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Research Article

Response of Cowpea (*Vigna unguiculata* L. Walp.) Varieties to Weed Control Methods in the Sudan Savanna of Kebbi State, Nigeria

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Abstract

Weed infestation remains one of the major constraints limiting cowpea (Vigna unguiculata L. Walp.) production in the Sudan Savanna of Nigeria. This study evaluated the response of three cowpea varieties to different weed control methods during the 2025 wet season at the Research Farm of Abdullahi Fodio University of Science and Technology, Aliero, Kebbi State, Nigeria. The experiment comprised three cowpea varieties (SAMPEA 14, SAMPEA 19 and SAMPEA 20) and four weed control methods: Eagrow at 750 mL ha^{-1} applied at 3 weeks after sowing (WAS), hoe weeding at 3 and 6 WAS, Eagrow at 1250 mL ha^{-1} applied at 6 WAS, and a weedy check. Treatments were arranged in a factorial randomized complete block design with three replications. Data were collected on weed cover score, plant height, number of leaves, 100-seed weight and grain yield, and subjected to analysis of variance, with means separated using Duncan's Multiple Range Test at the 5% probability level. Weed control methods and varieties significantly ($P \leq 0.05$) affected all measured parameters. Hoe weeding at 3 and 6 WAS and Eagrow at 1250 mL ha^{-1} applied at 6 WAS effectively suppressed weeds and produced superior crop performance compared with Eagrow at 750 mL ha^{-1} and the weedy check. Hoe weeding at 3 and 6 WAS recorded the highest grain yield (2.31 t ha^{-1}), which was statistically similar to Eagrow at 1250 mL ha^{-1} (2.19 t ha^{-1}), whereas the weedy check produced the lowest yield (0.47 t ha^{-1}). Among the varieties, SAMPEA 20 produced the highest 100-seed weight (18.14 g) and grain yield (2.28 t ha^{-1}). Therefore, hoe weeding at 3 and 6 WAS or the application of Eagrow at 1250 mL ha^{-1} at 6 WAS, particularly for SAMPEA 20, is recommended for effective weed management and improved cowpea productivity in the Sudan Savanna of Kebbi State, Nigeria.

Keywords: *Cowpea, Eagrow herbicide, Grain yield, Sudan Savanna, Weed management.*

Introduction

Cowpea (*Vigna unguiculata* L. Walp.) is one of the most important grain legumes cultivated in the tropics and subtropics because of its nutritional, economic, and agronomic significance. It provides an inexpensive source of dietary protein, carbohydrates, vitamins, and minerals for millions of people, particularly in sub-Saharan Africa, while also improving soil fertility through biological nitrogen fixation (Timko & Singh, 2008; Boukar *et al*., 2020; Gonçalves *et al*., 2022). Nigeria is the world's largest producer and consumer of cowpea, highlighting the crop's vital role in food security, income generation, and sustainable agricultural development (Dugje *et al*., 2009; Kamara *et al*., 2018).

Despite its importance, cowpea productivity remains below its genetic potential due to several production constraints, among which weed infestation is one of the most serious. Weeds compete with cowpea for light, water, nutrients, and space during the critical stages of crop establishment, resulting in reduced vegetative growth, poor seed development, and substantial yield losses when left uncontrolled (Akobundu, 1987; Chikoye *et al*., 2004; Adigun *et al*., 2014; Ahmed *et al*., 2021). The extent of yield reduction depends on the weed species present, the duration of weed interference, and the competitive ability of the cowpea variety.

Timely and effective weed management is therefore essential for improving cowpea productivity. Although manual hoe weeding remains a common practice among smallholder farmers, it is labour-intensive, costly, and often constrained by labour shortages during peak farming periods. Consequently, selective post-emergence herbicides such as imazethapyr have become an important component of integrated weed management. Imazethapyr effectively controls a broad spectrum of annual grasses and broadleaf weeds by inhibiting acetolactate synthase (ALS), thereby reducing weed competition and enhancing crop growth when applied at the recommended growth stage (Senseman, 2007; Shaner, 2014). The integration of chemical and cultural weed control methods has been shown to improve weed suppression and increase crop productivity in grain legumes (Chikoye *et al*., 2004; de Sousa *et al*., 2023).

The performance of weed management strategies is influenced by environmental conditions, soil characteristics, weed flora composition, and varietal response. Consequently, weed control practices that perform well in one agroecological zone may not produce similar results under different production environments. Information on the response of improved cowpea varieties to different weed control methods under the Sudan Savanna conditions of Kebbi State remains limited despite the increasing adoption of improved varieties and herbicide technologies (Ahmed *et al*., 2021; Kamara *et al*., 2018).

This study was therefore conducted to evaluate the response of selected cowpea varieties to different weed control methods under the Sudan Savanna agroecological zone of Kebbi State, Nigeria, with the objective of identifying suitable variety–weed management combinations for effective weed suppression, improved crop growth, and enhanced grain yield.

Materials and Methods

The experiment was conducted during the 2025 wet season at the Teaching and Research Farm of Abdullahi Fodio University of Science and Technology, Aliero, Kebbi State, Nigeria (12°16′42″ N, 4°29′30″ E; 262 m above sea level). The site is located in the Sudan Savanna agroecological zone and experiences a unimodal rainfall pattern with an annual rainfall of 650–850 mm and mean temperatures ranging from 26 to 40°C. The experimental soil was sandy loam (0–15 cm) and loamy sand (15–30 cm), slightly acidic (pH 6.0–6.3), with low to moderate fertility characterized by low organic matter (0.60–0.95%), total nitrogen (0.030–0.045%), available phosphorus (6.5–9.0 mg kg^{-1}), and exchangeable potassium (0.14–0.17 cmol kg^{-1}).

The experiment consisted of three cowpea (*Vigna unguiculata* L. Walp.) varieties (SAMPEA 14, SAMPEA 19, and SAMPEA 20) and four weed control methods: Eagrow® Legume Herbicide (imazethapyr 10% SL) applied at 750 mL ha^{-1} at 3 weeks after sowing (WAS), Eagrow® at 1250 mL ha^{-1} at 6 WAS, hoe weeding at 3 and 6 WAS, and a weedy check. Treatments were arranged in a 3 × 4 factorial experiment in a randomized complete block design (RCBD) with three replications. Each plot measured 3 m × 3 m with a spacing of 75 cm × 20 cm.

Three seeds were sown per hole and thinned to two healthy plants per stand at two weeks after emergence. Single superphosphate (SSP, 18% P_2O_5) was applied at the rate of 220 kg ha^{-1} (equivalent to approximately 40 kg P_2O_5 ha^{-1}) between 4 and 6 WAS. Herbicide treatments were applied using a calibrated knapsack sprayer fitted with a flat-fan nozzle according to the treatment schedule, while manual hoe weeding was carried out at 3 and 6 WAS. Other recommended agronomic practices, including insect pest control, were uniformly maintained throughout the experiment. Harvesting was carried out manually by hand-picking mature pods at regular intervals as they turned yellow and the leaves senesced naturally.

Data were collected on weed cover score, plant height, number of leaves, 100-seed weight, and grain yield. Weed cover score was assessed at 4, 8, and 12 weeks after sowing (WAS) using a visual rating scale of 1–6. Plant height and number of leaves were recorded from five randomly selected and tagged plants per plot at the same sampling periods. At harvest, 100 seeds were randomly selected from the cleaned seed lot of each plot and weighed using a digital electronic balance to determine the 100-seed weight (g). Grain yield was determined by harvesting all mature pods from the net plot area, threshing and cleaning the seeds, weighing the grain, and converting the plot yield to tonnes per hectare (t ha^{-1}). Data were subjected to analysis of variance (ANOVA) using SAS software (Version 9.4). The effects of cowpea variety, weed control method, and their interaction were evaluated, and treatment means were separated using Duncan's Multiple Range Test (DMRT) at the 5% probability level.

Results and Discussion

The effect of cowpea varieties and weed control methods on weed cover score is presented in Table 1. Cowpea varieties differed significantly ($P \leq 0.05$) at 4 and 8 weeks after sowing (WAS), but not at 12 WAS. SAMPEA-20 recorded the highest weed cover score, whereas SAMPEA-14 and SAMPEA-19 generally had lower weed cover scores.

Weed control methods significantly affected weed cover score at 8 WAS. The weedy check recorded the highest weed cover score (5.11), while hoe weeding at 3 and 6 WAS (1.33) and Eagrow® Legume Herbicide applied at 1250 mL ha^{-1} at 6 WAS (1.88) provided the most effective weed suppression. At 12 WAS, the weedy check maintained the highest weed cover score, whereas Eagrow® at 1250 mL ha⁻¹ recorded the lowest value. The interaction between cowpea varieties and weed control methods was not significant at all sampling stages.

The lower weed cover scores observed under hoe weeding and Eagrow® at 1250 mL ha⁻¹ indicate effective weed suppression during the critical period of crop–weed competition. This likely reduced competition for light, moisture, nutrients, and space, thereby promoting better crop growth. These findings agree with those of Abudulai *et al*. (2021), Chikoye *et al*. (2021), and Khamare *et al*. (2022), who reported that timely weed control using manual or imazethapyr-based herbicide effectively reduced weed infestation in cowpea.

Table 1: Effect of weed control methods on weed cover score of Cowpea Varieties During 2025 Wet Season.

VARIETY (V)	4WAS	8WAS	12WAS
SAMPEA-14	3.76^{b}	2.83^{b}	2.57
SAMPEA-19	3.42^{c}	3.10^{ab}	2.58
SAMPEA-20	4.66^{a}	3.25^{a}	2.66
SE	**0.186**	**0.059**	**0.150**
WEED CONTROL (W)			
Eagrow750ml/ha 3WAS	3.66	3.00^{b}	2.55
Hoe weeding @3 and 6 WAS	3.00	1.33^{c}	2.77
Eagrow@1250ml/ha @ 6WAS	3.44	1.88^{c}	1.55
Weedy check	3.88	5.11^{a}	6.55
SE	**0.215**	**0.041**	**0.017**
Interaction VxW	NS	NS	NS

Means followed with the different letters within column (a,b,c) are statistically difference at (0.05%) level. t ha^{-1}= tons per hectare, ml/ha= mil per hectare, SE± =standard error, WAS= weeks after sowing, g= gram, VxW= varieties and weed control methods

The effect of cowpea varieties and weed control methods on plant height is presented in Table 2. Cowpea varieties differed significantly ($P \leq 0.05$) in plant height at all sampling periods. SAMPEA-19 produced the tallest plants at 4 WAS, whereas SAMPEA-14 recorded significantly greater plant height at 8 and 12 WAS.

Weed control methods had no significant effect on plant height at 4 WAS but significantly influenced plant height at 8 and 12 WAS. Eagrow® Legume Herbicide applied at 1250 mL ha⁻¹ at 6 WAS produced the tallest plants, followed by hoe weeding at 3 and 6 WAS, while the weedy check consistently recorded the shortest plants. The interaction between cowpea varieties and weed control methods was not significant at all sampling periods.

The increased plant height observed under Eagrow® at 1250 mL ha⁻¹ and hoe weeding at 3 and 6 WAS could be attributed to effective weed control, which reduced competition for light, water, nutrients, and space during crop growth. Similar findings have been reported by Chikoye *et al*. (2021), Khamare *et al*. (2022), and Abudulai *et al*. (2021), who observed that effective weed management enhanced vegetative growth and plant vigour in cowpea.

Table 2: Effect of weed control methods on plant height of Cowpea Varieties During 2025 Wet Season.

VARIETY (V)	4WAS	8WAS	12WAS
SAMPEA-14	10.04^{b}	16.91^{a}	37.02^{a}
SAMPEA-19	11.17^{a}	15.17^{b}	33.59^{b}
SAMPEA-20	11.10^{a}	13.01^{c}	32.79^{b}
SE±	**0.178**	**0.289**	**0.426**
WEED CONTROL (W)			
Eagrow750ml/ha@3WAS	11.63	14.12^{c}	29.02^{c}
Hoe weeding @3 and 6 WAS	11.76	17.10^{b}	38.11^{b}
Eagrow@1250ml/ha @ 6WAS	11.02	20.02^{a}	49.30^{a}
Weedy check	11.00	12.92^{d}	16.89^{d}
SE±	**0.156**	**0.258**	**0.381**
Interaction (VxW)	NS	NS	NS

Means followed with the different letters within column (a,b,c) are statistically difference at (0.05%) level. t ha^{-1}= tons per hectare, ml/ha= mil per hectare, SE± =standard error, WAS= weeks after sowing, g= gram, VxW= varieties and weed control methods.

The effect of cowpea varieties and weed control methods on the number of leaves is presented in Table 3. Cowpea varieties differed significantly ($P \leq 0.05$) at 8 and 12 weeks after sowing (WAS), with SAMPEA-20 producing the highest number of leaves. No significant varietal difference was observed at 4 WAS.

Weed control methods significantly influenced the number of leaves at all sampling periods. Eagrow® Legume Herbicide applied at 1250 mL ha^{-1} at 6 WAS and hoe weeding at 3 and 6 WAS consistently produced higher leaf numbers, whereas the weedy check recorded the lowest values throughout the sampling periods. The interaction between cowpea varieties and weed control methods was not significant at all sampling periods.

The higher number of leaves recorded under effective weed control treatments was attributed to reduced weed competition, which enhanced the availability of light, moisture, and nutrients for crop growth. Conversely, the reduced leaf production observed in the weedy check resulted from severe weed interference during the crop growth period. These findings are consistent with those of Chikoye *et al*. (2021), Abudulai *et al*. (2021), and Khamare *et al*. (2022), who reported that effective weed management improved vegetative growth and leaf development in cowpea.

Table 3. Effect of weed control methods on number of leaves of Cowpea Varieties During 2025 Wet Season in Aliero.

VARIETY (V)	**4WAS**	**8WAS**	**12WAS**
SAMPEA-14	17.66	31.41^{c}	43.41^{b}
SAMPEA-19	18.65	32.42^{b}	45.08^{b}
SAMPEA-20	16.58	33.95^{a}	48.75^{a}
SE	**0.298**	**1.306**	**1.419**
WEED CONTROL (W)			
Eagrow750ml/ha @3WAS	16.66^{a}	28.57^{b}	45.91^{a}
Hoe weeding @3 and 6 WAS	15.20^{a}	30.37^{a}	49.64^{a}
Eagrow@1250ml/ha @ 6WAS	16.53^{a}	33.31^{a}	47.97^{a}
Weedy check	11.13^{b}	12.78^{c}	19.46^{b}
SE±	**0.922**	**1.240**	**1.257**
Interaction (VxW)	NS	NS	NS

Means followed with the different letters within column (a,b,c) are statistically difference at (0.05%) level. t ha^{-1}= tons per hectare, ml/ha= mil per hectare, SE± =standard error, WAS= weeks after sowing, g= gram, VxW= varieties and weed control methods.

The effect of cowpea varieties and weed control methods on 100-seed weight and grain yield is presented in Table 4. Cowpea varieties differed significantly ($P \leq 0.05$) for both parameters. SAMPEA-20 produced the highest 100-seed weight, while SAMPEA-20 and SAMPEA-19 recorded significantly higher grain yield than SAMPEA-14.

Weed control methods also significantly affected 100-seed weight and grain yield. Hoe weeding at 3 and 6 WAS and Eagrow® Legume Herbicide applied at 1250 mL ha^{-1} at 6 WAS produced significantly higher grain yield than the other treatments, whereas the weedy check recorded the lowest 100-seed weight and grain yield. The interaction between cowpea varieties and weed control methods was not significant for either parameter.

The improvement in 100-seed weight and grain yield under effective weed control treatments was attributed to reduced weed competition, which enhanced resource availability for seed filling and grain development. Conversely, the poor performance of the weedy check resulted from prolonged weed interference throughout the growing season. These findings agree with those of Abudulai *et al*. (2021), Chikoye *et al*. (2021), and Khamare *et al*. (2022), who reported that effective weed management significantly improves yield components and grain yield of cowpea.

Table 4: Effect of weed control methods on pod weight, 100 seed weight and grain yield of Cowpea Varieties During 2025 Wet Season in Aliero.

VARIETY (V)	100 seed weight (g)	Grain Yield (t/ha)
SAMPEA-14	15.08^{c}	1.87^{b}
SAMPEA-19	16.00^{b}	2.02^{a}
SAMPEA-20	18.14^{a}	2.28^{a}
SE±	**0.221**	**0.223**
WEED CONTROL (W)		
Eagrow750ml/ha@ 3WAS	13.25^{c}	**1.32^{b}**
Hoe weeding @3 and 6 WAS	17.12^{b}	**2.31^{a}**
Eagrow@1250ml/ha @ 6WAS	15.00^{a}	**2.19^{a}**
Weedy check	6.03^{d}	**0.47^{c}**
SE±	**0.233**	**0.220**
Interaction (VxW)	NS	NS

Means followed with the different letters within column (a,b,c) are statistically difference at (0.05%) level. t ha^{-1}= tons per hectare, ml/ha= mil per hectare, SE± =standard error, WAS= weeks after sowing, g= gram, VxW= varieties and weed control methods.

Conclusion

The study demonstrated that weed control methods significantly influenced weed suppression, plant growth, and yield of cowpea under the Sudan Savanna conditions of Aliero, Kebbi State. Among the cowpea varieties evaluated, SAMPEA-20 exhibited superior growth performance and produced the highest 100-seed weight, while SAMPEA-19 and SAMPEA-20 achieved comparable grain yields. Effective weed management through Eagrow® Legume Herbicide applied at 1250 mL ha^{-1} at 6 weeks after sowing or hoe weeding at 3 and 6 weeks after sowing substantially reduced weed infestation and enhanced plant growth and grain yield compared with the weedy check. Therefore, the use of SAMPEA-20 in combination with Eagrow® at 1250 mL ha^{-1} applied at 6 WAS or timely hoe weeding at 3 and 6 WAS is recommended for improved cowpea productivity under the Sudan Savanna agroecological zone of Kebbi State, Nigeria.

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