

PERSISTENCE OF HERBICIDES APPLIED TO SUGARCANE DURING THE RAINY SEASON IN BRAZIL

By

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Pre-Emergence Control, Cane Trash.

Abstract

THIS RESEARCH aimed to study the persistence of herbicides in soil after the rainy season, evaluated by weed control in sugarcane. A split-plot design was used with main-plots consisting of six sugarcane rows (37.5 m²) and sub-plots one cane row (7.5 m²). Seeds of *Ipomoea quamoclit*, *Ipomoea hederifolia*, *Merremia cissoides*, *Panicum maximum* and *Brachiaria decumbens* were sown in the sub-plots while the main-plots consisted of ten herbicide treatments as follows: an untreated control, imazapic (147 g/ha), imazapic (98 g/ha) + sulfentrazone (600 g/ha), sulfentrazone (800 g/ha), tebuthiuron (1000 g/ha), amicarbazone (1400 g/ha), flumioxazin (125 g/ha), diuron (1066 g/ha) + hexazinone (134 g/ha) + imazapic (98 g/ha), amicarbazone (840 g/ha) + isoxaflutole (82.5 g/ha), imazapic (98 g/ha) + isoxaflutole (85 g/ha). During the 120 days following spraying, 698.7 mm of rainfall was observed, the average minimum and maximum temperature being 21.9 and 30.6°C respectively. The herbicides that best resisted this weather had a satisfactory control on the species studied in the following descending order: amicarbazone (91.2% control), imazapic (90.8%), imazapic + sulfentrazone (89.6%), amicarbazone + isoxaflutole (89.2%), imazapic + isoxaflutole (85.6%), diuron + hexazinone + imazapic (84.4%), tebuthiuron (76%), sulfentrazone (70.8%), flumioxazin (19.2%).

Introduction

Concerning *Ipomoea* spp., the usual method of control is chemical, which, according to Siebert *et al.* (2004), is conducted in pre-emergence in early spring. During that period, the more intense rainfall associated with high temperatures may cause faster degradation of residual herbicides in soil (Viator *et al.*, 2002). The persistence of some herbicides in the soil is extremely variable. Some herbicides may be degraded within days, while others may persist for several months or years; however, the time they remain active in the soil depends on edapho-climatic conditions (Silva *et al.*, 1999). Within this context, the objective of this work was to study the persistence of herbicides during bad weather in the rainy season, by assessing their control over weeds in sugarcane.

Material and methods

The experiment was established in a commercial sugar cane plantation in its 3rd ratoon, Brazil; the cane variety was SP84-2025 and it was planted at a row spacing of 1.50 m. The soil type is Red Latosol, clay textural class with 49.9% clay, 36.6% sand and 13.5% silt.

The experimental design was a split-plot scheme, with the main-plots composed of 5 sugarcane rows of 5 m length, representing an area of 37.5 m², and the sub-plots by each row with 7.5 m² of area. Herbicides were assigned to the main plots: Untreated; imazapic (147 g/ha); imazapic (98 g/ha) + sulfentrazone (600 g/ha); sulfentrazone (800 g/ha); tebuthiuron (1000 g/ha);

amicarbazone (1400 g/ha); flumioxazin (125 g/ha); diuron (1066 g/ha) + hexazinone (134 g/ha) + imazapic (98 g/ha); amicarbazone(840 g/ha) + isoxaflutole (82.5 g ha) e imazapic (98 g/ha) + isoxaflutole (85 g/ha). The weed species assigned to the sub-plots: *Ipomoea quamoclit*, *Ipomoea hederifolia*, *Merremia cissoides*, *Panicum maximum* and *Brachiaria decumbens*.

The seeds were sown in the interrows of each plot. During sowing, the cane straw was removed, the seeds were sown and the straw returned to the plots. The amount of seeds used was related to the germination test provided by the seed supplying company, so that each species provided 100 plants in the usable area of each main-plot. Herbicide application was performed in pre-emergence of the weed species and sugarcane with pressurised backpack equipment regulated at 200 kPa pressure and 250 L/ha spray volume.

At 70, 90 and 120 days after application (DAA), herbicide control over the weeds sown was assessed. The methodology used was assigning percentage scores to the coverage of weeds in the main-plot area, with 0 for no infestation and 100% for total infestation. Those scores were used for assigning control based on the calculation: $ctr = 100\%$ specific coverage.

The control scores were submitted to an analysis of variance according to the design proposed, and the averages were compared by Tukey test at 5% probability.

Results and discussion

The herbicides applied were possibly exposed over the straw for at least 15 days as, at the end of that period, an accumulation of 26.1 mm rain was recorded, possibly enough for herbicides to be leached through the straw layer and reach the soil. However, during that period, the 8.7°C oscillation between minimum and maximum temperature and the sunlight fell directly over the herbicide.

At 120 DAA, in addition to flumioxazin (125 g/ha), herbicides sulfentrazone (800 g/ha), tebuthiuron (1000 g/ha) and diuron (1066 g/ha)+hexazinone (134 g/ha)+imazapic (98 g/ha) also had an unsatisfactory level of control on the infesting weed communities. All species had lower controls by the herbicides when compared to those in the previous assessments, especially against the grasses.

However, when looking closer at the level of control by each herbicide treatment, it was observed that all herbicides provided unsatisfactory control for some species; herbicide imazapic (147 g/ha) had unsatisfactory control only for *B. decumbens*, imazapic (98 g/ha) + sulfentrazone (600 g/ha) on *M. cissoides*, sulfentrazone (800 g/ha) on *M. cissoides*, *P. maximum* and *B. decumbens*; tebuthiuron (100 g/ha) on *P. maximum* and *B. decumbens*; amicarbazone(1400 g/ha) on *I. quamoclit* and *B. decumbens*, flumioxazin (125 g/ha) unsatisfactory control for all the species, diuron (1066 g/ha) + hexazinone (134 g/ha) + imazapic (98 g/ha) on *I. quamoclit*, *M. cissoides* and *B. decumbens*; amicarbazone (840 g/ha) + isoxaflutole (82.5 g/ha) on *I. hederifolia* and imazapic (98 g g/ha) + isoxaflutole (85 g/ha) on *I. quamoclit* and *B. decumbens*.

Conclusions

One hundred and twenty days after application, during which 698.7 mm rain were recorded with averages of 21.9 and 30.6°C as minimum and maximum temperature respectively, the herbicides that resisted the bad weather had an average control over the species studied in the following order: sufficient control: imazapic, amicarbazone, imazapic + sulfentrazone, imazapic + isoxaflutole amicarbazone + isoxaflutole; doubtful control: diuron + hexazinone + imazapic, tebuthiuron; insufficient control: sulfentrazone; and very bad control: flumioxazin.

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PERSISTANCE DES HERBICIDES APPLIQUÉS À LA CANNE À SUCRE PENDANT LA SAISON DES PLUIES AU BRÉSIL

Par

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**MOTS CLES: Gestion de l'Enherbement,
Contrôle de Pré-émergence, Paillis de Canne.**

Résumé

CETTE ÉTUDE avait pour but de déterminer la persistance des herbicides dans le sol après une saison des pluies en évaluant les mauvaises herbes contrôlées dans des cultures de canne à sucre. Un dispositif en split-plot fut utilisé avec des parcelles principales de six lignes de canne (37.5 m²) et des sous parcelles d'une ligne de canne (7.5 m²). Des graines d'*Ipomoea quamoclit*, *Ipomoea hederifolia*, *Merremia cissoides*, *Panicum maximum* et *Brachiaria decumbens* furent semées dans les sous parcelles tandis que les parcelles principales étaient composées des dix traitements herbicides suivants: un témoin non traité, imazapic (147 g/ha), imazapic (98 g/ha) + sulfentrazone (600 g/ha), sulfentrazone (800 g/ha), tebuthiuron (1000 g/ha), amicarbazone (1400 g/ha), flumioxazin (125 g/ha), diuron (1066 g/ha) + hexazinone (134 g/ha) + imazapic (98 g/ha), amicarbazone (840 g/ha) + isoxaflutole (82.5 g/ha), imazapic (98 g/ha) + isoxaflutole (85 g/ha). Pendant les 120 jours suivant la pulvérisation, nous avons observé 698.7 mm de pluies, des températures moyennes minimum et maximum de 21.9°C et 30.6°C. Les herbicides qui ont le mieux persisté furent dans l'ordre décroissant: amicarbazone (avec un contrôle de 91.2% des mauvaises herbes), imazapic (90.8%), imazapic + sulfentrazone (89.6%), amicarbazone + isoxaflutole (89.2%), imazapic + isoxaflutole (85.6%), diuron + hexazinone + imazapic (84.4%), tebuthiuron (76%), sulfentrazone (70.8%), et enfin flumioxazin (19.2%).

**PERMANENCIA DE HERBICIDAS APLICADOS A CANA DE AZUCAR
DURANTE LA EPOCA LLUVIOSA EN BRASIL**

Por

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**PALABRAS CLAVE: Control de Malezas,
Control Preemergente, Trash de Cana.**

Resumen

EL OBJETIVO de la presente investigación era estudiar la permanencia de los herbicidas en el suelo después de la época lluviosa, evaluados de acuerdo al control de malezas en cana de azúcar. Se utilizó un diseño de parcelas divididas, con una parcela grande de seis surcos de cana (37.5 m²) y una parcela pequeña de un surco (7.5 m²). Se sembraron semillas de *Ipomoea quamoclit*, *Ipomoea hederifolia*, *Merremia cissoides*, *Panicum maximum* and *Brachiaria decumbens* en la parcela pequeña, mientras la parcela grande consistió en diez tratamientos con herbicidas, de la siguiente manera: un testigo sin aplicación, imazapic (147 g/ha), imazapic (98 g/ha) + sulfentrazone (600 g/ha), sulfentrazone (800 g/ha), tebuthiuron (1000 g/ha), amicarbazone (1400 g/ha), flumioxazin (125 g/ha), diuron (1066 g/ha) + hexazinone (134 g/ha) + imazapic (98 g/ha), amicarbazone (840 g/ha) + isoxaflutole (82.5 g/ha), imazapic (98 g/ha) + isoxaflutole (85 g/ha). Durante los 120 días después de la aplicación, se tuvo una precipitación de 698.7 mm, con temperatura mínima promedio de 21.9 y máxima promedio de 30.6°C. Los herbicidas que mejor soportaron estas condiciones presentaron un control satisfactorio de las especies bajo estudio, en el siguiente orden descendente: amicarbazone (91.2% de control), imazapic (90.8%), imazapic + sulfentrazone (89.6%), amicarbazone + isoxaflutole (89.2%), imazapic + isoxaflutole (85.6%), diuron + hexazinone + imazapic (84.4%), tebuthiuron (76%), sulfentrazone (70.8%), flumioxazin (19.2%).