

# Desiccation pre-sowing of *Conyza* spp., by alternative herbicides to 2,4-D

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**Abstract.** The control of *Conyza* spp., can happen in function of its phenological stage. For that reason, in infested areas with *Conyza*'s height less than 10 cm, one single application of herbicides can be enough for its control. Therefore, the purpose of this work was to evaluate the efficacy of alternatives herbicides from 2,4-D on the control of *Conyza* spp., lower than 10 cm. For such, it was done a field experiment with experimental delineation of casualization blocks. It was applied the followed herbicides treatments in one single application: fluroxypy + clethodim + saflufenacil; dicamba + glyphosate + saflufenacil; triclopyr + glyphosate + saflufenacil; chlorimurrom-ethyl + glyphosate + saflufenacil; mesotrione + atrazine + glyphosate; fluroxypy + clethodim + glyphosate; dicamba + glyphosate; triclopyr + glyphosate; chlorimurrom-etílico + glyphosate; mesotrione + atrazine + glyphosate + 2,4-D; halaxifen + diclosulam + glyphosate; tembotrione + atrazine + glyphosate; tembotrione + atrazine + glyphosate + 2,4-D e witness with no herbicides application. The *Conyza*'s control was evaluated at 7, 14, 21, 28, 35 and 42 days after the application and the statistics analysis was done by F test and Tukey test. The herbicides dicamba + glyphosate + saflufenacil; triclopyr + glyphosate + saflufenacil; e mesotrione + atrazine + glyphosate + 2.4 -D reported results above 80% in the control of *Conyza*'spp. Therefore, alternatives herbicides to 2,4-D can be effective on the control of *Conyza* spp., lower than 10 cm with one single application.

**Keywords.** Horseweed, synergism, association.

## 1. Introduction

In Brazil on *Conyza* spp., gender it was identify three species: *C. bonariensis*, *C. canadensis* e *C. Sumatrensis*<sup>[1]</sup>. The soybeans plantation comprehends an estimated area of 44 million of hectare according to Conab<sup>[2]</sup>, as this species infests between 40,8% to 49% of these areas. For this reason, in the South and Southeast region 81% of the planted territory are target with herbicides application pursuing *Conyza*'s spp., due to climatic conditions and positive cultivate standards for *Conyza*'s spp., in the region<sup>[3]</sup>.

In the Mato Grosso do Sul's South region, when the corn's cycles end or after its harvest, the germinative fluxes of *Conyza* spp., happen continually, considering the states average temperature near to 20°C and cloudy periods that are observed at the months of June, July and August.<sup>4</sup> Those climatic characteristics are favorable for the plant's emergence with different phenological stages near the soybean sowing<sup>[5,6]</sup>. As well as the regrowth's

occurrences with were reported in agricultural areas in the cities of Dourados and Maracajú in 2021/2022 harvest, according to Conab<sup>[2]</sup>.

In this scenario, the strategies of *Conyza*'s management are frequently focused in the soybean's pre sowing desiccation, as homogeneous areas with *Conyza*'s lower than 10 cm are estimated an effective control with one single application of isolated herbicides or in association<sup>[7]</sup>.

In Mato Grosso do Sul's south are recently reports of *Conyza*'s biotypes with glyphosate, chlorimuron, paraquat and 2,4-D multiple resistance<sup>[8]</sup>. Such resistance has limited the pre and post emergence registered herbicides options.

At first, auxinic products were positioned and beside these it was also observed the placement of corn's registered herbicides, for example atrazine + mesotrione, and recently tembotrione + atrazine<sup>[9]</sup>. Also had been tested the soybean's herbicides changing of placement, changing the constantly

applications of chlorimuron-ethyl and chlorasulan done in soybean's post emergence desiccation [10]. Through these herbicides, in plants lower than 10 cm, the applications can be single, normally by the herbicides association that has different mechanism of action and performance in plants [7].

Therefore, the intensification of *Conyza's* resistant biotypes to 2,4-D had been limited the products for its effective control becoming even more necessary the studies about this topic. In view of this, the purpose of this work was to evaluate the efficacy of alternative herbicides to 2,4-D in the control of *Conyza's spp.*, in homogeneous areas with plants lower than 10 cm.

## 2. Materials and methods

The experiment was conducted in the field, at Dourados, Mato Grosso do Sul, Brazil (22°18'22"S 54°51'26"W, altitude de 413 m). The climatic classification at the city is from Koppen and the mean annual temperature is 22,7°C [11]. In the moment of the experiment were collected soil samples in depth of 0-20 cm, and classified as Dystrophic Red Latosol which is clayey with physicochemical properties that are in table 1.

**Tab. 1** – Physical and chemical analysis of the soils sample in the experimental area.

Ca	Mg	H+Al	T	Al
4,56	2,08	7,08	13,82	0,12
K	P	V (%)	pH	
18	40,73	48,8	5,77	

Font: TECSOLO's laboratory.

The experiment was conducted with experimental delineation of casualization blocks. The experimental unities were constituted by parcels of 3x5m dimensions totalizing 15 m<sup>2</sup>. The single application with *Conyza's* biological target lower than 10 cm was done through the following post emergence herbicides: (1) fluroxypyr + clethodim + glyphosate + saflufenacil (250 + 175 + 1000 + 28 g i.a. ha-1 ); (2) dicamba + glyphosate + saflufenacil (288 + 1000 + 28 g i.a. ha-1 ); (3) triclopyr + glyphosate + saflufenacil (1990 + 1000 + 28 g i.a. ha-1 ); (4) chlorimuron-ethyl + glyphosate + saflufenacil (17,5 + 1000 + 28 g i.a. ha-1 ); (5) mesotrione + atrazine + glyphosate (100 + 1000 + 1000 g i.a. ha-1 ); (6) fluroxypyr + clethodim + glyphosate (250 + 175 + 1000 g i.a. ha-1 ); (7) dicamba + glyphosate (288 + 1000 g i.a. ha-1 ); (8) triclopyr + glyphosate (1190 + 1000 g i.a. ha-1 ); (9) chlorimuron-ethyl + glyphosate (17,5 + 1000 g i.a. ha-1 ); (10) mesotrione + atrazine + glyphosate + 2,4 D (100 + 1000 + 1000 + 1209 g i.a. ha-1 ); (11) haloxifen + diclosulam + glyphosate (4,85 + 25,52 + 1000 g i.a. ha-1 ); (12) tembotrione + atrazine + glyphosate (84 + 1000 + 1000 g i.a. ha-1 ); (13) tembotrione + atrazine + glyphosate + 2,4 D (84 + 1000 + 1000 + 1209 g i.a. ha-1 ) besides (14) witness

with no herbicides application.

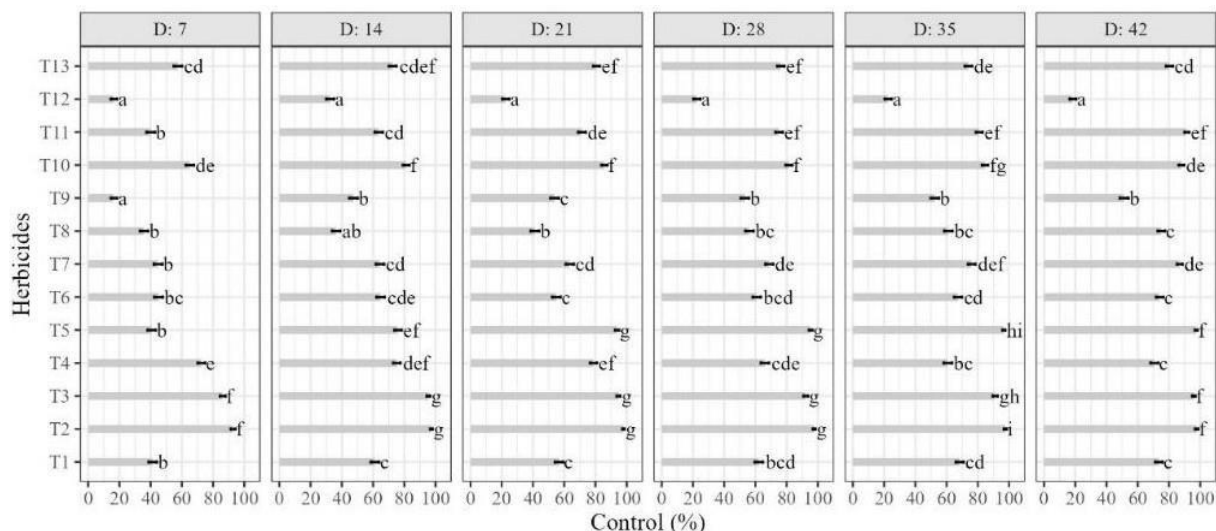
At the moment of the application the area had *Conyza's* infestation at the density of 96 plants per m<sup>2</sup> with homogeneous plants distributed in the field, that had average height of 8,4 cm. The density of *Conyza's spp.*, was taken by measured through the inventory's square method, which consists in randomly throwing a hollow square with area of 1m<sup>2</sup> in the area for posterior identification and quantification of *Conyza's spp.* At the moment of the application the air relative humidity was 70%, temperature of 28°C and wind speed of 2,3 km/h.

The *Conyza's* percent of control with visual analysis was done at 7, 14, 21, 28, 35 and 42 days after the application (DAA). For statistical analysis purposes, it was done the Deviance's analysis, in which it was used the Generalized Additive Model for Location, Scale and Shape (GAMLSS). To verify the distribution's adequation to the model's residues it was applied the Shapiro-Wilk's test, while the F Deviance's analysis was applied to verify the factors allocated as fix effect's significance. It was adopted a level of 5% significance in all of the tests.

## 3. Results and discussion

At the first evaluation – 7 DAA – it was noted that the treatments T2 - dicamba + glyphosate + saflufenacil and T3 - triclopyr + glyphosate + saflufenacil didn't presented significant difference between itself, however these treatments had difference between the others, presenting satisfactory values of control, with percents above 80%. At 14 DAA the treats T4 - chlorimuron + glyphosate + saflufenacil; T5 - mesotrione + atrazine + glyphosate; T10- mesotrione + atrazine + glyphosate + 2,4-D and T13 - tembotrione + atrazine + glyphosate + 2,4 - D, didn't had difference among it selves by the statistics analysis, with more than 80% of control. While the treatments T2 - dicamba + glyphosate + saflufenacil and T3 - triclopyr + glyphosate + saflufenacil, didn't had difference between itself by the statistics control and had difference between the others, presenting satisfactory values of control nears to 90%, at the same period, the others treatments presented control lower than 80%.

At 21 DAA the treatments T2 - dicamba + glyphosate + saflufenacil; T3 - triclopyr + glyphosate + saflufenacil and T5 - mesotrione + atrazine + glyphosate + 2,4 -D, didn't had difference among themselves by the statistics analysis, with percents nears to 100%. At 28 DAA the treatments T2 - dicamba + glyphosate + saflufenacil, T3 - triclopyr + glyphosate + saflufenacil and T5 - mesotrione + atrazine + glyphosate + 2,4 - D continued to present difference among the others treatments, with values above 100%, while at 35 DAA only the treatments T2 - dicamba + glyphosate + saflufenacil and T4 - mesotrione + atrazine + glyphosate + 2,4-D had difference between the others.



**Figure 1** – Tukey's test result for treatments comparison in each day after the application when evaluated the control of *Conyza's* lower than 10cm.

**Subtitle:** T1 - fluroxypyr + clethodim + glyphosate; T2 - dicamba + glyphosate + saflufenacil; T3 - triclopyr + glyphosate + saflufenacil; T4 - chlorimuron-ethyl + glyphosate + saflufenacil; T5 - mesotrione + atrazine + glyphosate + 2,4-D; T6 - fluroxypyr + chletodim + glyphosate; T7 - dicamba + glyphosate; T8 - triclopyr + glyphosate; T9 - chlorimuron-ethyl + glyphosate; T10 - mesotrione + atrazine + glyphosate; T11 - haloxifen + diclosulam + glyphosate; T12 - tembotrione + atrazine + glyphosate; T13 - tembotrione + atrazine + glyphosate + 2,4 D.

At 42 DAA it was noticed the higher efficacy of the treatments T2 – dicamba + glyphosate + saflufenacil, T3 – triclopyr + glyphosate + saflufenacil and T5 – mesotrione + atrazine + glyphosate + 2,4 -D in the control of *Conyza'spp.*, lower than 10 cm, presenting values near to 100% of control.

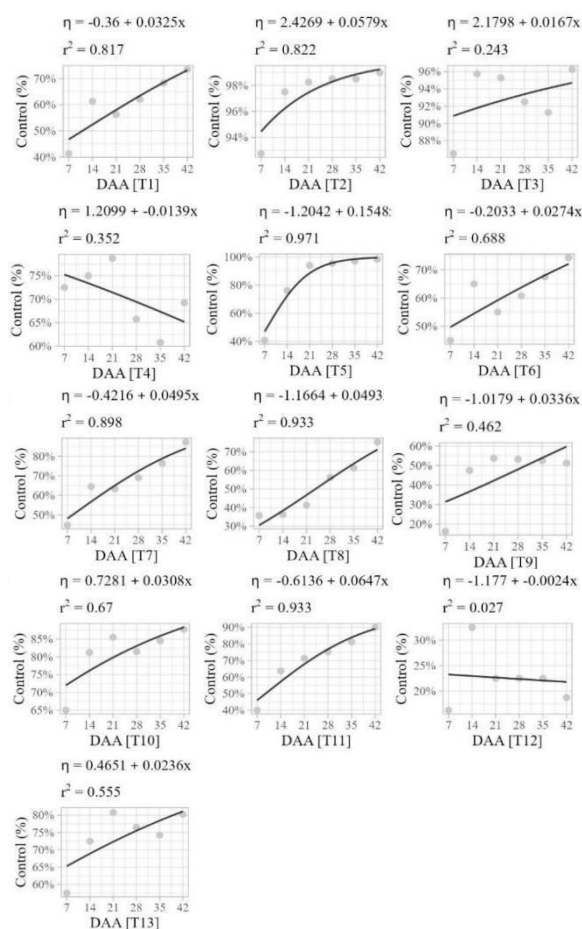
From the results obtained it was possible to notice, still at the first evaluation, the efficacy of the *Conyza's* control by using auxinic herbicides associated with saflufenacil, that caused synergism in the control of *Conyza's spp.*, highlighting the treatments T2 – dicamba + glyphosate + saflufenacil, T3 – triclopyr + glyphosate + saflufenacil and T4 – chlorimuron + glyphosate + saflufenacil, that had values higher than 80%, differently of the treatments that didn't present this herbicide, just as T7 – dicamba + glyphosate, T8 - triclopyr + glyphosate and T9 – chlorimuron + glyphosate that didn't present satisfactory values, with percents lower than 60%.

This result is also compared with the one observed by Dalazen<sup>[12]</sup>, who had noticed the synergic effect in the association between the herbicides glyphosate and saflufenacil in the control of *Conyza's spp.*, also noticing the prevent of *Conyza's* regrowth. The author emphasize that this mixture presented control results higher than the expected independent of the dose applied.

Other synergism association is observed between the herbicides HPPD's inhibitors and FSII and 2,4 -D, in this case, T5 – mesotrione + atrazine + 2,4-D + glyphosate, been able to notice that this association had an increasing of almost 20% in the last

evaluation. Although mesotrione + atrazine had satisfactory results in the control of *Conyza spp.*, this fact can be explained by Kruse<sup>13</sup>, who had observed the synergism between those mechanisms of action, since the Photosystem's II electrons' transport's inhibitors herbicides can cause oxidative stress, however these can be tempered by the carotenoids action, potentializing this mixture.

Through the analysis of regression, which are observe the evolution of the *Conyza's* control by one single application. This result was also observed by Dalazen<sup>[12]</sup>, which was possible to notice that the majority of the treatments had a progressive increase in the control, with emphasis in the treatments T2 – dicamba + glyphosate + saflufenacil and T3 – triclopyr + glyphosate + saflufenacil, which presented satisfactory control that were above 80% since 14 DAA.



**Figure 2** – Regression analysis when evaluated the control in the experiment with *Conyza's* lower than 10 cm for the DAT. The black line indicates the Beta's regression adjustment with function of logit connection,  $1/\{1 + \exp[-\eta]\}$ .

Therefore, in *Conyza's* natural infested areas with plants lower than 10 cm, one single herbicide's application can be efficient, and an effective alternative can be the association of auxinic with saflufenacil, in which it was observed the synergism and the velocity of control. This result differs from the work done by Gazola<sup>7</sup>, which noticed that *Conyza's spp.*, higher than 10 cm are difficult to control with one single application.

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