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Pre-emergent herbicides for weed management in soybean cultivation on the farm. Sobradinho (Uberlândia-MG)

Pre-emergent herbicides for weed management in soybean cultivation at Sobradinho Farm (Uberlândia-MG)

Pre-emergent herbicides for managing heavy bags in soybean cultivation on a farm Sobradinho (Uberlândia-MG)

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Abstract: Weeds are one of the main limiting factors in soybean productivity due to competition for water, light, nutrients, and space. In this context, the use of pre-emergent herbicides has stood out as an important tool in integrated weed management, contributing to the initial control of the weed community and to the reduction of selection pressure on resistant species. This study aimed to evaluate the efficiency of different pre-emergent herbicides in weed management in soybean cultivation at Fazenda Sobradinho, Uberlândia-MG. The experiment was conducted in a randomized block design with seven treatments and four replications. The treatments consisted of: control, S-metolachlor, sulfentrazone, diclosulam + S-metolachlor, flumioxazin + S-metolachlor, diclosulam + sulfentrazone, and flumioxazin + sulfentrazone. The phytosociological survey of the weed community, the percentage of weed control, the 100-grain weight, and soybean productivity were evaluated. The species **Urochloa decumbens** and **Alternanthera tenella** showed the highest importance indices in the experimental area. All herbicide treatments provided high weed control, with S-metolachlor and sulfentrazone standing out. Although no statistically significant differences were observed in productivity and 100-grain weight, the herbicide treatments showed numerically superior performance compared to the control. It is concluded that the evaluated pre-emergent herbicides are efficient in the initial management of weeds in soybean cultivation, contributing to the reduction of weed competition and the maintenance of the crop's productive potential.

Keywords: *Glycine max;* chemical management; weeds; pre-emergence; productivity.

Abstract: Weeds are among the main limiting factors for soybean productivity due to competition for water, light, nutrients, and space. In this context, pre-emergent herbicides have become an important tool in integrated weed management, contributing to initial control of the weed community and reducing selection pressure on resistant species. This study aimed to evaluate the efficacy of various pre-emergent herbicides for weed management in soybean cultivation at Fazenda Sobradinho in Uberlândia-MG, Brazil. The experiment was conducted in a randomized block design with seven treatments and four replications. The treatments consisted of: control, S-metolachlor, sulfentrazone, diclosulam + S-metolachlor, flumioxazin + S-metolachlor, diclosulam + sulfentrazone, and flumioxazin + sulfentrazone. The phytosociological survey of the weed community, weed control percentage, 100-grain weight, and soybean yield were evaluated.

Urochloa decumbens and *Alternanthera tenella* showed the highest importance value indices in the experimental area. All herbicide treatments provided high weed control efficiency, especially

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Smetolachlor and sulfentrazone. Although no statistically significant differences were observed for yield and 100-grain weight, herbicide treatments showed numerically higher performance than the untreated control. It was concluded that the evaluated pre-emergent herbicides are effective for initial weed management in soybean cultivation, thereby reducing weed competition and maintaining crop yield potential.

Keywords: *Glycine max;* chemical management; weeds; pre-emergence; yield.

1. INTRODUCTION

Soybeans *(Glycine max* (L.) Merrill) are one of the most important agricultural crops in Brazil and of the world, playing an essential role in the economy and food production. However, the its cultivation faces considerable obstacles, mainly competition from weeds that They compete for crucial resources, such as light, water, and nutrients, which reduces the productive capacity of culture (Pollnow *et* al., 2020).

Effective management of these invasive species is crucial to ensuring high profits and the viability of the operation. production system. Among the weed control strategies, herbicides Pre-emergent fertilizers have stood out for their effectiveness and practicality. These products, when applied... Before the emergence of crops and invasive species, they create a chemical barrier in the soil. causing the death of weeds during germination and/or emergence of the species invasive (Pollnow *et* al., 2020).

Pre-emergent herbicides, in addition to providing more effective initial control, They help reduce the demand for subsequent post-emergence herbicide applications. contributing to the reduction of selection pressure for resistant biotypes, an issue on the rise. in contemporary agriculture (Rizzardi, 2017).

With the growing need for more sustainable and efficient agricultural practices, the generation Knowledge about the performance and selectivity of these herbicides can contribute significantly impacts producers' decision-making. Given this scenario, the present study... Its objective is to evaluate the efficiency of different pre-emergent herbicides in plant management. Weeds in soybean crops, using the active ingredients s-metolachlor and sulfentrazone, isolated or in combination with flumioxazin and diclosulam. The experiment will be conducted at the Farm Sobradinho, located in the municipality of Uberlândia-MG, and will consider, in addition to the control of Weed species, the impact of herbicides on soybean productivity.

Considering the importance of proper weed management for sustainability. Regarding soybean production, this study aimed to determine the best herbicides.

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pre-emergent herbicides for weed management in soybean cultivation at Fazenda Sobradinho, in Uberlândia-MG.

2. MATERIALS AND METHODS

The experiment was developed in the soybean production area of the Sobradinho Farm. IFTM Campus Uberlândia, in Uberlândia-MG, located at coordinates 18º46'34" south latitude and 48°17'37" west longitude. The altitude of the location is 703 meters. The climate classification is Aw, according to Köppen-Geiger (Peel; Finlayson; McMahon, 2007). The soil at the site was classified as Oxisol. Eutrophic red.

Before planting the soybean crop, a phytosociological survey was carried out to to understand the type of weed community present in the area. Thus, 15 days before sowing In the soybean field, weeds were sampled using an inventory square (1 m x 1 m). randomly positioned at 12 sampling points. At each point, the following was recorded: Number of individuals of each weed species that emerged in the area. With the data collected In the field, the phytosociological parameters proposed by Mueller-Dombois were calculated and Ellenberg (1974):

Frequency (repetition index of species in the squares):

$$F = \frac{u}{\text{and}}$$

Density (index of the number of individuals of the same species in all squares):

$$D = \frac{i}{\text{and}}$$

THE

Abundance (grouping of species at different points in the total area):

$$A = \frac{i}{\text{and}}$$

and

Relative frequency:

$$Fr = \frac{\text{and} \quad \text{and} \quad 100}{}$$

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and and

Relative density:

and 100

Dr = _____

and

Relative abundance (relates a species to all other species found in the area):

the and 100

Air = _____

the and

Importance value index:

IVI = + +

All the results obtained were presented in tables for descriptive profile analysis.

of the weed community present in soybean cultivation.

On the same day as the phytosociological survey, the area designated for soybean cultivation was desiccated.

with glyphosate (Topa Tudoÿ; 1440 g of iaha-1) + 2,4-D (Aminolÿ; 1209 g of iaha-1). _____

Fifteen days after desiccation, the soybean cultivar CZ37B39I2X was sown.

adding 14 seeds per linear meter and 240 kg haÿ¹ of 08-28-26 formulated fertilizer, with

Spacing between furrows was 0.5 m. Planting fertilization and sowing were carried out with...

The agricultural machinery at the Sobradinho Farm.

The experimental design used was a randomized block design with 7 treatments and 4

The treatments consisted of: control; S-metolachlor; sulfentrazone; repetitions.

diclosulam + S-metolachlor; flumioxazin + S-metolachlor; diclosulam + sulfentrazone;

flumioxazin + sulfentrazone. Specifications of the quantity of active ingredient in each product.

The commercial interest rates applied per hectare are presented in Table 1.

Table 1. Specifications of pre-emergent herbicides used in the experiment with the soybean crop. Sobradinho Farm. Uberlândia-MG. 2024/2025 Harvest.

Active ingredient	Commercial product	Ai dose (g haÿ¹)
S-metolachlor	Dual Gold®	1920.00
Sulfentrazone	Boral®	400.00
Diclosulam + S-metolachlor	Spider® + Dual Gold®	35.03 + 1920.00
Flumioxazin + S-metolachlor	Flumyzin® + Dual Gold®	60.00 + 1920.00
Diclosulam + sulfentrazone	Spider® + Boral®	35.03 + 400.00
Flumioxazin + sulfentrazone	Flumyzin® + Boral®	60.00 + 400.00

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The experimental plots consisted of 4 rows of soybeans, each 5 m long.
length. The useful area of the experimental plot was composed of the two central lines, with the
Exclusion of 0.5 m from each end of each row. Between the experimental plots and the blocks,
Borders 1 m long were structured.

Three days after soybean planting, all herbicides were applied.
pre-emergent pesticides, using a backpack sprayer equipped with a CO2 cylinder and a boom with 4 nozzles.
fan-type sprayer (MAGNO 110 03). The equipment was adjusted to spray 200
L haÿ¹ of spray volume with an application speed equivalent to 5 km hÿ¹.

At the V4 phenological stage, topdressing fertilization was carried out with 70 kg haÿ¹ of KÿO.
using potassium chloride as a source.

Disease management was carried out with the application of Unizeb Gold fungicides (3 kg).
pc/ha or 2250 g of mancozeb/ha) and Priori Top (300 mL pc/ha or 60 g of azoxystrobin/ha + 37.5
g of difenoconazole/ha), applied from the R3 phenological stage, with the first application of
Unizeb Gold is the second in the Priori Top.

After reaching physiological maturity, the soybean plants in the usable area of each plot were
harvested and packed in raffia bags. The grains were obtained with the aid of a
stationary threshing machine at the Federal University of Uberlândia. After measuring the total mass of
Grain samples from the usable area of each plot were taken to the IFTM Campus laboratory.
Uberlândia. In this study, a sample of 100 grains from each plot was evaluated for
wet mass and dry mass, using the oven method at 105 °C for 24 h to determine the
Grain moisture. The 100-grain weight and grain yield per hectare were corrected.
to 13% humidity.

The collected data were analyzed in SISVAR (Ferreira, 2011) using the *F*- test .
Analysis of Variance, at a 5% probability level, was performed, and the treatments were compared to each other.
using Tukey's test, also at the 5% probability level.

3. RESULTS AND DISCUSSION

The weed community present in the area designated for soybean cultivation was
analyzed through the phytosociological survey presented in Table 2. The three species with
The highest values for frequency, density, and abundance (absolute or relative) were: *Urochloa*
decumbens, Alternanthera tenella and *Amaranthus spinosus.*

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Table 2. Number of individuals present (NQ), number of individuals (NI), frequency (F), density (D), abundance (A), relative frequency (Fr), relative density (Dr), relative abundance (Ar) and importance value index (IVI) of weed species 15 days before sowing the soybean cultivar CZ37B39I2X. Sobradinho Farm, Uberlândia-MG. 2024/2025 crop season.

Species	NI	NQ	F		D	THE	Fr	Dr	Air	IVI
Urochloa decumbens	432	12		1.00	36.00	36.00	27.91	51.74	45.28	124.93
Alternanthera tenella	359	12		1.00	29.92	0.50	29.92	27.91	3.83	42.99	37.63	108.53
Amaranthus spinosus	23	6		1.92			13.95	2.75		4.82	21.52
Commelina benghalensis	5	4		0.33	0.42	1.25	9.30	0.60	1.57	11.47
Neonotonia wightii	6	2		0.17	0.50	3.00	4.65	0.72	3.77	9.14
Ipomoea triloba	4	2		0.17	0.33	2.00	4.65	0.48	2.52	7.65
Sida glaziovii	3	2		0.17	0.25	1.50	4.65	0.36	1.89	6.90
Ricinus communis	2	2		0.17	0.17	1.00	4.65	0.24	1.26	6.15
Ageratum conyzoides	1	1		0.08	0.08	1.00	2.33	0.12	1.26	3.71
Total	**835**	**12**		**3.58**	**69.58**	**79.50**	**100.00**	**100.00**	**100.00**	**300.00**	

Source: The authors.

Phytosociological analysis revealed that highly competitive species, such as Urochloa decumbens and Alternanthera tenella dominated the study area, presenting the largest... Frequency, density, and abundance indices. The predominance of these species indicates a high infestation pressure in the experimental area, especially due to the strong adaptation of these plants. to the edaphoclimatic conditions of the Cerrado.

The species *Urochloa decumbens* presented the highest Importance Value Index (IVI). indicating a broad presence in the region and high competitiveness. According to Embrapa Soja (Brighenti *et* al., 2021), grasses of the genus *Urochloa* have a high capacity to compete for water, Light and nutrients, which can significantly affect the initial development of the soybean crop.

Alternanthera tenella has also demonstrated high phytosociological relevance, suggesting that possibility of interfering with crop development. Researchers from Embrapa Maize and Sorghum Studies have been conducted that indicate that broadleaf species with high population density may They reduce soybean productivity because they quickly occupy space and compete for resources. environmental (Voll *et* al., 2002).

Although it has a lower IVI (Index of Viability), the presence of *Commelina benghalensis* requires attention. special. This is because this species is resistant to glyphosate and has a high capacity to vegetative propagation, which makes management difficult in regions where this mechanism of action is used. On a recurring basis. According to the Brazilian Society of Weed Science

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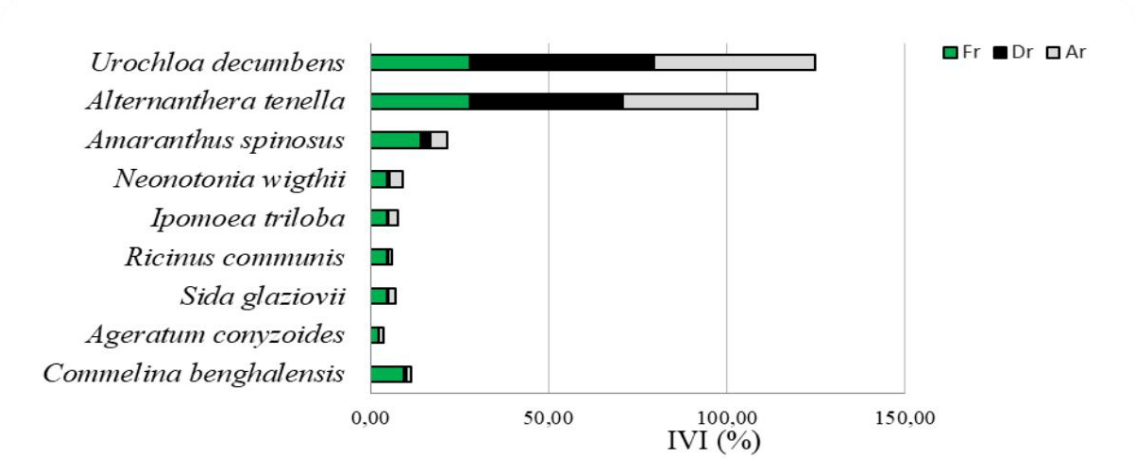
(SBCPD), the continuous application of herbicides with the same mechanism of action favors selection of tolerant and resistant species (Pereira *et* al., 2022).

Phytosociological results indicate the need to implement management strategies. integrated methods, including the use of pre-emergent herbicides with varied mechanisms of action, in order to to reduce selection pressure and increase the effectiveness of weed control in the area.

The weed community identified at the site, 30 days before soybean planting, was composed predominantly of broadleaf species. However, the grass *U. decumbens* presented the highest importance index (Figure 1).

Figure 1. Phytosociological survey of weeds in the area intended for soybean cultivation CZ37B39I2X, at the Sobradinho Farm, IFTM Campus Uberlândia, in Uberlândia, Minas Gerais.
Crop 2024/2025. Fr: relative frequency (%); Dr: relative density (%); Ar: relative abundance (%); IVI: importance value index (%).



The fourth weed species with the highest importance value index was *C. benghalensis.* Although the IVI was low in the weed community, this fact should be analyzed. with special attention, considering that the management of weed desiccation on the Farm Sobradinho has been treated annually with glyphosate, to which the spiderwort plant shows tolerance. If future management practices are not changed, this weed could become a major challenge. to be controlled due to the increase in the importance value index at Fazenda Sobradinho, in Uberlândia-MG.

When the soybean reached the V4 phenological stage, the percentage of weed control was evaluated. Weed control as a function of pre-emergent herbicide application.

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Table 3. Percentage of weed species control in soybean cultivation at the V4 phenological stage, subjected to the application of pre-emergent herbicides in the "plant-apply" system. Sobradinho Farm, Uberlândia-MG. 2025/26 crop season.

Treatments	**Control (%)**
Witness	0.00 b
S-metolachlor	96.75 a
Sulfentrazone	96.00 a
Diclosulam + S-metolachlor	93.75 a
Flumioxazin + sulfentrazone	94.25 a
Diclosulam + sulfentrazone	85.75 a
Flumioxazin + S-metolachlor	79.25 a

* Means followed by different letters in the column differ from each other by Tukey's test at a 5% probability level. CV = 14.52%.

Compared to the control group without application, herbicide treatments Pre-emergent treatments showed high levels of weed control. The treatments that including S-metolachlor and sulfentrazone, both isolated and in combination, showed control percentages exceeding 85%, demonstrating significant effectiveness in the initial management of infesting community.

S-metolachlor exhibited one of the highest control percentages, which can be attributed to due to its high effectiveness in controlling annual grasses and some broadleaf species. According to According to Embrapa Cerrados, this active ingredient inhibits cell division in weeds during the germination, providing effective pre-emergence control (Brighenti *et* al., 2021).

Sulfentrazone also showed excellent performance, especially due to its action. about broadleaf species. According to studies published by the Federal University of Viçosa (UFV), PROTOX-inhibiting herbicides, such as sulfentrazone and flumioxazin, play plays an important role in the management of glyphosate-resistant weeds (Rizzardi, 2017). The results show that the use of pre-emergent herbicides is an effective strategy for controlling weeds in soybean crops, helping to reduce competition during the critical period of cultural interference.

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Table 4. 100-grain weight (CGW) and grain yield (GY) of the soybean cultivar CZ37B39I2X subjected to pre-emergent herbicide application in the "plant-apply" system. Sobradinho Farm, Uberlândia-MG. 2025/26 crop season.

Treatments	MCG (g)ÿÿ	PG (kg haÿ¹)ÿÿ
Witness	15.84	1502.90
S-metolachlor	23.78	4015.35
Sulfentrazone	21,22	3089.88
Diclosulam + S-metolachlor	26.28	3285.53
Flumioxazin + S-metolachlor	18.50	2176.38
Diclosulam + sulfentrazone	20.95	2929.14
Flumioxazin + sulfentrazone	29.91	3887.84

ns Not significant by the F-test of ANOVA at 5% probability. CVMCG = 49.35%; CVPG = 61.22%

Although no statistically significant differences were found in relation to Regarding 100-grain weight and productivity, treatments with pre-emergent herbicides showed... numerically higher values compared to the uncontrolled witness.

The lower productivity observed in the control group highlights the harmful impacts of The presence of weeds in the development of soybean crops, according to Embrapa. In the Western Agropecuária region, competition with weeds can significantly reduce the soybean productivity, especially in the early stages of development (Brighenti *et* al., 2021).

The high experimental variability, evidenced by the coefficients of variation, led to absence of statistical differences between treatments in the variables of 100-grain weight and of Productivity. This fact can be explained by the heterogeneity in plant density per meter. A linear correlation was observed between the experimental plots. Due to the existing straw cover on the site, the set The tractor-seeder/fertilizer spreader did not distribute seeds uniformly per linear meter. Although there are no statistically significant differences, the results indicate a trend. positive impact on the use of pre-emergent herbicides to increase soybean productivity, which highlights its relevance in integrated weed management.

CONCLUSION

The pre-emergent herbicides analyzed demonstrated effectiveness in the initial control of Weeds in the experimental area of the Sobradinho Farm, in Uberlândia-MG.

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The species *Urochloa decumbens* and *Alternanthera tenella* stood out as the main ones. components of the infesting community, exhibiting the highest phytosociological indices and the greatest competitive potential in relation to soybean cultivation.

Treatments with S-metolachlor and sulfentrazone, both alone and in combination, They demonstrated high levels of weed control, indicating that they can be used in weed management. pre-emergent culture.

Although no statistically significant differences were found in relation to Regarding 100-grain weight and productivity, herbicide treatments showed improved performance. numerically superior compared to the uncontrolled witness. This highlights the relevance chemical management to reduce weed interference.

In conclusion, it is possible to determine that the use of pre-emergent herbicides is an effective strategy. in integrated weed management in soybean cultivation, which contributes to increasing the Productive security and the sustainability of the agricultural system.

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