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Review article

Varying Rates of Butaforce® Herbicide for Weed Control; Implication on Groundnut (*Arachis hypogaea L.*) Growth, Yield and Yield Characters in Anyigba, Kogi State

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Abstract: A field experiment was conducted at the price Abubakar Audu University Anyigba during the cropping season of the year 2022 to determine the effect of varying Butaforce® Herbicide on the growth, yield and yield characters of groundnut crop in Anyigba environment. Treatments consist of five Buta force rates; 0ml, 50 ml, 55 ml, 60 ml and 65 ml per 16 L of water respectively, applied to plots using a random number system at early stage of weed development. This experiment was laid in a Randomized Complete Block Design (RCBD) with four (4) replicates. Result shows that all growth characters of groundnut under examination were significantly influenced by different rates of Butaforce. Plant height, Number of Leaves, Leaf Area and stem girth were optimum at rate of 50ml/16L of Butaforce spray at respective sampling periods. Yield characters such as 100 seed weight and Pod yield were optimum at application rate 55ml/16L of Butaforce. Although, application at rate 55ml, 60ml and 65ml were statistically at par. Application of Butaforce® herbicide at rates aforementioned (55ml, 60ml and 65ml) performed equally with respect to yield characters, therefore this research recommends that spraying Butaforce timely at the rate of 55ml is optimum for yield performance of groundnut crop in Anyigba environment. Increasing spray doses above 55ml may inform toxicity to crop plants as well as beneficial microorganisms and the environment at large.

Keywords: Butaforce® herbicide, Groundnut, Growth, Yield Characters.

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INTRODUCTION

Groundnut (*Arachis hypogaea L.*) is an important oilseed tropical and subtropical crop (Gilbert *et al.,* 2020) grown in Nigeria. The plant is unique because it products have a wide range of uses in the daily life of the people as well as in various industries (Konlan *et al.,* 2013). Groundnut production covers about 26.4 million hectares of land globally, with a total production of 37.1 million metric tons and average production of 1690 kg/ha (FAO, 2011). Its production is widely concentrated in Asia and Africa, where it is grown mostly by smallholder farmers under rain-fed conditions with limited inputs. Nigeria is the third largest producer with annual production of 3.4 MT following China 15.7 MT and India 6.5 MT Vabi, *et al.,* (2019). Nigeria contributes 10% of total global production and 39% to that of Africa (Desire, *et al.,* 2010). However, average yield of the crop is still very low 1.7 t ha^{-1} compared to advance countries where yield is up to 3.5tons ha^{-1} (Bihter, *et al.,* 2016). Weed has become a major factor responsible for yield reduction in most groundnut producing areas. However, herbicide use can give spectacularly good control at doses considerably enough to suppress the physiological activities of weed.

Often times, herbicide combination may be additive or synergistic or prevent rapid detoxification of herbicides and are safer to crops than application of a single herbicide alone. This is however not a new area, but it has not received the attention and input that is necessary to fully understand and implement the practice. Dadari (2003) reported that competition between weeds and crop starts right from germination of the crop up to harvest affecting both growth and yield parameters adversely. In line with several other researchers Yadav *et al.* (2010) reported that pre-emergence application of Pendimethalin at 1.25 – 1.50 kg ha^{-1} + hand weeding is much more effective in reducing dry weight of weeds than other treatments. Jafari *et al*., (2013) had also reported that pre-emergence herbicides increased plant height in common bean significantly as compared to the weedy check. Number of pods per plant has reportedly improved under the application of s-metolachlor at 1.0 kg ha^{-1} + hand weeding and hoeing Abouziena *et al.,* (2013). Priya and Abouziena (2009) obtained the same result with single herbicide application and two hand weeding in peanut. Meanwhile, (Ayaz, 2001) reiterated that the number of pods produced per plant or maintained to final harvest in groundnut impact greatly on yield and depends on a number of environmental and management practices. However, (Mirshekari 2008) concluded that the presence of weeds is a prominent factor which could reduce the number of pods in cowpea.

Competition from weeds early in the development of groundnut remains one of the most serious and widespread production problems facing smallholder producers (Jat *et al.,* 2011), Hoe-weeding is the main weed control method used by smallholder communal area farmers, this method is described as slow, labor-intensive, cumbersome and inefficient, since farmers are showing promising interest in the use of herbicides with the seamless effort to reducing cost of cultivation, resulting from high cost of labor, it is therefore pertinent to adopt an economically viable strategy for weed management in groundnut farming. In this respect, this research seeks to evaluate the effect of Varying herbicide (Butaforce) rates in the control of *Impereta cylindrical* (weed of higher economic damage) in groundnut (*Arachis hypogaea* L.) in Anyigba Kogi State, by determining the effect of applying varying doses of Butaforce herbicide on the growth, yield and yield characters of groundnut in Anyigba environment.

MATERIAL AND METHOD

Study Area

The experiment was conducted at the Prince Abubakar Audu University Student Demonstration and Research Farm during the cropping season of the year 2022. The farm is located at Lat $7^{o}6^{1}$N and Long $7^{o}43^{1}$E in the Southern Guinea Savannah Agro-ecological zone with an altitude of 420m above sea level. The general climate is humid, having a distinct raining and dry seasons. The mean annual temperature and rainfall are 27^{o}C and 1260mm respectively (Amhakhian 2012).

Experimental Material

Groundnut seed was obtained from National Cereals Research Institutes Badeggi Niger State and Herbicide (Butaforce) was obtained from a Smart Agro chemical store in Anyigba.

Experimental Design and Treatment

Experimental site was ploughed, harrowed and ridged to attain fine tilt for proper cultivation at inter and intra-row spacing of 75cm by 25cm. The treatments consist of five Buta force rates; 0ml, 50 ml, 55 ml, 60 ml and 65 ml per 16 L of water respectively applied to plots using a random number system to avoid biasness at early stage of weed development. This experiment was laid in a Randomized Complete Block Design (RCBD) with four (4) replicates making a total of 20 plots, each plots measures $6m^2$ and separated from each other by 1m spacing. Seeds were sown 2 to 3 seeds per hill. Sowing was accomplished manually by dibbling method, a planting depth of 2-4cm was used. was used. Seedlings were thinned to 2 plants per stand about three weeks after sowing. No fertilizer was applied as soil is sufficiently high in P which is the most essential to the growth of groundnut from the pre-sowing soil test result as shown in table 1. Harvesting was done when the leaves turned yellow by pulling up gently.

Observations and Data Collection

Observations were made on growth parameters such as; plant height, number of branches, leaf area, stem girth on 6 randomly tagged plants at 2, 4, 6 & 8 Weeks After Sowing. Yield parameters such as pod yield/ha, number of seeds/pod and 100 – seed weight were recorded at harvest.

Analysis of Data

Data collected was subject to Analysis of Variance (ANOVA). Significantly different means were separated using Fishers Least Significant Difference test (F-LSD) at 5 % level of probability.

RESULT AND DISCUSSION

The physicochemical properties as shown in the table 1 below indicate that the soil is of Sandy-Loam textural class and slightly acidic with a pH of 4.65. It had an organic matter content of 1.85% and organic carbon of 1.05%. The N, Mg and K contents were 0.22%, 0.19mg kg-1 and 1.10cmol kg-1 respectively. The result from this Table 1 indicates that the soil can support the growth of the Groundnut (*Arachis hypogaea* L.).

Table 1. Result of Pre-Sowing Soil Test Value for the Experimental Site in 2022 Cropping Season.

Soil Characteristics	Values (from depth 0 – 30cm)
% Sand	75
% Silt	8
% Clay	17
Textural Class	Sandy Loam
P^H (H_2O)	4.65
P^H($Cacl_2$)	4.38
% Organic carbon	1.053
% Organic matter	1.85
%Total N	0.052
Available P (ppm)	10.33
Ca (cmol/kg)	0.267
K (cmol/kg)	1.102
N (cmol/kg)	0.222
Mg (cmol/kg)	0.19

Table 2. Effect of varying rates of Butaforce® herbicide on the growth characters of Groundnut in Anyigba environment during the 2022 cropping seasons.

Treatments	Growth Characters											
	Plant height (cm)				Number of Leaves				Leaf Area (cm)			
	Sampling Periods (Weeks After Sowing)											
Butaforce®/16L of water	2	4	6	8	2	4	6	8	2	4	6	8
Control	4.30±0.03	5.09±0.05	10.36±0.47^{c}	11.69±0.55^{d}	40.75±0.28	131.25±5.35^{b}	139.79±11.48^{b}	153.00±13.79^{b}	1.81±0.02	2.43±0.11	3.34±0.16^{b}	4.53±0.21^{b}
50ml	4.60±0.11	5.35±0.06	11.99±0.25^{a}	13.67±0.33^{a}	42.66±0.56	145.33±0.93^{a}	174.58±4.07^{a}	197.92±6.29^{a}	1.81±0.02	2.63±0.02	3.71±0.01^{a}	4.92±0.03^{a}
55ml	4.34±0.01	5.21±0.00	11.55±0.05^{ab}	13.64±0.32^{a}	41.66±0.12	145.67±1.08^{a}	165.50±0.01^{a}	171.83±5.37^{ab}	1.91±0.07	2.78±0.04	3.90±0.09^{a}	5.25±0.11^{a}
60ml	4.28±0.03	5.23±0.01	11.39±0.02^{b}	12.45±0.21^{c}	39.66±0.77	148.67±2.42^{a}	177.17±5.23^{a}	197.83±6.25^{a}	1.55±0.09	2.80±0.05	3.83±0.06^{a}	5.16±0.07^{a}
65ml	4.23±0.05	5.15±0.02	11.87±0.19^{ab}	13.18±0.11^{b}	42.25±0.38	145.33±0.93^{a}	170.33±2.17^{a}	198.6±6.62^{a}	1.68±0.03	2.75±0.03	3.71±0.01^{a}	5.14±0.06^{a}
P value	0.05	0.05	0.05*	0.05*	0.05	0.05*	0.05*	0.05*	0.05	0.05	0.05*	0.05*
$LSD_{0.05}$	-	-	0.59	0.37	-	4.73	13.48	34.41	-	-	0.27	0.35

*Means followed by the same letter(s) are not significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability***.** *LSD- Least Significant Difference***.**

Table 3. Effect of varying rates of Butaforce® herbicide on the girths of Groundnut crop and other yield characters in Anyigba environment during the 2022 cropping seasons.

Treatments	Stem Girth (cm)				Yield Characters		
	Weeks After Sowing				Number of seeds/pod	100 seed weight (g)	Pod yield (kg/ha)
Butaforce®/16L of water	2	4	6	8			
Control	1.02 ± 0.01	1.31 ± 0.01	1.41 ± 0.08^{b}	1.56 ± 0.15^{b}	2.50 ± 0.03	37.90 ± 1.70^{b}	937.50 ± 159.87^{c}
50ml	0.98 ± 0.00	1.34 ± 0.00	1.65 ± 0.02^{a}	1.98 ± 0.03^{a}	2.50 ± 0.03	39.24 ± 1.10^{b}	1,200.00 ± 42.48^{b}
55ml	1.05 ± 0.03	1.40 ± 0.02	1.68 ± 0.03^{a}	2.04 ± 0.05^{a}	2.63 ± 0.02	43.25 ± 0.69^{a}	1,375.00 ± 35.77^{a}
60ml	0.91 ± 0.03	1.37 ± 0.01	1.65 ± 0.02^{a}	1.99 ± 0.03^{a}	2.62 ± 0.02	44.12 ± 1.08^{a}	1,475.00 ± 80.49^{a}
65ml	0.92 ± 0.02	1.29 ± 0.02	1.60 ± 0.00^{a}	1.98 ± 0.03^{a}	2.62 ± 0.02	44.00 ± 1.02^{a}	1,487.50 ± 86.08^{a}
P value	0.05	0.05	0.05*	0.05*	0.05	0.05*	0.05*
$LSD_{0.05}$	-	-	0.13	0.10	-	2.56	173.53

*Means followed by the same letter(s) are not significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability***.** *LSD- Least Significant Difference*

Results obtained with plant height table 2 indicated that groundnut heights were not significantly influenced (P≥0.05) at 2 and 4 WAS. However, at 6 and 8WAS, application of Butaforce at 50ml produced the tallest plants (11.99cm and 13.67cm), these were however not significantly different from the application at rate of 55ml (11.55cm and 13.64cm) at both sampling period. Improved height observed with plants in contrast with control plots can be better explained as crops are strengthened by herbicides to better suppress weeds thus escaping thorough competition with weeds by growing taller and faster. This is confirmed by Jafari *et al.* (2013) who stated that pre-emergence herbicides increased plant height in common bean significantly as compared to the weedy check. Subhan *et al*. (2007) also reported similar results in maize. Different herbicides remarkably increased plant height in wheat by all weed management methods compared to the weedy check.

Application of Butaforce at 55, 60 & 65ml produced significantly indifferent heights of groundnut as control plots gave the shortest plant at 6WAS. Similarly, heights obtained with the application at 65ml follows application rate of 55ml, followed by heights obtained with 60ml as control plots also gave the shortest plants at 8 WAS.

Application of Butaforce at different rates had no significant influence on the number of leaves at 2 WAS. However, significant influence of these rates was observed at 4, 6 & 8WAS. Although, application at the rate 65ml produced plants the highest number of leaves but not significantly different from those obtained with 60ml, 55ml and 50ml of Butaforce respectively at 4, 6 & 8 WAS. Control plots consistently produced the least number of leaves (131.25, 139.79, 153.00).

At 2 and 4 WAS leaf area were not significantly influenced by application rates of Butaforce herbicides. At 6 & 8 WAS, application rates at 50ml, 55ml, 60ml and 65ml respectively produced leaf area that are statistically at par, while control plots produced plants with the least leaf area (3.34 cm, 4.53 cm).

Significant effect of Butaforce rates on leaf area, number of leaves and stem girth shows that growth characters of groundnut were better under weed-free environment compared to check. This is similar to the report of Kumar *et al.* (2011) who insinuated that pre-emergence herbicides spray will control the weeds up to 25 days after seeding and thus create favorable growth condition for crops and if followed with post-emergence on weed flora will take care to keep weeds below crop injury level (Mekky *et al.*, 2002).

For stem girth, thickest stems were observed with plants at 6 & 8 WAS as Butaforce application rates had no significant influence on plants at 2 & 4 WAS. All application rates at 6 & 8 WAS produced plants with statistically indifferent stem girth as control plots consistently produced plants with the thinnest stems table 3.

Table 3 also present the response of groundnut yield characters to Butaforce rates. application at rates 65ml, 60ml and 55ml produced significantly indifferent 100 - seed weight and pod yield respectively. However, 100 – seed weight obtained with Butaforce at 5oml and the control plots were statistically at par. As for pod yield, following the highest performance, application of 50ml produced 1200kgha pods which was followed by the least yield obtained from the control plots (937.5kg/ha).

Significant effect of Butaforce rates on pod yield table 3 indicates its effectiveness in management of weeds, this led to the favorable environment for growth and photosynthetic activity of the crop and thus improvement in the yield of pods. This result conforms with those of Abouziena *et al.* (2013). Ayaz (2001) also reported that number of pods produced per plant or maintained to final harvest depends on a number of environmental and management practices. Further, Dadari (2003) reported that competition between weeds and crop starts right from germination of the crop up to harvest affecting both growth and yield parameters adversely. Significant result obtained with 100 seed weight table 3 has been reported by

Chikoye *et al.* (2011) and Khan (2008) also observed remarkable variations in grain yield of *Z. mays* under the application of herbicides.

SUMMARY, CONCLUSION AND RECOMMENDATION

From the Foregoing research, yield characters such as 100 seed weight and Pod yield were optimum at application rate 55ml/16L of Butaforce. Although, application at rate 55ml, 60ml and 65ml were statistically at par. Application of Butaforce® herbicide at rates aforementioned (55ml, 60ml and 65ml) performed equally with respect to yield characters, therefore this research concludes that spraying Butaforce timely at the rate of 55ml is optimum for yield performance of groundnut crop in Anyigba environment and thus recommended. Increasing spray doses above 55ml may inform toxicity to crop plants as well as beneficial microorganisms and the environment at large.

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