# Weed management affects pasture productivity and livestock performance - Tropical Perspective

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## Abstract

Weed competition in pastures has a great impact on livestock productivity, as, in addition to competing with forage, it interferes with animal grazing. Without question, weeds can compete with forage for water, space, light and nutrients. Weeds reduce the feed value of forage, decrease pasture carrying capacity, and can be toxic or unpalatable to livestock. For most weeds in pasture, the root system is robust, which contributes to the survival of these plants, affecting the development of the pasture. Due to the large number of seeds, they usually produce, they are very easily dispersed. In addition, when there are weeds in the pasture, cattle tend to select the grazing site, keeping away from species that can harm them. Productivity losses resulting from competition between forage and weeds are extensively studied by the scientific community, both from a qualitative and quantitative point of view. Studies show that there is a direct relationship between the period of coexistence of forage and weeds in a pasture that impacts biomass productivity.

## Introduction

Weed competition is a fundamental part of vegetation ecology. Clementes et al. (1929) defined that competition begins when the supply of an essential growth factor is below the combined needs of the coexisting plants. Christoffoleti and Victoria Filho (2001) commented that competition occurs when two or more organisms need the same essential growth factor, which is found in limited amounts for all individuals. This definition differentiates competition from the broader term called "interference" which includes, in addition to competition itself, allelopathy, biotic interference and environmental changes. Grasslands are the foundation upon which livestock performance, ranch profitability, livestock farmer sustainability and subsistence are built. Without a healthy, well-managed grassland resource the genetic potential of livestock will not be realized. Grassland systems involve applying various practices to manipulate forage interactions with other plants, the environment, and grazing animals to meet resource manager objectives (Masters et al., 1996). There are different weed control techniques, but to achieve the expected result it is necessary to adopt the best strategy according to the weed species, the degree of infestation and the stage of its development.

In this paper we present results from 5 experiments in *Brachiaria brizantha* pastures infested by two different weed species, *Urena Lobata* (URNLO) and *Waltheria americana* (WALAM), and the impact of these two weeds species on forage production.

## Methods and Study Site

Five field experiments were conducted in 2019 and 2020 at two locations in Brazil (Mato Grosso and Rondônia) to evaluate the efficacy, selectivity, and biomass production in plots treated with one of three herbicides. The experiments were carried out on established pastures of *Brachiaria brizantha* that contained natural infestations of *Urena Lobata* (URNLO) and *Waltheria americana* (WALAM). The products tested were two different formulations of aminopyralid + 2,4-D (Jaguar® herbicide = 40 + 320 grams acid equivalent $L^{-1}$ and Jaguar® Ultra herbicide = 50 + 400 grams acid equivalent $L^{-1}$), picloram + 2,4-D

(Tordon® herbicide = 64 + 240 grams acid equivalent $L^{-1}$), and an untreated plot. In all experiments, the experimental design consisted of a completely randomized block with 8 treatments. All plots were 5 by 10 m with 4 replications. The cattle were allowed to graze within the experiment area before the experiment was established but were removed from the experiment after the application of herbicides for evaluations and biomass sampling. The treatments evaluated are listed in Table 1. Each herbicide treatment included a 0.5% v/v mineral oil. All applications were made with a $CO_2$ backpack sprayer set to deliver 200 L $ha^{-1}$ with XR8002 flat fan nozzles. All treatments were visually evaluated for weed control and crop selectivity. The selectivity (injury) for *Brachiaria brizantha* was evaluated at 15 and 30 days after application (DAA) and control of *Urena Lobata* (URNLO) and *Waltheria americana* (WALAM) at 15, 30 and 60 DAA. Visual ratings for injury and weed control were taken on a scale from 0 to 100%, with 0% being equivalent to no injury or no control and 100% being equivalent to completely dead grass and complete weed control. Biomass production was measured at 30 DAA by collecting (manual rake) 0.5 square meters in 2 different locations within each replication using the methodology developed by the University of São Paulo (PENATI at all, 2005). In total, 8 samples were collected for each treatment. After harvesting, the samples were weighed and converted into kg of biomass per hectare.

**Table 1. Weed control, crop injury and biomass productivity from treatments averaged across the 2019 and 2020 seasons.**

| trt # | Product | Form (g ai/L) | Dose (g ai/ha) | Dose (L/ha) | Weed Control (%) – 60 DAA | | *Brachiaria brizantha* – 30 DAA | |
|---|---|---|---|---|---|---|---|---|
| | | | | | *Urena lobata* | *Waltheria americana* | Injury (%) | Biomass (kg/ha) |
| 1 | Jaguar® | 360 | 288 | 0.8 | 73 ab | 87 a | 4 a | 27550 a |
| 2 | Jaguar | 360 | 360 | 1 | 70 ab | 82 a | 3 a | 28140 a |
| 3 | Jaguar | 360 | 540 | 1.5 | 87 a | 93 a | 3 a | 28993 a |
| 4 | Jaguar® Ultra | 450 | 288 | 0.64 | 69 b | 94 a | 3 a | 26920 ab |
| 5 | Jaguar Ultra | 450 | 360 | 0.8 | 72 ab | 92 a | 3 a | 27550 a |
| 6 | Jaguar Ultra | 450 | 540 | 1.2 | 86 ab | 94 a | 1 a | 28565 a |
| 7 | Tordon® | 304 | 608 | 2 | 85 ab | 92 a | 2 a | 31355 a |
| 8 | Untreated | | | | | | | 20745 b |

*Different letters within columns show significant differences ($P$<0.05).

## Results and Discussion

## Weed Control

Regarding weed control, both Jaguar formulations showed numerically positive dose responses for both weed species. For these weeds, control greater than 80% is considered commercially acceptable. *Urena lobata* showed commercially acceptable control only at the highest rates for both Jaguar and Jaguar Ultra. *Waltheria americana* was more sensitive, showing very good control even at the lowest rate for both Jaguar and Jaguar Ultra. Tordon showed excellent control at 2 L $ha^{-1}$ for both weeds and was similar to Jaguar and Jaguar Ultra.

## Crop Injury

There was minimal injury on *Brachiaria brizantha* independent of treatment and was perceptible only when compared to untreated plot side by side.

## Biomass Production

The results showed excellent correlation between weed control and biomass production. All treatments, except for the lowest rate of Jaguar Ultra, showed higher biomass production compared to untreated plot. When averaged across all herbicide treatments (28,439 kg $ha^{-1}$), biomass increased 37% compared to untreated (20,745 kg $ha^{-1}$). Higher biomass productivity can increase the carrying capacity, resulting in better land productivity.

## Conclusions

Weed competition can degrade forage quality, reduce livestock performance and carrying capacity, and decrease property value. The management of weeds in pastures is still a big challenge and requires knowledge of the characteristics of the weeds, such as life cycle, root system, dispersal, infestation etc. Another important factor to be considered is that there is not a single type of management, but a combination of management techniques that together, can provide better forage and livestock productivity. The rancher must consider the forage as a crop and, as such, must manage its development with a focus on soil fertility, grazing management, and weed management. This comprehensive approach leads to higher productivity and greater return on investment. This study showed that controlling weeds can significantly increase forage biomass productivity, resulting in increased livestock carrying capacity.

### References

Christoffoleti, P.J.; Victoria Filho, R. Competição e alelopatia. In: Biologia e manejo de plantas daninhas. Piracicaba: Esalq/USP, 2001.

Clements, F.E.; Weaver, J.E.; Hanson, H.C. Plant competition – an analysis of community function. Washington: Carnegie Inst., 1929. 340 p.

Masters, R.A., Nissen, S.J, Gaussoin, R.E., Beran, D.D., and Stougaard, R.N.. 1996. Imidazolinone herbicides improve restoration of Great Plains grasslands. Weed Technol. 10:92-403.

Penati, M.A.; Corsi, M.; De Lima, C.G.; Martha Junior, G.B.; Silva Dias, C.T. Number of Sampling and Dimension:Format Ratio of the Quadrat for Herbage Mass Determination in Tussock-Forming Grasses. Revista Brasileira de Zootecnia. 2005: V4;N1; 36-43.