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INFLUENCE OF SOWING DATE AND WEED CONTROL METHODS ON GROWTH AND YIELD OF GROUNDNUT (*Arachis hypogea* L.) VARIETIES IN KATSINA STATE, NIGERIA

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ABSTRACT

Field trials were carried out during the 2023 wet season at the Federal University Dutsin-Ma Teaching and Research Farm and Tambu-Daura to assess the influence of sowing date and weed control methods on growth and yield groundnut (A*rachis hypogea* L.) varieties. The treatments consisted of three groundnut varieties (SAMNUT 24, SAMNUT 26 and KWAN-KWASIYA), four weed control methods (Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS + 1 hoe weeding at 6WAS, hoe weeding at 3 and 6WAS and Weedy check) and three sowing dates (4th week of June, first week of July and second week of July) and replicated three times. Split plot design was used to arrange the treatments. Weed control methods and varieties were allocated to main plots and sowing dates were in sub plots. The study revealed that SAMNUT 24 and SAMNUT 26 were statistically similar in all the sampling stages but produced significantly (P<0.05) higher growth and yield parameters than local variety (KWANKWASIYA) at both locations. The results also indicated that sowing groundnut at the first week of July produced significantly (P<0.05) higher values than other sowing dates in most of the measured parameters. Application of various weed control methods produced significantly higher values than weedy check in all the parameters. Imazethapyr application at 3WAS + 1hoe weeding at 6WAS gave better performance than other weed control methods. In conclusion, SAMNUT 24/26, planting at first week of July and Imazethapyr application @3 + 1 hoe weeding at 6WAS seem to be most appropriate in the study area.

Keywords: Groundnut Varieties, Hoe weeding, Imazethapyr, Sowing Date, Weed Control Methods

INTRODUCTION

Groundnut, also known as peanut, is commonly referred to as the poor man's nut. The plant is currently a significant food and oilseed crop, yet it has never been discovered in the wild (Vabi *et al.*, 2019). The groundnut plant is distinctive because it yields a variety of products that are used extensively in both daily life and many businesses. Additionally, the plant's roots nourish the soil and its vines provide great cattle feed. The nuts are helpful in many other ways, and they are the most significant source of edible oil. Defatted groundnut meal is produced by powdering the cake and extracting it using a solvent. Because of this, the crop has become very popular due to its general use and the financial benefits it offers to the grower. For human consumption or industrial use, just over half of the groundnut harvest is crushed and turned into oil (Vabi *et al.*, 2019). It ranks fourth globally in terms of oil seed importance and thirteenth globally in terms of food importance. Groundnuts are now widely available and have evolved in many different nations. Brazil, USA, India, China, Nigeria, and India are the leading producers. Nigeria, Sudan, Senegal, Chad, Congo, and Ghana are among the continent's top producers (ICRISAT, 2008). According to FAO (2021) estimates, groundnuts were planted on 3.9 million hectares in Nigeria in 2019. Thirty-one of the thirty-six states and the Federal Capital Territory cultivate groundnuts; Kano and Niger account for roughly 19.6% and 10.7%, respectively, followed by Kaduna, Benue, Zamfara, Taraba, Bauchi, Borno, Katsina and Nasarawa States with 54.7% (Abate *et al*., 2011). However, the top 16 leading producing states in Nigeria are Kano, Katsina, Niger, Jigawa, Zamfara, Kebbi, Sokoto, Kaduna, Adamawa, Yobe, Borno, Taraba, Plateau, Nasarawa, Bauchi and Gombe and are account for nearly 80-90% of the total production of groundnut. (Taru *et al.*, 2008). Ahmed *et al.* (2010) state that pests, illnesses, ineffective weed control, and improper crop management practices are the key issues restricting groundnut production.

Due to climate variations, planting time is one of the most important factors affecting groundnut production in Nigeria. While the Sudan Savannah Zone's 1,018mm of annual rainfall is sufficient, the amount of rain that falls in April and May is typically low, making it less favorable for good germination and establishment of groundnut plants. The rain eventually stabilizes around mid-June, though occasionally its distribution becomes erratic (ADP, 2000).

Weed species prevalence, life cycle, and propagation mechanism all have a major impact on how effective weed control is. Reduced weed competition for space and growth resources is a documented benefit of high cropping densities in groundnuts (Dalley *et al.,* 2004). Low productivity, weed control method, pest and disease, poor seed variety and appropriate time of planting groundnut are some of the major problems of groundnut in Nigeria however, many attempt were made by different scholars in order address the problem but still remain low which could be due to the fact that the previous investigation were not followed appropriately or were made without taking good data and important component of groundnut. Consequently, this research was made in order to help in addressing the problems for maximum productivity. Therefore, study is to evaluate the influence of sowing date and weed control methods on growth and yield groundnut (A*rachis hypogea* L.) varieties.

MATERIALS AND METHODS

Description of the Experimental Sites

In the growing season of 2023, two distinct trials were carried out at the Tambu-Daura Agricultural Research Farm, situated at 12^0 58'33 N, 8^0 15'57 E, and 548 meters above sea level) in Katsina State, Nigeria, and the Teaching and Research Farm of Federal University Dutsin-Ma, 11^0 57'26 N, 8^0 26 E, and 456 meters above sea level. The region experiences between 500 and 750 inches of rain and between 15^0 and 43^0 degrees Celsius of average yearly temperature. The local soil type is sandy loamy.

Treatment and Experimental Design

Treatments were arranged in a 3x4x3 factorial combination, factored (SAMNUT 24, SAMNUT 26, and KWAN-KWASIYA), four weed control methods (application of Imazethapyr @3 and 6WAS, application of Imazethapyr at 3 + 1 hoe weeding at 6WAS, hoe weeding only at 3 and 6WAS and weedy check and three sowing dates 4^{th} week of June, first week of July, and second week of July. The treatments were laid out in split plot design and replicated three times. Weed control methods and varieties were allocated to main plots and sowing dates were in sub plots. Soil samples were randomly taken from the experimental sites before land preparation at various positions at soil depths of 30 cm across the field. Using standard techniques as outlined by (Black, 1968), the composite sample was examined for physical and chemical characteristics. The field was cleared, harrowed and ridged. The ridges were then separated into plots of six ridges each, 3m by 4.5m ($13.5m^2$). The net plot was made up of two inner rows, 1.5m by 3m ($4.5m^2$). The seeds of the two types (SAMNUT 24 and SAMNUT 26) were obtained from the Katsina State Agricultural and Rural Development Authority (KTARDA) while the local variety (KWANKWASIYA) was obtained from the market. The seeds were treated with Difenoconazole @10g per 3 kg of seeds before planting. Two seeds were planted in each hole manually and spaced 75 cm apart and 15 cm apart, at a depth of 5 cm. The seeds were sowed on June 25, July 5, and July 14, 2023, in accordance with the treatment plan. NPK fertilizer was applied at a rate of 30:30:30 at three weeks after sowing. Weed control was done in accordance with the treatments. The following data was collected: crop vigour score, weed control index, crop growth rate, relative growth rate, dry weight per plant, number of days to maturity, stand count at harvest, number of pods per plant and kernel yield per plant. Data on plant growth were collected at 3, 6, and 9WAS from five (5) tagged plants per plot. Statistical analysis of variance (ANOVA) using General linear model (GLM) was used to analysed the data, following Gomez and Gomez instructions. (1984) using version 9.0 of the SAS package 2002. At the 5% level of probability ($P < 0.05$), the treatment means were divided for the significant difference using the Duncan Multiple Range Test (DMRT) Duncan (Duncan, 1955).

RESULTS

The table 1 displayed the findings of the physical and chemical composition of the soil analysis from the two locations (FUDMA and TAMBU). Based on the soil texture measurements, it was found that the two sites had lower silt and clay contents, but larger in sand fractions (595 and 860 g/kg for FUDMA and TAMBU, respectively). The soils of the two locations are very low in organic carbon, 4.6 and 1.8 g kg^{-1}, for FUDMA and Tambu, respectively, total N, 0.76 and 0.20 g kg^{-1}, for FUDMA and Tambu. respectively and available P, 11.2 and 5.25 mg kg^{-1}, for FUDMA and Tambu, respectively. However, the soil's physio-chemical composition revealed that FUDMA had substantially more organic carbon, nitrogen, potassium, phosphorus, and calcium than TAMBU, making it more fertile than TAMBU soil. Furthermore, the results showed that the two soil samples taken from the two locations have varying soil pH values of 6.30 for FUDMA and 6.56 for TAMBU, respectively.

Table 1: Result of the soil analysis from the experimental sites in at FUDMA and Tambu-Daura during the 2023 growing season

	Locations	
Soil Parameters	FUDMA	TAMBU
Particle size distribution (g kg^{-1})		
Clay	230.00	45.00
Silt	175.00	95.00
Sand	595.00	860.00
Textural class	Sandy Clay Loam	Loamy sand
Chemical properties		
pH in water	6.30	6.56
Organic Carbon (g kg^{-1})	4.60	1.80
Total N (g kg^{-1})	0.76	0.28
Available P (mg kg^{-1})	11.20	5.25
Exchangeable Cation (cmol kg^{-1})		
K	0.76	0.20
Mg	3.41	0.80
Ca	4.95	1.20
Na	0.54	0.30
CEC	2.73	2.16

Analysis was done at analytical laboratory of Soil Science Department, Bayero University, Kano, Nigeria.

Crop vigour score per plant was observed at 3, 6 and 9WAS at the two locations (Table 2). The result indicated that crop vigour score per plant was significantly influence ($P<0.05$) by variety, sowing date and weed control methods. SAMNUT 24 and SAMNUT 26 were statistically similar on crop cover score in all sampling periods in both locations except at 3WAS at Tambu where SAMNUT 24 gave significantly higher crop vigour score than SAMNUT 26 but both varieties gave significantly higher crop cover score than local variety (KWANKWASIYA). Planting of groundnut at the end of June significantly ($P<0.05$) performed better than sowing at 1st and 2nd week of July on crop vigour score at FUDMA and 3WAS at Tambu but at 6 and 9 WAS at Tambu, 2nd week of July and 1st week of July that gave significantly ($P<0.05$) higher crop vigour score, respectively. Application of Imazethapyr at 3WAS + 1hoe weeding at 6WAS provided significantly ($P<0.05$) higher crop vigour score than other weed control methods at FUDMA while at Tambu, there was no significant difference between application of Imazethapyr at 3WAS + 1hoe weeding at 6WAS and hoe weeding @ 3 and 6WAS but gave higher crop vigour score than plants in weedy check (Table 2). All the interactions were not significant ($P>0.05$) at both locations.

Table 2: - Effect of variety, sowing date and weed control method on crop vigour score at 3, 6 and 9WAS at FUDMA and Tambu-Daura during the 2023 raining season

	Crop vigour score per plot					
	FUDMA			TAMBU-DAURA		
Treatment	**3WAS**	**6WAS**	**9WAS**	**3WAS**	**6WAS**	**9WAS**
Varieties (V)						
SAMNUT 24	4.75[a]	4.78[a]	4.08[a]	3.86[a]	3.31[a]	3.78[a]
SAMNUT 26	4.44[a]	3.17[a]	4.00[a]	3.31[b]	3.22[a]	3.69[a]
KWANKWASIYA	4.17[b]	3.00[b]	2.83[b]	2.89[c]	2.36[b]	2.94[b]
S.E±	0.12	0.26	0.11	0.10	0.18	0.10
Significance	*	*	**	**	**	**
Sowing Date (T)						
4th Week of June	5.08[a]	3.78	3.83[a]	3.78[a]	2.58[b]	3.08[c]
1st Week of July	4.25[b]	3.39	3.42[b]	3.11[b]	2.92[b]	3.81[a]
2nd Week of July	4.00[c]	3.78	3.67[a]	3.17[b]	3.39[a]	3.53[b]
S.E±	0.12	0.26	0.11	0.10	0.18	0.10
Significance	**	NS	*	**	**	*
Weed control method (W)						
Imazethapyr @3 and 6 WAS	4.33[b]	3.15[c]	2.81[c]	3.29	3.00[a]	3.22[c]
Imazethapyr @3 +1 hoe weeding 6 WAS	4.96[a]	4.48[a]	4.81[a]	3.33	3.15[a]	4.30[a]
Hoe weeding @3 and 6 WAS	4.44[b]	3.81[b]	4.22[b]	3.48	3.11[a]	4.04[a]
Weedy check	4.07[c]	3.15[c]	2.70[c]	3.30	2.59[b]	2.33[d]
S.E(±)	0.14	0.30	0.13	0.12	0.21	0.11
Significance	*	*	**	NS	*	**
Interactions						
V x T	NS	NS	NS	NS	NS	NS
V x W	NS	NS	NS	NS	NS	NS
W x T	NS	NS	NS	NS	NS	NS
V x T x W	NS	NS	NS	NS	NS	NS

Note *= Significant, NS= Not Significant at 5% level of probability. Means followed by the same letter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT.

The result obtained from table 3 indicated that weed control index per plot had a significant (P <0.05) effect on variety, sowing date and weed control methods. SAMNUT 24 and SAMNUT 26 though statistically similar but produced significantly higher weed control index than the local variety (KWANKWASIYA) at both locations except at 6WAS where SAMNUT 24 and KWANKWASIYA were statistically similar. Sowing date at the 1st week of July produced significantly higher weed control index per plot than other sowing dates but at 3WAS at Tambu, sowing dates of 1st week of July and 2nd week of July were statistically similar. Application of Imazethapyr @3WAS + 1hoe weeding @6WAS and hoe weeding at 3 and 6WAS were statistically similar on weed control index at 3WAS at FUDMA and all the sampling periods at Tambu but significantly higher than other weed control methods while at 6 and 9WAS at Tambu, application of Imazethapyr @3WAS + 1hoe weeding @6WAS produced significantly (P<0.05) higher weed control index than other weed control methods. The interaction between weed control methods and sowing dates was significant (P<0.05) only at FUDMA (Table 4) where the combination of sowing groundnut at 4th week of June and 1st and 2nd week July with weed control methods produced significantly higher weed control index than weedy check weed control index except at 2nd week of July with application of Imazethapyr at 3WAS and at 6WAS gave lowest weed control index (Table 4).

SAMNUT 24 produced significantly higher crop growth rate (CGR) than SAMNUT 26 and KWANKWASIYA in both locations (Table 5). Sowing dates did not significantly (P>0.05) influence crop growth rate in both locations. Application of Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher crop growth rate than weedy check but the difference among them was not

significant. All the interactions were not significant (P>0.05) on CGR.

Relative growth rate (RGR) was significantly (P < 0.05) affected by variety and weed control methods as presented in (Table 5). SAMNUT 24 performed significantly better than other varieties on RGR at FUDMA while at Tambu, SAMNUT 24 and SAMNUT 26, though statistically similar, they gave significantly higher RGR than KWANKWASIYA. Sowing dates did not significantly (P>0.05) influence RGR in both locations. Application of Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher RGR than other weed control methods. All the interactions were not significant (P>0.05) on RGR in both locations.

SAMNUT 24 and SAMNUT 26, though statistically similar, they gave significantly higher dry weight per plant than KWANKWASIYA in both locations (Table 5). Sowing dates was only significant at FUDMA where planting groundnut at 4th week of June and 1st week of July, though statistically similar, produced significantly (P < 0.05) higher dry weight per plant than planting groundnut at 2nd week of July. Application of Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher dry weight per plant than weedy check but the difference among them was not significant (P < 0.05) on dry weight per plant (Table 5). All the interactions were not significant (P>0.05) on dry weight per plant.

Table 3: - Effect of variety, sowing date and weed control method on weed control index at 3, 6 and 9WAS at FUDMA and Tambu-Daura during the 2023 raining season

	Weed control index per plot (%)					
	FUDMA			TAMBU-DAURA		
Treatment	**3WAS**	**6WAS**	**9WAS**	**3WAS**	**6WAS**	**9WAS**
Varieties (V)						
SAMNUT 24	52.51[a]	44.83[a]	47.87[a]	55.83[a]	43.56[a]	58.40[a]
SAMNUT 26	50.16[a]	40.58[b]	47.61[a]	52. 50[a]	44.11[a]	58.24[a]
KWANKWASIYA	45.94[b]	45.53[a]	40.95[b]	49.23[b]	36.63[b]	51.88[b]
S.E(±)	1.93	1.31	1.30	1.43	1.30	0.67
Significance	*	**	**	*	**	**
Sowing Date (T)						
4th Week of June	49.25[b]	38.03[c]	40.08[b]	43.06[b]	32.39[c]	48.16[c]
1st Week of July	53.33[a]	48.53[a]	48.00[a]	58.16[a]	51.28[a]	66.34[a]
2nd Week of July	46.03[b]	44.39[b]	40.35[b]	56.33[a]	40.64[b]	54.01[b]
S.E(±)	1.93	1.31	1.30	1.43	1.30	0.67
Significance	*	**	**	**	**	**
Weed control method (W)						
Imazethapyr @3 and 6 WAS	40.09[b]	47.96[c]	34.78[c]	49.43[b]	31.96[b]	40.88[c]
Imezthapyr @3 WAS +1 hoe weeding @ 6 WAS	62.04[a]	66.67[a]	61.48[a]	58.73[a]	52.04[a]	65.26[a]
Hoe weeding @3 and 6 WAS	59.78[a]	53.15[b]	58.33[b]	58.06[a]	49.44[a]	65.17[a]
Weedy check	36.24[b]	6.81[d]	27.32[d]	44.87[c]	32.30[b]	53.37[b]
S.E(±)	2.23	1.52	1.51	1.56	1.50	0.77
Significance	**	**	**	**	*	**
Interactions						
V x T	NS	NS	NS	NS	NS	NS
V x W	NS	NS	NS	NS	NS	NS
W x T	NS	*	NS	NS	NS	NS
V x T x W	NS	NS	NS	NS	NS	NS

Note *= Significant, NS= Not Significant at 5% level of probability. Means followed by the same letter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT.

Table 4: -Interaction effect of variety and weed control method on weed control index at 6WAS at FUDMA

Treatments	Weed control index at 6WAS			
	Imazethapyr @3 and 6 WAS	Imazethapyr@3 + 1hoe weeding 6 WAS	Hoe Weeding only @3 and 6 WAS	Weedy check
Varieties (V)				
4th Week of June	54.44[a]	65.55[a]	48.89[a]	8.55[c]
1st Week of July	65.56[a]	68.89[a]	65.56[a]	8.22[c]
2nd Week of July	26.11[b]	63.33[a]	45.00[a]	3.67[c]
S.E(+)		0.67		

Means followed by the same letter are statistically the same using DMRT at 5% level of significance

Table 5: - Effect of variety, sowing date and weed control method on crop growth rate (g m^{-2} wk^{-2}), relative growth rate (g $g^{-1}wk^{-1}$) and number of days to maturity at FUDMA and Tambu-Daura during the 2023 rainfed season

	Crop growth rate at 6WAS (CGR)		Relative growth rate at 6WAS (RGR)		Dry weight per plant (g)	
Treatment	**FUDMA**	**TAMBU**	**FUDMA**	**TAMBU**	**FUDMA**	**TAMBU**
Varieties (V)						
SAMNUT 24	21.95[a]	19.51[a]	0.37[a]	0.25[a]	39.00[a]	19.42[a]
SAMNUT 26	19.97[b]	17.49[b]	0.35[b]	0.24[a]	36.56[a]	18.00[a]
KWANKWASIYA	14.84[c]	12.27[c]	0.29[c]	0.18[b]	28.22[b]	13.78[b]
S.E(±)	0.39	0.39	0.0059	0.0058	3.30	1.59
Significance	**	**	**	**	*	*
Sowing Date (T)						
4th Week of June	18.78	16.38	0.34	0.22	38.86[a]	16.69
1st Week of July	19.09	16.50	0.34	0.23	38.89[a]	17.67
2nd Week of July	18.90	16.39	0.35	0.22	26.03[b]	16.83
S.E(±)	0.39	0.39	0.0059	0.0058	3.30	1.59
Significance	NS	NS	NS	NS	**	NS
Weed control method (W)						
Imazethapyr @3 and 6 WAS	18.97[a]	16.47[a]	0.34[b]	0.22[b]	32.78[a]	19.30[a]
Imezapyr @3 +1 hoe weeding 6 WAS	19.90[a]	17.36[a]	0.35[a]	0.23[a]	47.04[a]	22.33[a]
Hoe weeding @3 and 6 WAS	19.06[a]	16.70[a]	0.35[a]	0.23[a]	41.85[a]	20.59[a]
Weedy check	17.76[b]	15.28[b]	0.33[c]	0.21[c]	16.70[b]	6.04[b]
S.E(±)	0.45	0.45	0.0067	0.0067	3.81	1.83
Significance	*	*	*	*	**	**
Interactions						
V x T	NS	NS	NS	NS	NS	NS
V x W	NS	NS	NS	NS	NS	NS
W x T	NS	NS	NS	NS	NS	NS
V x T x W	NS	NS	NS	NS	NS	NS

Note *= Significant, NS= Not Significant at 5% level of probability. Means followed by the same letter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT

Number of days to maturity had a significant (P<0.05) effect on variety, sowing date and weed control methods on groundnut at the two locations (Table 6). The result indicated that local variety (KWANKWASIYA) significantly (P<0.05) recorded higher number of days to maturity than SAMNUT 26 and SAMNUT 24 which were at par. More so, sowing date was only significant (P < 0.05) at Tambu where sowing groundnut at the 4th week of June and 1st week of July, though statistically similar, produced significantly (P<0.05) higher number of days to maturity than 2nd week of July. Application of Imazethapyr at 3WAS + 1hoe weeding at 6WAS produced significantly higher number of days to maturity than other weed control method at FUDMA but at Tambu, application of Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher number of days to maturity than weedy check but the difference among them was not significant. All the interactions were not significant (P>0.05) at both two locations.

Table 7 shows the significant effect of variety and weed control method on stand count at harvest. The result indicated that SAMNUT 24 and SAMNUT 26 were statistically similar but were significantly (P<0.05) higher than local variety (KWANKWASIYA) on stand count at harvest at both locations. Sowing date was not significant (P>0.05) on stand count at harvest. Application of Imazethapyr at 3WAS and 1 hoe weeding at 6WAS produced significantly higher stand count at harvest than weedy check. All the interactions were not significant (P>0.05) on stand count at harvest in both locations.

The effect of variety, sowing date and weed control method was significant on number of pods per plant (Table 7). SAMNUT 24 and SAMNUT 26 were statistically similar but were significantly (P<0.05) higher than local variety (KWANKWASIYA) on number of pods per plant at both locations. Sowing date was significant (P<0.05) on number of pods per plant at FUDMA only, where sowing groundnut at 1st week of July produced significantly higher number of pods per plant than sowing groundnut on other sowing dates. Application of Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher number of pods per plant than weedy check but the difference among them was not significant (P<0.05) on number of pods per plant (Table 7). However, application of Imazethapyr herbicide at 3WAS + 1hoe weeding at 6WAS gave the highest value on number of pods per plant in both locations. All the interactions were not significant (P>0.05) on number of pods per plant at both locations.

Table 7 shows the significant effect of variety, sowing date and weed control method on kernel yield per plant (Table 7). SAMNUT 24 and SAMNUT 26 were statistically similar but were significantly (P<0.05) higher than local variety (KWANKWASIYA) on kernel yield per plant at both locations. Sowing date was significant (P<0.05) on kernel yield per plant where sowing groundnut at 1st week of July produced significantly higher kernel yield per plant than sowing groundnut on other sowing dates at both locations. Application of Imazethapyr at 3 and 6WAS, Imazethapyr at 3WAS and 1 hoe weeding at 6WAS and hoe weeding at 3 and 6WAS produced significantly higher kernel yield per plant than weedy check but the difference among them was not significant (P<0.05) on kernel yield per plant (Table 7). However, application of Imazethapyr herbicide at 3WAS + 1hoe weeding at 6WAS gave the highest value on kernel yield per plant in both locations. All the interactions were not significant (P>0.05) on kernel yield per plant at both locations.

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Table 6: - Effect of variety, sowing date and weed control method on number of days to maturity at FUDMA and TAMBU during the 2023 raining season

	Number of Days to Maturity	
Treatment	**FUDMA**	**TAMBU**
Varieties (V)		
SAMNUT 24	85.11[b]	88.40[b]
SAMNUT 26	81.00[b]	86.30[b]
KWANKWASIYA	118.9[a]	101.00[a]
S.E(±)	14.10	1.63
Significance	*	**
Sowing Date (T)		
4th Week of June	87.14	94.61[a]
1st Week of July	111.9	95.03[a]
2nd Week of July	85.97	86.47[b]
S.E(±)	14.10	1.63
Significance	NS	**
Weed control method (W)		
Imazethapyr @3 and 6 WAS	85.26[b]	94.44[a]
Imazethapyr @3 +1hoe weeding 6 WAS	121.10[a]	96.00[a]
Hoe weeding only @3 and 6 WAS	88.96[b]	95.70[a]
Weedy check	84.81[b]	82.00[b]
S.E(±)	16.00	1.88
Significance	*	**
Interactions		
V x T	NS	NS
V x W	NS	NS
W x T	NS	NS
V x T x W	NS	NS

Note *= Significant, NS= Not Significant at 5% level of probability. Means followed by the same letter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT.

Table 7: - Effect of variety, sowing date and weed control method on Stand count @ harvest, number of pods per plant and kernel yield per plant at FUDMA and Tambu-Daura during the 2023 rainfed season

	Stand Count at Harvest		Number of pods per plant		Kernel Yield/plant	
Treatment	**FUDMA**	**TAMBU**	**FUDMA**	**TAMBU**	**FUDMA**	**TAMBU**
Varieties (V)						
SAMNUT 24	26.53[a]	20.30[a]	20.29[a]	8.93[a]	5.75[a]	4.82[a]
SAMNUT 26	26.42[a]	19.60[a]	19.98[a]	8.19[a]	5.53[a]	4.43[a]
KWANKWASIYA	22.42[b]	13.90[b]	13.96[b]	6.29[b]	3.92[b]	2.84[b]
S.E(±)	0.91	1.51	1.65	0.57	0.47	0.45
Significance	**	**	**	**	**	**
Sowing Date (T)						
4th Week of June	26.39	17.50	16.63[b]	8.20	4.72[b]	3.62[b]
1st Week of July	24.78	17.78	22.02[a]	7.58	6.06[a]	4.88[a]
2nd Week of July	24.19	18.50	15.58[b]	7.63	4.42[b]	3.58[b]
S.E(±)	0.91	0.51	1.65	0.57	0.47	0.45
Significance	NS	NS	**	NS	**	*
Weed control method (W)						
Imazethapyr @3 and 6 WAS	24.44[b]	17.74[b]	18.03[a]	8.44[a]	5.44[a]	4.36[a]
Imazethapyr @3 +1 hoe weeding 6 WAS	28.22[a]	19.07[a]	21.21[a]	10.05[a]	6.52[a]	5.48[a]
Hoe weeding @3 and 6 WAS	25.85[b]	17.56[b]	20.77[a]	8.83[a]	6.04[a]	5.03[a]
Weedy check	21.96[c]	17.33[b]	12.29[b]	3.90[b]	2.26[b]	1.24[b]
S.E(±)	1.05	0.59	1.90	0.66	0.55	0.51
Significance	*	*	**	**	**	**
Interactions						
V x T	NS	NS	NS	NS	NS	NS
V x W	NS	NS	NS	NS	NS	NS
W x T	NS	NS	NS	NS	NS	NS
V x T x W	NS	NS	NS	NS	NS	NS

Note *= Significant, NS= Not Significant at 5% level of probability. Means followed by the same letter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT.

DISCUSSION

The soils of the two locations were low in organic carbon, total nitrogen and available phosphorus and CEC which are characteristic features of Savanna soil. This agrees with Singh (1987) that reported that savanna soils of Nigeria are low total nitrogen, available phosphorus, organic carbon effective CEC and exchangeable cations plus clay and silt contents. The similarities of sand and pH levels of the two soils are indicating that they are both appropriate for groundnut production. This outcome is in line with the results of the soil analysis conducted in 2021 by Ibrahim *et al.*, at Badole and Kugado which discovered that the soils at both sites had soil textures of 740 and 750 and were sandy loamy with slightly acidic pH values. Conclusively varieties of groundnuts can

grow in a range of soil types, such as sandy, sandy loamy and loamy soils with high calcium and phosphorous levels and a slightly acidic pH (Vabi *et al.*, 2019).

The similarities exhibited by SAMNUT 24 and SAMNUT 26 at the two locations could be attributed to their genetic makeup and their physiological ability for growth and yield which are far better than local variety. It could also be due their higher potentials for growth and yield over local variety (KWANKWASIYA). These results are consistent with a report by Usman (2015), which found that improved groundnut varieties had higher CGRs and were therefore much more efficient at partitioning assimilates to the seeds than older land races. However, variations in the genetic composition of groundnut varieties were linked to variations in yield and yield attributes. Crops vary in their capacity to assimilate photosynthesis and in how they divide assimilate into components that contribute to growth and yield (Ibrahim *et al.*, 2021). The dates of groundnut sowing were inconsistent with some parameters examined at the two sites, however, sowing groundnut in the first week of July gave significantly higher values on weed control index, number of days to maturity, number of pods per plant, and kernel yield per plant than those sown in the 4th week of June and 2nd week of July, which could be that planting groundnut at first week of July gave better favourable environmental conditions for the parameters mentioned. This inconsistency, however, could be attributed to temperature fluctuations that occurred often during the rainy season of 2023 as well as imbalances in the chemical makeup of the soil, particularly in terms of nitrogen, phosphorus and calcium that are higher at FUDMA over TAMBU location. This is also consistent with research by Ajeigbe *et al.* (2014), which found that although it is challenging to determine a standard planting date due to the current weather fluctuations, farmers should plant as soon as the soil has sufficient and stable moisture for healthy germination and subsequent plant growth. According to Tavora *et al.* (2002), peanut cultivars are produced in a variety of environments with varying soil types, moisture contents, temperatures, and management techniques.

The application of Imazethapyr at 3WAS + 1 hoe weeding at 6WAS considerably outperformed the other three weed control strategies studied. This could be because of the type of weed and its abundance in the area it could also be because combination of different techniques can effectively control the weeds and facilitates plants growth to generate more resources for photosynthesis and soil aeration. These results also align with those of Rajendran and Lourduraj (1999), who found that the amount of groundnut output lost to weeds varies depending on the kind and density of weed flora and can be as high as 96%. Vilas *et al.* (2012) also found that compared to the weedy control (677 kg ha^{-1}), hand weeding twice at 15 and 30 DAS produced a considerably higher pod production (1741 kg ha^{-1}). A pod yield of 16.58 kg ha^{-1} was obtained by pre-emergence application of Pendimethalin @ 1.0 kg a.i. ha^{-1}, which is equivalent to the total weed free condition and on par with cultivation method of weed control. According to Garko *et al.* (2016), groundnuts are unable to successfully compete with weeds, particularly during the growing stage, which occurs three to six weeks after seeding.

CONCLUSION

Based on the findings form this research, SAMNUT 24 and SAMNUT 26 produced significantly higher growth and yield than the native variety KWANKWASIYA. Results from sowing dates were not consistent, however, it was found out that groundnuts sown in the first week of July gave significantly higher values on weed control index, number of days to maturity, number of pods per plant, and kernel yield per plant than those sown in the 4th week of June and 2nd week of July. Weed control methods significantly produced higher values of parameters measured than weedy check, however, application of Imazethapyr herbicide at 3WAS + 1hoe weeding at 6WAS gave a better performance on groundnut growth and yield. For effective weed control method, planting SAMNUT 24 and SAMNUT 26 during the first week of July and application of Imazethapyr herbicide at 3WAS plus one hoe weeding at 6WAS are therefore the most suitable in the study area.

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