EFFECT OF VARIETY AND PLANTING DATE ON THE PERFORMANCE OF GROUNDNUT (*Arachis hypogaea L.*) IN CALABAR, THE HUMID RAINFOREST OF SOUTH EASTERN NIGERIA

[1]Akpanke U. Agiapule, [2]Aniefiok E. Uko, [1]Ujah A. Fredrick and [1]Andowhobe J. Beshi

[1]School of Vocational Education, Federal College of Education, Obudu
[2] Department of Crop Science, University of Calabar, Calabar
Corresponding author's email: ushieakpankpe2007@gmail.com

Abstract
A factorial experiment was conducted to evaluate the effect of variety and planting date on the growth and yield of groundnut (*Arachis hypogaea L*) at the Teaching and Research Farm of the University of Calabar in 2020 and 2021 cropping seasons. The treatments consisted of three varieties of groundnut (SAMNUT 24, SAMNUT 25 and SAMNUT 26) planted on 17th April, 15th May, 16th June, 15th July, 17th August, 18th September and 14th October were laid out in a randomized complete block design (RCBD) with three (3) replications. Data were taken on growth and yield parameters of groundnut and statistically analyzed using analysis of variance (ANOVA). Means were compared using Fishers Least Significant Difference (FLSD) at 5% level of probability. Variety had significant ($P<0.05$) effect on biomass weight, number of filled pods, pods yield and seed yield of groundnut in 2020 and 2021. SAMNUT 24 produced significantly ($P<0.05$) higher biomass weight and haulm weight while SAMNUT 25 had higher number of filled pods, pod yield and seed yield in both cropping seasons. Planting date had a significant ($P<0.05$) effect of on all the yield variables except shelling percentage. Also, October planting was affected by early end of rain in December which led to low yield. SAMNUT 25 planted in June gave the higher pod yield of 1.62 t/ha, seed yield of 1.60 t/ha, harvest index of 0.84 and higher pod yield of 1.70 t/ha in 2020 and seed yield of 1.60 t/ha, harvest index of 0.86 in 2021. Thus SAMNUT 25 is recommended for cultivation in the study area and could be planted in the month of June.

K**eywords:** Groundnut variety, planting date, humid rain forest, performance.

Introduction

Groundnut (*Arachis hypogaea* L.) belongs to the family *Fabaceae* and sub-family *Papilionoideae* (Bamshaiye *et al*, 2011). Groundnut is derived from two Greek words, 'arachis' meaning 'legume' and hypogaea, meaning 'below ground', referring to the formation of pods in the soil. Groundnut is grown in diverse environments throughout the world between 40^0N and 40'S of the equator (FAO, 2013). Groundnut is an important food and cash crop for resource poor farmers in Asia and Africa (FAOSTAT, 2008). About 41 % of the world groundnut crop is used for oil production, whereas 45 % is used directly as human food (Fletcher *et al.,* 2016).

Groundnut kernels usually cooked or toasted are appreciated worldwide as a flavorful snack food, nutritionally dense due to its high energy, protein and fat content. Groundnuts are also the primary ingredient of many finished products such as peanut butter, confections, and nutritional bars which are used in numerous dishes (Davis *et al*., 2016). Groundnut also improves soil fertility through nitrogen fixation, thereby increasing the productivity of other crops when used in rotation or in a mixed cropping system (Ajeigbe *et al.,* 2014).

The crop is a native to Central America and has never been found uncultivated (Vabi *et al.,* 2019). The World production figure of groundnut in 2025 is 51.74 million tonnes from 30.6 million hectares as against 31.43 million tonnes produced from 32.7 million hectares in 2023 (FAO, 2025). The production of groundnut is concentrated in Asia and Africa, where the crop is grown mostly by smallholder farmers under rain-fed conditions with limited inputs. Nigeria is the third largest producer of groundnut in 2025 with annual production of 4.3 million tonnes after China 19 million tonnes and India 7.35 million tonnes (FAO, 2025). It is estimated that 3.9 million hectares were planted in 2023 with groundnut in Nigeria (FAO, 2023). Nigeria, a major groundnut producer, ranks third globally and first in Africa, with an estimated production of 4.28 million tonnes, accounting for approximately 8% of the world's total which might be attributed to small holdings farmed by aging and resource poor farmers, whose yields are determined by the limiting factors of bio-geophysical environment as well as continuous use of low yielding variety (FAO, 2023).

The main agro-ecological zones for groundnut production in Nigeria are Sahel, Sudan, northern guinea and most of the southern guinea and derived savannah (Vabi *et al.,* 2019). However, environmental factors for successful groundnut production found during the rainy season also prevail during the dry season in the savanna, while moisture requirements can be adequately met by the supply of water through irrigation (Mukhtar, 2009).

The need to improve groundnut productivity has also necessitated the breeding of varieties that can take the advantage of factors such as high yielding early maturing crop, resistance to pests and diseases, tolerance to drought and escape to end of season drought due to extra early maturity (Vabi *et al.,* 2019). Reddy *et al*. (1993) reported that the yield of groundnut can be increased up to 30-89 % provided high yielding varieties are identified and cultivated. (Onwubiko *et al.,* 2010; Akpalu *et al.,* 2010) noted difference in growth attributes of different cultivars. Variations in total yield of groundnut were probably attributed to genetic differences between varieties and how they responded to environmental changes (Shambhakar *et al.,* 2006).

Before 1992, twenty groundnut varieties had been officially released in Nigeria. Most of

these were medium-to late maturing varieties, requiring more than four months to mature. The Savanna zone has a short growing season (90-100 days) and requires short-duration varieties, three varieties, SAMNUT 21 (UGA 2), SAMNUT 22 (M5782.801) and SAMNUT 23 (ICGV-15 96894) were formally released in 2001. Subsequently, early maturing varieties resistant to several biotic stresses were released: SAMNUT 24 (1CAR 198T) in 2011, and SAMNUT 25 and SAMNUT 26 in 2013 (Ndjeunga *et al*., 2013).

The effect of planting dates on the growth and yield of leguminous crops such as *Arachis hypogaea* cannot be underestimated as it is crystal clear that good timing of planting date is one of the key factors that strongly affect production in rain fed agriculture (Ati *et al*., 2002).

Statement of the problem

Low yields of groundnuts are mainly associated with a lot of factors such as diseases, inappropriate planting dates and the use of poor and local varieties. Differences in time of planting may relate to different climatic conditions such as rainfall, temperature, relative humidity and photoperiod amongst others which will adversely affect the crop (Sogut *et al*, 2016). This is especially true in many parts of Africa, where the rainy season starts with some light showers followed by dry spells, which can cause poor crop emergence or desiccate a young crop. Therefore, good timing of planting date is one of the key factors that strongly affect groundnut production in rain fed agriculture.

Objectives of the study

The main objective of this study was to evaluate the varieties that give maximum growth and yield of groundnut (*Arachis hypogaea* L.) in Calabar, a typical humid rainforest zone.

The specific objectives of this study were to:

Determine the effects of planting dates on the growth and yield of groundnut.

Assess the yields potentials of three groundnut varieties in Calabar, in the rainforest zone of south eastern Nigeria.

Materials and methods

Study area description: This research was carried out at the University of Calabar Teaching and Research Farm, Calabar from April to October, 2021. Calabar is situated in the South-Eastern rainforest agro ecological zone of Nigeria between latitudes 4.5 - 5.2^{0}N, and longitude 8.0 - 8.3^{0}E and altitude of 62.3m above sea level, with a bimodal annual rainfall distribution that ranges from 3000 mm to 3500 mm with a mean annual temperature range of 27 ^{0}C to 35 ^{0}C and a relative humidity between 75 to 85 % (NIMET, 2020).

Experimental design and treatments: It was a factorial experiment laid out in a randomized complete block design (RCBD)

and replicated three times. The treatments comprised three (3) varieties of groundnut (SAMNUT 24, SAMNUT 25 and SAMNUT 26) denoted as A_1, A_2, A_3 and seven planting dates (17th April, 15th May, 16th June, 15th July, 17th August, 18th September and 14th October 2021 and 2022) denoted as B_1, B_2, B_3, B_4, B_5, B_6, B_7. The treatment combinations were A_1B_1, A_1B_2, A_1B_3, A_1B_4, A_1B_5, A_1B_6, A_1B_7, A_2B_1, A_2B_2, A_2B_3, A_2B_4, A_2B_5, A_2B_6, A_2B_7, A_3B_1, A_3B_2, A_3B_3, A_3B_4, A_3B_5, A_3B_6, and A_3B_7. The 21 treatments were replicated thrice to give 63 experimental plots. The groundnut varieties were chosen based on the following characteristics:

SAMNUT-24: Early-maturing (80-90 days), good haulm yield (2.5-3 t/ha), vigorous plant growth, good yield (2-2.5 t/ha) and high oil content (53 %).

SAMNUT-25: Early-maturing (80-90 days), good yield potential (2.5-3 t/ha), highly resistant to rosette disease, with high oil content (51.5 %).

SAMNUT 26: Early-maturing (80-90 days), highly resistant to rosette disease, good yield potential (2-2.5 t/ha) and good oil content 50.9 % (Ajeigbe *et al.*, 2014).

TABLE 1: Monthly rainfall, temperature and relative humidity values for 2021

	2020			**2021**		
Months	**Rainfall (mm)**	**Temperature (°C)**	**Relative Humidity (%)**	**Rainfall (mm)**	**Temperature (°C)**	**Relative Humidity (%)**
January	33.8	31.5	73	8.9	32.0	76
February	10.0	32.0	65	10.0	32.0	70
March	91.2	28.4	75	34.3	29.4	75
April	188.3	27.3	77	186.9	27.1	76
May	196.6	26.8	78	235.4	25.0	80
June	296.4	25.0	81	304.2	24.4	81
July	221.8	26.5	79	293.0	24.6	80
August	324.8	24.0	85	247.4	25.5	83
September	705.8	23.0	90	336.6	23.0	85
October	351.5	24.3	85	331.0	23.3	84
November	169.3	26.4	76	867.0	22.0	75
December	65.8	31.0	74	0.2	31.0	75
Total	2655.3	326.2	938	2854.9	319.3	940
Mean	221.28	27.18	78.17	237.91	26.61	78.33

(Source NIMET, 2021)

Data collection and analysis: Data were collected on all the necessary plant parameters and subjected to a two-way analysis of variance (ANOVA) using a 3 x 7 factorial in randomized complete block design (RCBD) and computed using Microsoft Excel (GenStat version 2020). Significant treatment means were compared using Fisher's Least significant difference (F-LSD) ($P \leq 0.05$) as described by Gomez and Gomez (1984).

Results and discussion

Effect of variety and planting date on plant height, number of leaves, number of branches, stem girth, leaf area index and days to 50% flowering of groundnut at 7WAP in 2021 season

In 2020, variety had a significant ($P<0.05$) effect on plant height at 7 WAP. SAMNUT 24 had taller plants throughout the sampling stages compared to others (Table 2). These were followed by SAMNUT 26 and the least was SAMNUT 25. Although SAMNUT 25 and SAMNUT 26 were not significantly different from each other but they were shorter than SAMNUT 24. The result also showed that variety had significant ($P<0.05$) effect of on the number of branches of groundnut at 7 WAP. At 7 WAP, SAMNUT 24 and SAMNUT 26 had significantly ($P<0.05$) higher number of branches when compared to SAMNUT 25. SAMNUT 25 had the least number of branches at 7 WAP. Variety had significant ($P<0.05$) effect on stem girth at 7WAP in 2020. SAMNUT 24 had a significantly ($P<0.05$) higher stem girth value compared to SAMNUT 25 and SAMNUT 26. In 2021, Variety had significant ($P<0.05$) effect on plant height, number of branches, stem girth, leaf rea index and number of nodules. SAMNUT 24 produced significantly ($P<0.05$) taller plants, higher stem girth and leaf area index while SAMNUT 25 had higher number of nodules and SAMNUT 26 higher number of branches at 7 WAP.

Planting date had significant ($P<0.05$) effect on plant height, number of leaves, number of branches, stem girth, number of nodules and leaf area index of groundnut at 7 WAP at both cropping seasons. At 7 WAP, the month of August produced significantly ($P<0.05$) taller plants compared to other months of planting except June. This was followed by June planting which in turn had taller plants compared to others at 7 WAP. The least values of plant height were obtained in October planting date at 7 WAP. At 7 WAP, April planting produced significantly ($P<0.05$) higher number of leaves compared to other months of planting. This was followed by the May, August and September plantings. However, October planting had the least number of leaves at 5 and 7 WAP. The month of April produced significantly higher number of branches compared to other months of planting except May and June. July planting had the least number of branches. April planting produced significantly ($P<0.05$) higher number of leaves compared to other months of planting.

TABLE 2: Effect of variety and planting date on plant height, number of leaves, number of branches, stem girth, leaf area index and days to 50% flowering of groundnut at 7WAP in 2021 season

Treatments	Plant height (cm)		Number of leaves		Number of branches		Stem Girth (cm)		Leaf area index		Number of nodules	
	7WAP		7WAP		7WAP		7WAP		7WAP		7WAP	
Variety (A)	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
SAMNUT 24 (A_1)	35.53	34.81	68.61	71.95	11.59	10.77	0.82	1.06	3.86	5.09	50.90	52.81
SAMNUT 25 (A2)	30.97	32.06	67.11	68.49	9.38	9.38	0.77	0.97	3.45	3.50	51.33	58.14
SAMNUT 26 (A_3)	31.02	32.59	68.67	68.29	11.46	10.79	0.79	0.97	3.68	3.47	46.86	49.29
LSD (0.05)	4.07	2.87	NS	NS	1.94	1.37	NS	0.05	NS	0.78	NS	5.65
Planting Date(B)												
April (B_1)	35.51	34.20	97.22	96.66	14.28	12.60	0.86	1.14	7.16	4.68	53.33	58.78
May (B_2)	34.25	33.70	81.21	82.21	12.14	10.20	0.81	1.00	5.49	4.94	53.44	57.44
June (B_3)	36.52	35.40	53.96	56.40	12.89	10.60	0.85	0.99	3.26	5.26	64.56	66.89
July (B_4)	26.30	26.00	58.15	61.71	8.60	6.50	0.78	1.01	2.13	3.13	47.44	51.00
Aug (B_5)	42.66	40.50	77.68	78.56	9.75	7.42	0.77	1.07	3.69	3.81	62.67	64.56
Sept (B_6)	31.88	32.90	75.02	75.80	9.88	8.30	0.84	0.94	2.80	3.80	38.11	41.67
Oct (B_7)	24.97	25.30	33.67	35.67	8.11	7.22	0.66	0.85	1.08	2.53	28.33	33.56
LSD (0.05)	6.21	4.93	13.09	8.83	2.96	2.09	0.10	0.08	1.55	1.19	14.27	8.64
Interaction												
A × B												
A_1B_1	36.98	35.78	94.41	97.75	14.88	12.60	0.89	1.18	7.75	4.75	58.67	59.67
A_1B_2	33.28	33.00	73.27	76.61	10.87	10.30	0.88	1.07	4.72	5.72	60.67	62.67
A_1B_3	35.49	34.50	54.70	58.03	15.00	12.00	0.90	1.17	3.49	5.82	68.00	70.00
A_1B_4	33.00	33.90	68.40	71.74	8.57	9.50	0.78	1.08	3.02	4.36	42.00	44.00
A_1B_5	44.14	37.40	82.37	85.70	9.92	8.40	0.78	1.09	4.04	5.04	66.67	68.00
A_1B_6	33.77	40.70	74.81	78.15	8.48	7.70	0.87	0.97	2.91	5.24	32.00	35.00
A_1B_7	27.03	30.30	32.33	35.67	7.67	7.00	0.67	0.90	1.06	4.73	28.33	30.33
A_2B_1	33.01	31.21	97.52	95.19	13.07	9.30	0.86	1.14	6.18	4.51	54.67	68.33
A_2B_2	36.76	34.70	80.51	83.84	11.48	9.48	0.73	0.95	5.90	4.23	59.00	67.33
A_2B_3	36.76	34.77	50.83	54.17	10.00	12.20	0.82	0.88	2.92	5.26	59.00	62.33
A_2B_4	22.70	24.70	56.20	62.87	6.27	8.30	0.76	0.96	1.86	2.86	59.67	60.67
A_2B_5	43.20	41.60	70.77	69.11	8.37	12.77	0.76	1.06	3.26	2.93	60.00	63.33
A_2B_6	29.70	20.00	78.92	77.25	9.48	8.40	0.85	0.96	2.83	3.16	40.33	46.67
A_2B_7	22.33	21.30	35.00	37.00	6.99	8.50	0.63	0.83	1.19	1.53	26.67	38.33
A_3B_1	36.54	35.50	99.73	97.06	15.57	10.55	0.82	1.11	7.57	4.79	46.67	48.33
A_3B_2	32.71	33.75	89.86	86.19	13.73	10.53	0.81	0.98	5.85	4.85	40.67	42.33
A_3B_3	37.30	35.30	56.33	57.00	13.67	9.77	0.85	0.91	3.37	4.71	66.67	68.33
A_3B_4	23.21	25.20	49.85	50.51	5.57	6.67	0.80	0.98	1.51	2.18	40.67	48.33
A_3B_5	40.64	35.60	79.89	80.89	9.96	8.66	0.76	1.06	3.78	3.45	61.33	62.33
A_3B_6	32.18	30.20	71.33	72.00	10.03	8.30	0.81	0.91	2.66	3.00	42.00	43.33
A_3B_7	25.53	24.80	33.69	34.35	7.00	9.00	0.67	0.82	0.99	1.32	30.00	32.00
LSD (0.05)	NS	NS	NS	15.3	NS	NS	NS	NS	NS	2.07	NS	14.97

Legend: NS = Not significant at 0.05 level of probability, WAP = weeks after planting, LSD = least significant difference, A = variety, B = planting date.

This was followed by the May, August and September plantings. However, October planting had the least number of leaves at 5 and 7 WAP. The month of April produced significantly higher number of branches compared to other months of planting except May and June. July planting had the least number of branches. April planting also had significantly (P<0.05) higher stem girth compared to those in other months of planting except the August planting. These were followed by the July, May and June plantings which in turn had a higher stem girth compared to October planting which had the least stem girth at all the three sampling stages. There was a significant (P<0.05) effect of planting date on number of nodules with the month of June having significantly (P<0.05) higher number of nodules compared to other months except August, May and April plantings which were statistically the same. These were followed by July and September planting. However, October planting had the least number of nodules. April planting had a significantly (P<0.05) higher leaf area index compared to those in other months of planting. These were followed by May planting, while September planting had the least leaf area index. Similar results were obtained in 2021.

There was no significant (P<0.05) interaction effect between variety and date of planting on plant height, number of leaves, number of branches, stem girth, number of nodules and leaf area index of groundnut at 7WAP in 2020. There was significant (P<0.05) interaction effect between variety and date of planting on number of leaves, leaf area index and number of nodules of groundnut at 7 WAP in 2021.

Table 3 showed that variety had a significant (P<0.05) effect only on days to maturity, number of filled pods and 100-seed weight. SAMNUT 25 had significantly higher number of filled pods and 100 seed weight, followed by SAMNUT 26 and the least by SAMNUT 24. SAMNUT 25 had significantly (P<0.05) higher number of days to maturity compared to SAMNUT 24 and SAMNUT 26 which were statistically the same in 2020.

In 2021, Variety had a significant (P<0.05) effect on all the yield variables. SAMNUT 25 had significantly higher number of days to maturity, length of pods, number of filled pods, number of seeds per pod and 100-seed weight while SAMNUT 24 had higher number of unfilled pods.

Planting date had significant (P<0.05) effect on number of days to maturity, length of pods, number of filled pods, number of unfilled pods, number of seeds per pod and 100 seed weight of groundnut. August planting gave the highest number of days to maturity which was significantly different from July, April, May, June and September planting. However, October had the least number of days to maturity. July planting had significantly longer pod length compared to other months of planting. This

was followed by June, August and October planting which were not significantly different from each other. June planting had significantly (P<0.05) higher number of filled pods compared to other planting dates except April, July and August which were statistically the same. These were followed by September and May plantings with the least number of filled pods in October. May planting had the highest number of unfilled pods which was significantly different from other dates of planting except October and April. July had the least number of unfilled pods. The highest number of seeds per pod was also produced in July and June, followed by April, May and August and the least in October. Also, July and June gave the highest 100-seed weight, which was statistically similar with the values in August and April plantings. October planting had the least 100-seed weight.

There was significant (P<0.05) interaction effect between variety and planting date on

number of days to maturity and number of filled pods of groundnut. SAMNUT 24 planted in August had significantly (P<0.05) higher number of days to maturity compared to other treatment combinations except SAMNUT 25 planted in August. SAMNUT 24 planted in July gave the highest number of filled pods compared to other treatment combinations except SAMNUT 24 planted in June and in August, SAMNUT 25 planted in April and July and SAMNUT 26 planted in April which were not statistically different from each other.

Effect of variety and planting date on shelling percentage, harvest index, biomass, haulm weight, pod yield and seed yield of groundnut

Table 4 showed that Variety had significant (P <0.05) effect only on total biomass, pod yield and seed yield of groundnut. SAMNUT 26 produced significantly (P<0.05) higher total plant

biomass compared to SAMNUT 24 and SAMNUT 25. This was followed by SAMNUT 25 and the least was in SAMNUT 24. SAMNUT 25 had significantly (P<0.05) higher pod yield and seed yield compared to SAMNUT 24 but not significantly different from SAMNUT 26.

Planting date had significant (P<0.05) effect on harvest index, total biomass, haulm weight, pod yield, and seed yield of groundnut whereas shelling percentage was not significant. June planting gave the highest harvest index. April planting had the highest biomass weight compared to other months of planting.

TABLE 3: Effect of variety and planting date on number of days to maturity, length of pods, number of filled pods, number of unfilled pods, number of seeds per pod and 100 seeds weight of groundnut

Treatment	Days to maturity		Length of pods (cm)		Number of filled pods		Number of unfilled pods		Number of seeds per pod		100-seed weight (g)	
Variety (A)	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
SAMNUT 24 (A_1)	90.76	90.00	2.30	3.54	17.99	22.90	5.15	3.67	2.16	2.32	48.33	52.86
SAMNUT 25 (A_2)	92.19	91.67	2.29	4.77	21.05	27.24	4.18	2.88	2.11	2.44	57.14	58.10
SAMNUT 26 (A_3)	90.76	91.19	2.28	3.42	20.66	21.33	3.88	4.36	2.14	2.27	50.95	50.00
LSD (0.05)	0.23	0.93	NS	1.11	1.69	2.03	NS	0.49	NS	0.15	3.50	1.86
Planting Date(B)												
April (B_1)	91.67	92.22	2.21	4.66	21.45	26.20	5.35	3.46	2.08	2.30	53.33	55.00
May (B_2)	91.78	91.67	2.13	3.68	18.07	22.51	6.53	3.97	2.11	2.33	47.22	48.89
June (B_3)	91.89	91.67	2.34	5.01	21.76	25.45	4.98	3.31	2.26	2.44	56.67	58.33
July (B_4)	93.33	93.33	2.63	3.52	21.49	24.93	2.29	2.84	2.27	2.47	57.22	58.33
Aug (B_5)	98.22	96.11	2.26	3.48	20.74	24.86	2.41	3.06	2.10	2.32	55.00	56.67
Sept (B_6)	88.33	88.33	2.19	3.30	18.85	22.85	3.14	3.69	2.07	2.27	48.89	50.00
Oct (B_7)	83.44	83.33	2.26	3.71	16.96	19.96	6.12	5.12	2.06	2.29	46.67	48.33
LSD (0.05)	0.34	1.42	0.18	1.7	2.58	3.1	1.77	0.79	0.16	0.23	5.34	2.85
Interaction												
A × B												
A_1B_1	95.00	95.00	2.20	4.86	19.81	23.15	6.42	2.76	2.18	2.35	56.67	58.33
A_1B_2	90.00	90.00	2.07	3.07	17.27	20.61	6.67	3.34	2.17	2.33	53.33	55.00
A_1B_3	90.33	90.00	2.34	5.00	23.68	25.68	6.01	2.68	2.33	2.50	60.00	60.00
A_1B_4	95.00	93.33	2.59	2.92	25.26	25.59	1.84	3.18	2.15	2.31	65.00	65.00
A_1B_5	100.00	96.67	2.38	3.05	22.41	24.74	2.78	3.40	2.04	2.20	58.33	60.00
A_1B_6	85.00	85.00	2.29	2.96	18.62	20.62	7.19	5.52	2.11	2.28	56.67	56.67
A_1B_7	80.00	80.00	2.25	2.92	17.58	19.92	5.14	4.81	2.12	2.29	50.00	51.67
A_2B_1	90.00	90.00	2.16	5.83	23.63	30.29	5.06	2.72	2.00	2.33	53.33	55.00
A_2B_2	95.33	95.00	2.22	4.89	18.34	25.01	6.62	3.25	2.00	2.33	43.33	45.00
A_2B_3	90.33	90.00	2.35	5.01	23.00	29.67	4.33	2.67	2.11	2.44	60.00	63.33
A_2B_4	95.00	95.00	2.85	4.18	23.72	30.39	2.72	2.72	2.46	2.79	53.33	55.00
A_2B_5	99.67	96.67	2.13	4.46	20.79	27.46	3.10	2.77	2.11	2.44	56.67	58.33
A_2B_6	90.00	90.00	2.09	4.09	20.92	27.59	1.17	2.17	2.04	2.37	43.33	45.00
A_2B_7	85.00	85.00	2.24	4.91	16.96	20.29	6.23	3.90	2.03	2.37	46.67	48.33
A_3B_1	90.00	91.67	2.28	3.28	21.83	25.17	4.58	4.91	2.05	2.22	50.00	51.67
A_3B_2	90.00	90.00	2.09	3.09	18.59	21.93	6.31	5.31	2.17	2.33	45.00	46.67
A_3B_3	95.00	95.00	2.35	5.02	17.67	21.00	4.60	4.60	2.34	2.37	50.00	51.67
A_3B_4	90.00	91.67	2.46	3.46	15.49	18.82	2.30	2.63	2.20	2.30	53.33	55.00
A_3B_5	95.00	95.00	2.27	2.94	19.03	22.37	1.33	3.00	2.15	2.31	50.00	51.67
A_3B_6	90.00	90.00	2.19	2.86	17.00	20.33	1.05	3.39	2.07	2.17	46.67	48.33
A_3B_7	85.33	85.00	2.30	3.30	16.34	19.67	7.00	6.67	2.04	2.20	43.33	45.00
LSD (0.05)	0.60	2.47	NS	2.95	4.48	5.38	NS	1.3	NS	0.4	NS	4.94

Legend: NS = Not significant at 0.05 level of probability, WAP = weeks after planting, LSD = least significant difference, A = variety, B = planting date.

TABLE 4: Effect of variety and planting dates on shelling percentage, harvest index, biomass weight, haulm weight, Pods yield and seeds Yield of groundnut in 2020 and 2021 cropping season

Treatments	Shelling percentage (%)		Harvest index		Biomass weight (t/ha)		Haulm Weight(kg/ha)		Pods yield (t/ha)		Seeds Yield (t/ha)	
Variety (A)	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
SAMNUT 24 (A_1)	87.49	90.68	0.72	0.72	1.60	1.65	384.29	427.62	1.16	1.50	1.03	1.05
SAMNUT 25 (A_2)	88.22	93.50	0.73	0.75	1.55	1.50	367.62	380.95	1.20	1.60	1.16	1.20
SAMNUT 26 (A_3)	90.62	89.62	0.72	0.72	1.50	1.60	355.24	384.29	1.15	1.20	1.09	1.17
LSD (0.05)	NS	3.17	NS	0.03	0.04	0.03	NS	33.68	0.02	0.04	0.10	0.05
Planting Dates (B)												
April (B_1)	89.22	91.44	0.66	0.72	1.99	2.00	594.44	538.89	1.39	1.50	1.28	1.30
May (B_2)	88.10	91.77	0.76	0.79	1.39	1.40	321.11	357.78	1.09	1.15	1.07	1.10
June (B_3)	93.29	94.73	0.83	0.84	1.78	1.80	288.89	311.11	1.49	1.50	1.41	1.40
July (B_4)	89.75	91.97	0.72	0.73	1.58	1.60	405.56	413.33	1.18	1.30	1.16	1.20
Aug (B_5)	88.40	89.84	0.71	0.72	1.47	1.50	357.78	442.22	1.12	1.20	0.99	1.02
Sept (B_6)	90.04	93.15	0.71	0.71	1.42	1.50	365.56	427.78	1.05	1.05	0.95	1.00
Oct (B_7)	82.63	85.96	0.68	0.62	1.14	1.20	250.00	292.22	0.89	0.97	0.79	0.90
LSD (0.05)	NS	NS	0.06	0.05	0.06	0.05	83.56	51.45	0.03	0.02	0.15	0.09
Interaction												
A × B												
A_1B_1	89.85	92.18	0.68	0.70	2.00	2.00	616.67	500.00	1.48	1.50	1.30	1.30
A_1B_2	90.25	93.58	0.78	0.80	1.20	1.20	240.00	290.00	1.00	1.09	0.96	1.03
A_1B_3	94.12	97.45	0.83	0.85	1.70	1.70	283.33	333.33	1.42	1.40	1.30	1.30
A_1B_4	88.16	91.49	0.70	0.72	1.81	1.80	483.33	500.00	1.32	1.30	1.20	1.20
A_1B_5	82.81	86.14	0.74	0.76	1.38	1.50	313.33	433.33	1.07	1.06	0.88	0.90
A_1B_6	87.25	90.58	0.72	0.73	1.34	1.50	316.67	366.67	1.02	1.01	0.89	0.90
A_1B_7	80.00	83.33	0.68	0.51	1.07	1.10	233.33	266.67	0.83	0.80	0.67	0.70
A_2B_1	87.80	92.13	0.68	0.83	1.87	1.80	500.00	500.00	1.37	1.40	1.20	1.30
A_2B_2	87.35	95.02	0.72	0.73	1.52	1.50	413.33	416.67	1.13	1.20	1.11	1.10
A_2B_3	92.78	96.11	0.84	0.86	1.90	1.90	283.33	300.00	1.62	1.70	1.60	1.60
A_2B_4	94.12	97.45	0.74	0.75	1.49	1.50	360.00	366.67	1.14	1.20	1.13	1.10
A_2B_5	89.94	93.27	0.73	0.75	1.41	1.40	316.67	383.33	1.09	1.10	0.98	1.08
A_2B_6	85.52	93.85	0.65	0.68	1.46	1.50	450.00	450.00	1.01	1.06	0.87	1.00
A_2B_7	80.00	86.67	0.65	0.67	1.00	1.01	250.00	250.00	0.75	0.90	0.73	0.80
A_3B_1	90.00	90.00	0.63	0.63	2.10	2.20	666.67	616.67	1.35	1.40	1.33	1.30
A_3B_2	86.71	86.71	0.78	0.84	1.46	1.50	310.00	366.67	1.15	1.30	1.13	1.20
A_3B_3	92.96	92.96	0.81	0.81	1.73	1.80	300.00	300.00	1.43	1.40	1.33	1.30
A_3B_4	86.96	86.96	0.72	0.72	1.45	1.50	373.33	373.33	1.13	1.20	1.07	1.08
A_3B_5	92.45	92.45	0.67	0.67	1.63	1.60	443.33	510.00	1.19	1.20	1.10	1.10
A_3B_6	97.35	97.35	0.75	0.72	1.46	1.50	270.00	466.67	1.13	1.20	1.10	1.10
A_3B_7	87.88	87.88	0.69	0.68	1.37	1.40	266.67	360.00	1.10	1.10	0.96	1.00
LSD (0.05)	NS	NS	NS	0.09	0.11	0.09	NS	89.13	0.04	0.03	0.25	0.15

Legend: NS = Not significant at 0.05 level of probability, WAP = weeks after planting, LSD = least significant difference, A = variety, B = planting date

This was followed by June planting while October planting had the least plant biomass. April planting gave the highest haulm weight while June planting significantly (P<0.05) gave the highest pod yield, and seed yield compared to other months of planting which could probably be attributed to the rainfall pattern that was relatively stable, evenly distributed and at a normal range from April to June. October planting gave the least pod yield due to early end of rain. June planting gave the highest seed yield which could be attributed to the rainfall that was relatively stable and evenly distributed during this period.

There was significant (P<0.05) interaction effect of variety and planting date only on plant biomass, pod yield, and seed yield of groundnut. SAMNUT 24 planted in April had the highest biomass weight compared to other treatment combinations except SAMNUT 26 planted in April. Also, SAMNUT 25 planted in June was not significantly (P<0.05) higher than SAMNUT 25 planted in April. SAMNUT 25 planted in June in turn was significantly (P<0.05) different from SAMNUT 24 planted in July. SAMNUT 25 planted in June gave the highest pod yield and seed yield compared to other treatment combinations. SAMNUT 25 planted in October however gave the least pod yield. There was a significant (P<0.05) interaction effect between variety and planting date on total biomass, pod yield and seed yield of groundnut.

Discussion

The result of the soil analysis at the experimental site showed that the soil has sandy loam texture. The soil pH was weakly acidic with a pH value of 5.8 which groundnut can tolerate. Available phosphorus was high, organic matter, magnesium, effective cation exchange capacity (ECEC) and base saturation were moderate, while total nitrogen, exchangeable calcium, potassium, sodium, and acidity were low. Soil of this description is inherently low in some essential nutrient (Enwezor *et al*.,1991).

The various varieties evaluated in this study showed variations at 7 WAP in plant height, number of branches, stem girth and days to 50 % flowering. This observation is in line with Onwubiko *et al.* (2010), who reported that there are variations in the yield parameters of some improved varieties of groundnut. Zamen *et al*. (2011), Also had similar observation. The differences in growth and yield parameter recorded among the varieties suggest possible variations in the genes controlling the characters in different varieties. This observation agrees with Shambhakah *et al.* (2006) and Zamurrad. *et al* (2013) who observed variations in the growth parameters of groundnut species evaluated in Pakistan which they attributed to specific genetic characteristics of the varieties. It was observed that SAMNUT 24 consistently produced significantly higher vegetative growth than others in the study area whereas

SAMNUT 25 had significantly higher pod yield, seed yield and harvest index.

It was also observed that the various planting date varied significantly in plant height, number of leaves, number of branches, stem girth, leaf area index, days to 50 % flowering, number of nodules, days to maturity, pod length, number of filled pods, number of unfilled pods, number of seeds per pod, 100-seed weight, harvest index, total biomass, haulm weight, pod yield and seed yield. Only shelling percentage was not significant for planting date. This result of growth and yield parameters of groundnut further agree with the findings of Debjani and Rabinda (2014) who reported that shifting of sowing dates has significant effects on growth and yield parameters of groundnut. It was observed that the planting date of September and April showed consistently increased values in vegetative attributes such as plant height, number of leaves, number of branches, stem girth, leaf area index and days to 50 % flowering, while June planting date had higher pod yield, seed yield and harvest index. This observation disagrees with the findings of Swanvelder (1998) and Taminu (1996) who reported higher yield in October and July respectively at Samaru.

Most of the pods from September planting got rotten and began to sprout due to high moisture content in the soil. Ibrahim, (2010) also reported that total pod yield of groundnut was influenced significantly by factors such as soil moisture. April planting produced higher biomass weight of 1.99 t/ha and haulm weight of 594.44 kg/ha. June produced significantly ($P<0.05$) higher number of filled pods of 21.76 and pod yield of 1.49 t/ha and seed yield of 1.41tonnes/ha in 2020 and pod yield of 1.50 t/ha and seed yield of 1.40 t/ha in 2021, which could be attributed to the rainfall that was relatively stable and evenly distributed during this period. May gave the highest number of unfilled pods, followed by October. October planting gave the least pods yield due to early end of rain and these findings agrees with Bala *et al.* (2011), who attributed it to the inability of late sown crop to fully harness and utilize available natural resources. This agrees with Stadler (2009) who reported that pod filling in legumes is the most crucial process in the crop and can be hindered. It was also observed that groundnut seed yield obtained in this study was generally lower. This can be attributed to the fact that growth and development of groundnut is greatly influenced by complex uncontrolled environmental factors. This agrees with the observation by (Adewuyi *et al*., 2024; Caliskan *et al*., 2008) that crop management practices such as cultivar selection, time of sowing and duration of cultivar's life cycle may influence the growth, yield and seed quality of groundnut but sowing date can be adjusted to mitigate some the adverse effects of environmental stress.

Futuless *et al.* (2011), also had similar observation and reported that the difference observed in number of pods per plant on different planting dates could be explained in terms of fewer flowering nodes, rainfall

pattern and suppression of both primary and secondary branches.

There was significant interaction effect on days to maturity, number of filled pods, total biomass, pod yield and seed yield. From the result of this study, SAMNUT 25 planted in June of 2020 and 2021 had the highest pod yield of 1.62 and 1.70 tons/hectare, seed yield of 1.60 and 1.60 tons/hectare and harvest index of 0.84 and 0.86, respectively while SAMNUT 26 planted in April gave the highest total biomass (2.00 tons/hectare) and haulm weight of 666.67 and 616.67 kg/hectare in both years.

Conclusion / Recommendation

Based on the results of the experiment, since each of the variety showed superiority in some variables than the others, the following recommendations are made under rain fed agriculture.

1. In June, SAMNUT 25 is the preferred crop for cultivation in the study area if the primary objective is to increase seed yield.
2. In April, SAMNUT 26 is the preferred crop for cultivation in the study location if the primary objective is to produce haulm weight for animal consumption.

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