</tbody>
</table>

Values in a column with different letters are significantly different from each other at p = 0.05.

The trial at Mon Désert Alma (Trial V) confirmed the efficacy of the various treatments tested on *Paederia foetida*. The treatments were applied to younger weeds (pre-flowering stage) than in Trial I and
complete eradication of the weed was obtained with the standard treatment of Tordon-101 + Actril-DS. Fluroxypyr was nonetheless very good with more than 90% control at 0.4 kg a.e./ha (Table 1). Control was further enhanced when fluroxypyr was tank-mixed with atrazine. This treatment would be advantageous when pre-emergence control is desired to prevent the weed from regenerating from seed. Visual observations throughout the duration of trial revealed no adverse effect on the cane variety M 3035/66.

*Ipomoea nil (Trial II)*

Observations made 2 WAT revealed the standard Tordon 101 + Actril-DS and the tank-mix of fluroxypyr + atrazine as the best treatments with almost complete control of *Ipomoea nil*. Fluroxypyr alone, irrespective of dosage, caused severe chlorosis and scorching (leaf burn) of the weed with partial control but was in general inferior to the standard.

A final weed survey made 5 WAT showed a significant improvement in the level of control with the two lower rates of fluroxypyr (> 80% control). Fluroxypyr at 0.4 and 0.6 kg a.e./ha and in tank mixes with atrazine proved comparable to the standard with almost complete control of *I. nil* (Table 2). On the date of the survey an appreciable number of *I. nil* seedlings were present in all treatments except in the tank-mix fluroxypyr + atrazine. This suggests that atrazine had contributed to effective pre-emergence control of that vine. All treatments were well tolerated by the sugar cane variety R 570.

*Table 2—Post-emergence control of vine weeds in sugar cane with fluroxypyr (% control).*

<table>
<thead>
<tr>
<th>Herbicides</th>
<th>Dosage (Kg a.i. or a.e/ha)</th>
<th>Trial II (Ipomea nil)</th>
<th>Trial III (P. suberosa)</th>
<th>Trial IV (C. scarabaeoides)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 WAT</td>
<td>8 WAT</td>
<td>12 WAT</td>
</tr>
<tr>
<td>Tordon 101 + Actril-DS (Standard)</td>
<td>1.0 + 1.3</td>
<td>100.0a</td>
<td>57.0</td>
<td>51.7c</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.2</td>
<td>85.6b</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.3</td>
<td>90.0ab</td>
<td>61.0</td>
<td>96.0b</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.4</td>
<td>96.8ab</td>
<td>100.0</td>
<td>NA</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.5</td>
<td>NA</td>
<td>NA</td>
<td>97.0b</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.6</td>
<td>98.7ab</td>
<td>100.0</td>
<td>NA</td>
</tr>
<tr>
<td>Fluroxypyr</td>
<td>0.7</td>
<td>NA</td>
<td>NA</td>
<td>99.0a</td>
</tr>
<tr>
<td>Fluroxypyr + Actril-DS</td>
<td>0.3 + 1.3</td>
<td>NA</td>
<td>100.0</td>
<td>95.7b</td>
</tr>
<tr>
<td>Fluroxypyr + Actril-DS</td>
<td>0.4 + 1.3</td>
<td>NA</td>
<td>100.0</td>
<td>NA</td>
</tr>
<tr>
<td>Fluroxypyr + Actril-DS</td>
<td>0.5 + 1.3</td>
<td>NA</td>
<td>NA</td>
<td>97.0a</td>
</tr>
<tr>
<td>Fluroxypyr + atrazine</td>
<td>0.4 + 2.0</td>
<td>99.2a</td>
<td>100.0</td>
<td>NA</td>
</tr>
<tr>
<td>SE</td>
<td>6.05</td>
<td>NA</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>

Values in a column with different letters are significantly different from each other at p = 0.05.

*Passiflora suberosa (Trial III)*

Observations carried out two weeks after spraying showed partial defoliation of *Passiflora suberosa* with the standard treatment of Tordon 101 + Actril-DS and with the lowest rate of fluroxypyr. Control improved with increasing dosage of fluroxypyr or when the latter was tank-mixed with either Actril-DS or atrazine. The final survey made 8 WAT revealed Tordon 101 + Actril-DS and the lowest rate of fluroxypyr to be less effective on *P. suberosa* with only partial control of younger stems; some regrowth was also apparent in these two treatments.

The level of control improved substantially with complete control of the vine being observed with fluroxypyr at 0.4 kg a.e./ha and when tank-mixed with either Actril-DS or atrazine (Table 2). Furthermore, no regrowth was observed in those treatments. In this trial, the synergistic effect between fluroxypyr and Actril-DS or atrazine was not apparent since fluroxypyr alone at the same rates was just as effective. Cane var. M 1658/78 proved tolerant to all treatments.

*Cajanus scarabaeoides (Trial IV)*

*Cajanus scarabaeoides* was well established and at an advanced growth stage (post-flowering) on the day of application. Severe scorching of *C. scarabaeoides* was observed in all treatments three weeks...
after spraying. Six weeks later, burn-down of the first generation of the vine was achieved with the standard Tordon 101 + Actril-DS, but some regrowth was apparent. Fluroxypyr proved more effective than the standard treatment with greater than 95% control of the weed irrespective of dosage. Moreover tank-mixing fluroxypyr at the two lower rates with Actril-DS was not justified (Table 2). Regrowth in all fluroxypyr plots was negligible. The weed survey carried out 12 WAT confirmed observations made previously that the standard treatment provided only fair control of C. scarabaeoides and regrowth was appreciable.

Fluroxypyr rates as low as 0.3 kg a.e./ha were sufficient to provide more than 95% control (Table 2). Application to well-established weeds suggests that rates lower than 0.3 kg a.e./ha could be effective on younger weeds (5 to 6 leaf stage).

Ipomoea obscura (Trial VI)

Observations made 3 WAT showed severe chlorosis and scorching of Ipomoea obscura in all treatments. 6 WAT, all treatments were equivalent to the standard Tordon 101 + Actril-DS treatment. Fluroxypyr at 0.3, 0.4 and 0.6 kg a.e./ha and fluroxypyr at 0.4 kg a.e./ha tank-mixed with atrazine at 2.0 kg a.i./ha provided complete (100%) control of I. obscura.

Cost and ecotoxicological characteristics of fluroxypyr

The cost of treating vines with the standard herbicides, i.e Tordon 101 or Garlon tank-mixed with Actril-DS, is currently between $US90 and $US95/ha. Fluroxypyr at rates of 0.3 and 0.6 kg a.e./ha would cost $US32.5 and $US65/ha, respectively; thus representing a reduction of 35% to 70% in the cost of treatment.

Rotational land is usually cropped with potatoes or other food crops and use of Tordon 101 or Garlon has often resulted in phytotoxicity due to the long residual action of these two herbicides in Mauritius.

Fluroxypyr is rapidly degraded by micro-organisms and has a half-life in the soil of only 5 to 9 days compared to picloram and triclopyr with 30 to 90 days and 46 days, respectively (BCPC, 1997).

Conclusion

Fluroxypyr can be as good as or superior to the standard Tordon 101 + Actril-DS for post-emergence control of vine weeds. Furthermore, fluroxypyr has been found to have no adverse effect on sugar cane. Effective control of Ipomoea nil, C. scarabaeoides and I. obscura was obtained at rates of 0.3 and 0.4 kg a.e./ha. A higher rate of 0.4 to 0.6 kg a.e./ha was required to control Paederia foetida and Passiflora suberosa.

Tank-mixing fluroxypyr with Actril-DS did not significantly improve the level of control. Some synergistic effect was observed when fluroxypyr was tank-mixed with atrazine. Moreover, addition of atrazine would provide the advantage of pre-emergent control of vines when added in a tank mix.

Fluroxypyr is a more cost-effective and environmentally friendly treatment than the standard Tordon 101 + Actril-DS. Fluroxypyr is now recommended for commercial use at rates of 0.3 to and 0.6 kg a.e./ha.

REFERENCES


UN CONTROLE EFFICACE DES LIANES DANS LA CANNE A SUCRE A MAURICE AVEC LE FLUROXYPYR
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MOTS CLES: Gestion de la Paille, Post-Levee, Herbicide.

Résumé
L’INFESTATION des lianes est devenue plus fréquente dans plusieurs pays sucriers. A Maurice, des changements dans certaines pratiques culturales, tels l’adoption du paillis complet, ont favorisé la prolifération de cinq espèces de lianes, notamment Ipomoea nil, I. obscura, Cajanus scarabaeoides, Paederia foetida et Passiflora suberosa. L’herbicide fluroxypyr, appliqué seul ou en mélange avec Actril-DS (ioxynil + 2,4-D ester) a été comparé au standard Tordon 101 (picloram + sel aminé de 2,4-D) + Actril-DS. Aux taux variant entre 0.3 à 0.4 kg a.e./ha, le fluroxypyr a donné un contrôle efficace de I. nil, I. obscura et C. scarabaeoides tandis que des taux plus élevés (0.4 à 0.6 kg a.e./ha) étaient nécessaires pour éradiquer P. foetida et P. suberosa. L’inclusion de l’Actril-DS dans le mélange n’apporta aucune amélioration significative dans le niveau de contrôle. Par contre, en mélange avec l’atrazine, un effet synergique a été observé ce qui implique l’utilisation de taux plus faibles du fluroxypyr. Le fluroxypyr a été recommandé comme un substitut moins onéreux et plus harmonieux avec l’environnement que le mélange Tordon 101 + Actril-DS.

LA MALEZA EN LA CAÑA DE AZÚCAR: FLUROXYPYR PROPORCIONA UN CONTROL DE BROTES A COSTO EFECTIVO
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PALABRAS CLAVES: Manejo de Desechos, Control de la Maleza, Herbicida.

Resumen
LA MALEZA se está transformando en un serio problema en muchos países productores de caña de azúcar. En Mauricio, cambios recientes de ciertas técnicas de cultivo como cobertura con los residuos de la caña verde (GCTB), han favorecido la proliferación de cinco especies de enredaderas, a saber, Ipomoea nil, I. obscura, Cajanus scarabaeoides, Paederia foetida y Passiflora suberosa. El herbicida fluroxypyr en dosis que varían de 0.2 a 0.6 kg a.e./ha., aplicado solo o mezclado en tanque con Actril-DS (ioxynil + 2,4-D ester), fue comparado con el herbicida más común, Tordon 101 (picloram + 2,4-D sal amino) + Actril-DS, tratamiento aplicado después del brote de los cinco tipos de enredaderas. Fluroxypyr en dosis de 0.3 a 0.4 kg a.e./ha, proporcionó un control efectivo de Ipomoea nil, I. obscura y Cajanus scarabaeoides mientras que Paederia foetida y Passiflora suberosa necesitaron dosis más elevadas (0.4–0.6 kg a.e./ha). La adición del Actryl DS al fluroxypyr en la mezcla de tanque no mejoró los niveles de control obtenidos con el fluroxypyr aplicado solo. Se observó una reacción sinergética al mezclarse fluroxypyr con atrazine en el tanque, lo que permitió usar el fluroxypyr en proporciones más bajas. Fluroxypyr es recomendado como una alternativa más económica y menos nociva al medio ambiente que el Tordon + Actril-DS en el control de las malezas en plantaciones de caña de azúcar.