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Research Article

Weeds Analysis in Lowland Rice Fields as Influenced by Selected Herbicides in Igbaja, Guinea Savanna Ecology Zone of Nigeria

[1]T. Ajala, [2]A. Muhammad*, [3]J. Alhassan, [2]M. S. Na-Allah, [4]O. E. Fadeiyi, [5]A. Aisha, [5]A. L. Hafsat and [5]M. I. Safiya

[1]Department of Agronomy, Faculty of Agriculture, Al-Hikmah University Igbaja, Kwara State, Nigeria.
[2]Department of Crop Science, Abdullahi Fodiyo University of Science and Technology, Aliero. Kebbi State, Nigeria.
[3]Department of crop Science, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria.
[4]National Cereals Research Institute, Birnin Kebbi Sub-station, Kebbi State, Nigeria.
[5]Department of Science Education, School of Science and Technology, Waziri Ummaru Federal Polytechnic, Birnin Kebbi, Kebbi State, Nigeria.

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***Corresponding author:** *A. Muhammad*
Department of Agronomy, Faculty of Agriculture, Al-Hikmah University Igbaja, Kwara State, Nigeria.

Abstract

Weeds constitute one of the major biological constraints to rice production in sub-Saharan Africa. This study evaluated the effectiveness of three post-emergence herbicides (Bracer, Bracer Plus and Quinedear) against weedy check in lowland rice fields of Igbaja, Guinea savanna ecology of Nigeria, during 2022 and 2023 wet seasons. Data were collected on weed cover score (WCS), total weed count (TWC), weed dry matter (WDM), weed control efficiency (WCE), and weed flora composition. Results indicated that Quinedear significantly reduced WCS, TWC, and WDM, while improving WCE compared with other treatments. Comparative weed flora analysis revealed that broadleaf weeds such as Boerhavia diffusa and Chromolaena odorata, grasses including Cynodon dactylon, and sedges such as Cyperus rotundus remained dominant across years. The findings demonstrated the potential of integrated herbicide use in suppressing weed proliferation and improving weed control efficiency in Guinea savanna lowland rice systems.

Keywords: *Herbicides, weed suppression, lowland rice, weed flora, Guinea savanna.*

1. Introduction

Weeds are a serious production constraint in lowland rice, accounting for yield losses between 15% and 90% when left uncontrolled (Rodenburg and Johnson, 2009). Manual weeding is labor-intensive, time-consuming, and increasingly less feasible due to rising rural-urban migration (Ekeleme *et al*., 2020). Herbicides have therefore become an essential component of integrated weed management strategies in rice production systems (Mahadi *et al.,* 2021). However, weed flora composition and herbicide efficiency vary across ecologies, necessitating site-specific evaluations. In the Guinea savanna of Nigeria, systematic studies on herbicide effectiveness under lowland conditions are limited. This study assessed the performance of three selected herbicides on weed suppression, weed control efficiency, and weed flora dynamics in rice fields of Igbaja, Guinea savanna ecology of Nigeria.

2. Materials and Methods

The experiment was conducted at Al-Hikmah University Teaching and Research Farm, Igbaja, during 2022 and 2023. The site is located at latitude 8°25′N and longitude 4°55′E in the southern Guinea savanna ecology of Nigeria. A split-plot design was used with herbicide application as the main factor and replicated three times. Herbicide treatments included: Weedy check, Bracer (250 mL ha^{-1}), Bracer Plus (129 mL ha^{-1}), and Quinedear (600 g ha^{-1}). Each sub-plot measured 2 × 1.5 m with 0.2 m spacing between plots. Data were collected on weed cover score (WCS) at 6, 8, 10, and 12 WAT, total weed count (TWC), weed dry matter (WDM). Weed control efficiency (WCE), weed flora composition and Important Value Index (IVI) were also computed to determine dominant weed species.

3. Results and Discussions

Table 1. Effect of herbicide treatments on Weed Cover Score (WCS) at 6–12 WAT in the combined data of 2022 and 2023 wet seasons at Igbaja, Guinea savanna zone of Nigeria

Herbicide Treatment	6 WAT	8 WAT	10 WAT	12 WAT
Weedy check	7.6 a	8.2 a	8.6 a	9.1 a
Bracer	4.2 b	4.7 b	5.1 b	5.4 b
Bracer Plus	3.9 b	4.3 b	4.7 b	5.0 b
Quinedear	2.8 c	3.2 c	3.6 c	3.9 c
SE (±)	**0.271**	**0.250**	**0.221**	**0.241**

Means followed by the same letter (s) in a treatment group are not significantly different at 5% level of significance using Least significant difference LSD

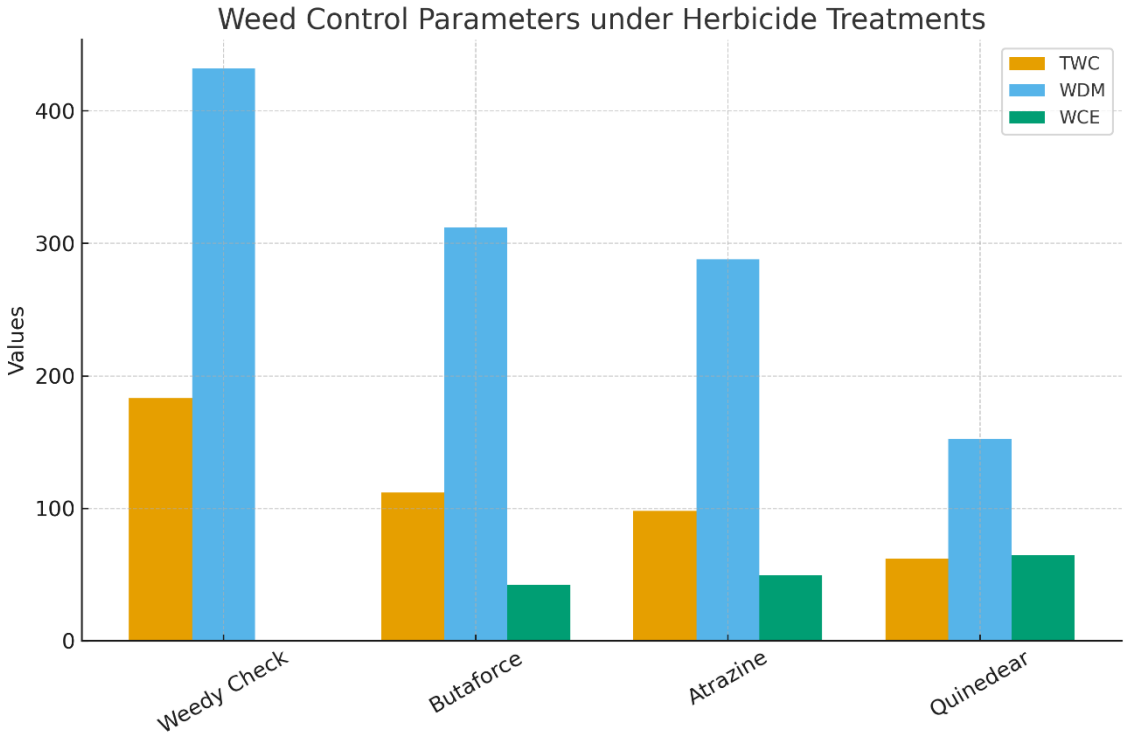

Figure 1. Weed Control Parameters as Influenced by Herbicides Treatment

Table 1 and Figure 1 show that herbicide treatments significantly reduced weed cover compared to the untreated control. The weedy check consistently recorded the highest WCS (7.6–9.1) across 6–12 WAT, reflecting intense weed pressure under unchecked growth. In contrast, Quinedear maintained the lowest WCS values (2.8–3.9), showing superior and persistent suppression of weed cover. Butaforce and Atrazine provided intermediate control but were less effective compared to Quinedear. These results confirm earlier findings by Ekeleme et al. (2020) and Mahadi et al. (2021), who reported that effective post-emergence herbicides maintain lower weed cover scores through prolonged field activity.

Table 2. Effect of herbicide treatments on Total weed count (TWC), Weed dry matter (WDM) and Weed Cover Efficiency (WCE) at 6–12 WAT in the combined data of 2022 and 2023 wet seasons at Igbaja, Guinea savanna zone of Nigeria

Herbicide Treatment	TWC	WDM	WCE (%)
Weedy check	183 a	432 a	0.3 d
Bracer	97 b	227 b	47.4 b
Bracer Plus	91 b	214 b	50.5 b
Quinedear	62 c	152 c	64.8 a
SE (±)	**5.411**	**12.722**	**1.831**

Means followed by the same letter (s) in a treatment group are not significantly different at 5% level of significance using Least significant difference LSD

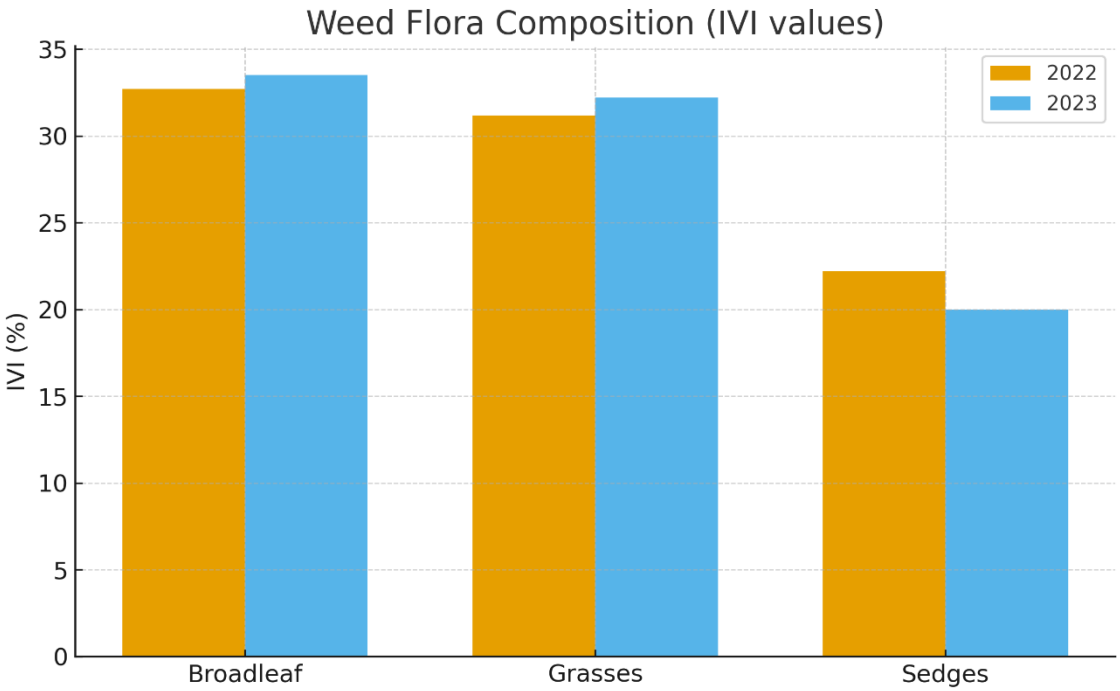

Figure 2. Weed Flora Composition across the Years 2022/23

Table 2 and Figure 2 further confirm the superiority of herbicide use. The weedy check recorded the highest TWC (183 plants m^{-2}) and WDM (432 g m^{-2}), with a WCE of 0%. Application of Quinedear reduced TWC to 62 plants m^{-2} and WDM to 152 g m^{-2}, achieving the highest WCE of 64.8%. Atrazine and Butaforce had moderate efficacy, with WCE values of 49.2% and 42.1%, respectively. This pattern suggests that Quinedear has a broader activity spectrum against dominant weeds in lowland rice. Similar results were observed by Rodenburg & Johnson (2009), who highlighted that integrating effective herbicides with proper agronomy reduces weed competition and improves rice performance.

Table 3. Comparative dominant weed flora in lowland rice fields in the combined data of 2022 and 2023 wet seasons at Igbaja, Guinea savanna zone of Nigeria

Weed Group	Dominant Species	IVI (2022)	IVI (2023)	Trend
Broadleaf	Boerhavia diffusa	32.70	33.46	Slight ↑
Broadleaf	Celosia iserti	32.39	30.83	Slight ↓
Broadleaf	Chromolaena odorata	31.16	32.15	Slight ↑
Broadleaf	Tridax procumbens	22.23	20.04	Decline
Broadleaf	Commelina diffusa	20.26	20.62	Stable
Grasses	Cynodon dactylon	35.59	36.19	Slight ↑
Grasses	Axonopus compressus	31.74	31.95	Stable
Grasses	Pennisetum polystachion	30.10	29.91	Stable
Grasses	Imperata cylindrica	18.81	19.03	Stable
Sedges	Cyperus esculentus	20.81	21.00	Stable
Sedges	Cyperus rotundus	20.43	22.71	Noticeable ↑

Table 3 highlight the dynamic shifts in weed flora across seasons. In both years, broadleaf weeds dominated, accounting for 32.7% in 2022 and 33.5% in 2023. Grasses also maintained strong representation (31.2–32.2%), while sedges declined slightly from 22.2% to 20.0%. Species such as Commelina diffusa, Axonopus ompressus, Imperata cylindrica, and Cyperus esculentus were consistently dominant across both years. However, increasing trends were noted for Boerhavia diffusa, Chromolaena odorata, and Cynodon dactylon, while Tridax procumbens and Celosia iserti declined. These findings are consistent with Ogundele & Bamidele (2022), who reported that herbicide regimes often shift species composition toward tolerant weeds, necessitating integrated weed management approaches. Overall, the results suggest that Quinedear was the most effective herbicide in suppressing weed density, biomass, and cover, while also shaping weed flora composition favorably. The persistent presence of grasses and sedges, however, implies that reliance on herbicides alone may not provide complete control, thus supporting integrated management practices.

4. Conclusion

Herbicide application significantly improved weed suppression in lowland rice compared to the untreated control. Among the treatments, Quinedear consistently achieved the lowest weed cover score, lowest weed density, and the highest weed control efficiency, while Atrazine and Butaforce provided moderate control. Broadleaf weeds remained dominant across both years of study, though sedges declined slightly and species composition showed notable shifts under herbicide pressure. These findings underscore the effectiveness of herbicides in managing weed interference in rice but also highlight the need for integrated weed management strategies to prevent species shifts and resistance buildup over time.

5. Recommendations

- Quinedear should be recommended for lowland rice farmers in Igbaja and similar ecologies due to its superior weed suppression.
- Atrazine and Butaforce may serve as alternative options, but they should be integrated with other cultural practices for better control.
- Integrated Weed Management (IWM), combining herbicide use with crop rotation, timely manual weeding, and optimized planting density, is strongly advised to minimize herbicide resistance and shifts in weed flora.
- Continuous monitoring of weed populations is necessary to detect emerging problematic species (e.g., Boerhavia diffusa, Chromolaena odorata) that could reduce herbicide efficacy in the future.
- Further research should explore herbicide × nitrogen × plant density interactions for sustainable rice production.

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