IMPACT OF VARIETY AND VARIABLE RATES OF COW DUNG ON GROWTH CHARACTERS OF GROUNDNUT IN ABRAKA, NIGERIA.

Abstract

A study was carried out in Teaching and Research Farm of Delta State, Abraka in 2022 and repeated in 2023 farming seasons to assess the impact of variety and variable rates of cow dung on growth characters of groundnut in Abraka, Nigeria. It was a 2 x 5 factorial experiment in randomized complete block design with three replications. Seven parameters were investigated to achieve the objectives of the study, including initial soilphysico-chemical properties of the experimental site before planting, percentage emergence of the varieties after 10 days of planting based on different rates of cow dung applied, plant height, number of branches per stand, number of leaves per stand, leaf area and chemical properties of the cow dung used for the study. The results of the study showed that Samnut-21 was superior in all the parameters assessed, while manure application rate of 20 tha^{-1} was outstanding in performance of the growth characters. It was therefore recommended that farmers in the study area adopt Samnut-21 and 20 tha^{-1} of cow dung for groundnut production in Abraka, Delta State, Nigeria.

Keywords: *Impact of groundnut variety, growth characters, variable rates of cow dung, Abraka, Nigeria.*

Introduction

Groundnut(*Arachishypogaea*L.)isa leafy annuallegume cropthatproducesitspodinsidethesoil(Ajeigbe, *et al*; 2014). As an industrial cash and foodcrop,itplaysasignificantroleintheNigerianeconomy,employingabout70%oftheruralandurban population (Hakeem *et al*; 2015). Groundnut issecond to soybean among the food legume crops. Itcontains 40% - 50% edible fat, 20-50% protein, 10 –20% carbohydrates and other essential vitamins andminerals (Briend, 2001). Groundnut is used for human consumption, animal/livestockfeed,paint,polish,explosivesandsoap.Amoke (2019) posited that it is used as carrier for drugs like penicillin andadrenaline and that the oil is used medically as laxative andemollient. The researcher further indicated that groundnut production is influenced by differences in agro-ecologicalfactorssuchasrainfall,temperatureandsoilcondition.Groundnutperforms best in sandy loamsoilrichincalciumandphosphorus for pod formation,in addition to adequatesunshineandwelldistributedrainfall(Hakeem*etal*; 2015). The researcher further indicated that the cultivation of groundnut inNigeriaoccurs in five major producing states, including Kano,Kaduna,Katsina,BornoandSokoto.InNigeria,productionofgroundnutisintensebutyields are low due to inability to identify the varietybestsuitedforeachagro-ecologicalzone,decliningsoilfertility,pooragronomicpracticesandirregular/inadequaterainfall,Ibrahim*etal*.(2000)indicated that the growthcharactersofcropsvariedbecauseofthedifferencesintheirgeneticmakeup.OdeleyeandOdeleye(2001)suggestedthatsincecropvarietiesdifferinleafareaandothergrowthcharacters,breedersmustselectthe mostpromisingcombinersofgoodtraitsintheirbreedingprogrammeswithaviewtoenhancinggrowth and eventual yield.Enujeke(2013)tracedthedifferences in growth characters and yield of crops toleafarrangement,chlorophyllcontent,lightdistributionandphotosyntheticenzymesthatinterplayto affectgrowth,maturityperiodandyield.Thakur*etal.*(2002),indicatedthat crop varieties yield differently in differentecologicalzones,and some varieties can only express their full genetic potential when offeredadequate management resources such as choosing the right site, providing timelyandappropriate establishment, opportunity offering adequate

nutrition,diseaseandpestcontrol,timely harvesting toproperharvesting,andproducedisposaland/or storage. Odeleye and Odeleye (2001) posited thatimprovedcropvarietiesaresuperior intransferring assimilates to the ear sink, hence they yield higher thanlocalvarieties.

The numerous uses of groundnut inNigerianeconomy notwithstanding, therehasbeenadecrease in it production over the years because of inability to identify the variety best suited for eachagro-ecologicalzone,(Audi*etal*.,2013).Also, information with the respect tothe suitable variety ofgroundnutforlarge scale cultivation inAbraka areaof Delta State is lacking. Theobjectiveofthisstudytherefore was to determine the best rate of cow dung for the most suitable variety of groundnut in the study area.

Materials and Methods

Sitedescription

TheresearchwascarriedoutattheTeachingandResearchFarmofDeltaStateUniversity,Abraka,Delta State. Abraka lies between Latitude 6^0 4^0E and Latitude 5^0 54^0 N.Rainyseasonstarts in Apriland ends in October, whiledry season is fromNovemberto March.Temperaturerangesfrom 25^{o}–31^{o}C,whileannualrainfall is between2000mm to 3000mm annually (Efe and Aruegodor,2003).

Soilanalysisandanalyticalprocedure

Soil samples werecollectedrandomlyatadepthof0–15cmusingsoilauger.Thesampleswere air-dried, crushed and sieved with 2 mm sievemeshbefore analyzing forphysico-chemicalproperties.Particlesizedistributionwasascertainedbyhydrometer method (Gee and Bauder, 1986). The pHwas known using Pyeunican model MK 2pH meterin a 1:2:5 soil water suspension ratio. Organic carbonwasmeasured byWalkey-Blackwetoxidationmethod (Nelson and Sommer, 1982). Total nitrogenwasdetermined bymicro-kjedahldistillationtechnique asdescribedbyBremiuerandMulvancy(1982).Available phosphorus was assessed using Bray No. 1method(IITA,1979).Exchangeablepotassiumwasmeasured byFlamephotometer,whilecationexchangecapacity(CEC)wasknown byAmmoniumacetatesaturationmethod(Roades,1982). The cow dung used for the study wasanalyzedasindicated by IITAmanuals(1979).

Field work: A land measuring $132m^2$ (12m x 11m)wasclearedusing cutlass andtilledusinghoe.Threereplicatesmade up of fiveplotseach measuring 3mx 2mand separatedfromone another with a space of 0.5m marked out. Alleypathwaysof1mseparatedonereplicate fromtheother. The total number of plots laid out in the entireexperiment was thirty.Two groundnut seeds were plantedper hole at 5cm depth, using aspacing of 60cm by 40cm,but later thinned to oneplantperstand.Regular weeding was done usinghoe.Eightmiddlestandswere used as samplepopulationfordatacollection.Datacollectedwereinitial physico-chemical properties, percentage emergence, nutrient contents of cow dung use for the study, plant height, number of leaves, number of branches,and leaf area.Datacollectedweresubjectedtoanalysisofvariance(ANOVA)anddifferencesbetweenmeanswer eseparatedwithDuncanMultipleRangeTest(DMRT)using SAS 2005.

Results and Discussion

Initialphysico-chemical properties ofexperimentalsite

The initial physic-chemical properties of the soil usedforthestudyisshowninTable1.Particlesizedistributionshowsthatthesoilsweresandyloamthatis not fertile as indicated by the low organic mattercontent (12.4 gkg^{-1}) and total nitrogen of 0.62 gkg^{-1}).Availablephosphoruswas5.2gkg^{-1}),whilewatersoluble potassium (K) was 0.12 $cmolkg^{-1}$ which werelowbasedonFMANR(1996)ratingsforAbrakaenvironment.Thecationexchangecapacitywas9.20cmolkg^{1}. These low fertility values of the studyarea are typical of humid environments where heavyrainfallerodes,leachesandweatherslowactivityclaymineralsresultinginhighsoilacidity

The sandy loam texture of the experimental site may be attributed to the parent material (PM) from which the soil was formed and the climate of the area. The soil might be formed from sandstone and quartz parent materials. This is consistent with the report of Brady and Weil (1999) who indicated that high sand content of soil could be attributed to high content of quartz in the parent material. The acidic nature of the soil, low available phosphorus and soluble potassium may be traced to heavy rainfall which causes erosion and leaching of low activity clay minerals in the area as reported by Esu (2001), Enujeke (2013). The low organic matter status of the experimental site could be attributed to rapid decomposition of organic residues due to high solar radiation and moisture which favour optimum microbial activities in the soil. It could also be attributed to the annual bush burning which tend to deplete organic matter accumulation in the soil (Landor, 1991; Enujeke, 2013). The low levels of total nitrogen could be attributed to leaching of nitrate by torrential rainfall prevalent in the environment (Esu (2001); Enujeke, 2013).

Table 1: Soilphysico-chemicalpropertiesofexperimentalsite

Soilproperty	**Value**
Particlesizefractions(%)	
Coarsesand	35.0
Finesand	45.0
Silt	13.0
Clay	7.0
Texturalclass Sandyloam	
pHH_2O	5.2
Organicmatter(gkg^{-1})	12.4
TotalNitrogen(gkg^{-1})	0.62
AvailableP($mgkg^{-1}$)	5.2
ExchangeableK($cmolkg^{-1}$)	0.12
Cation exchange capacity ($cmolkg^{-1}$)	9.20

Chemical properties of the cow dung used for the study: Theanalyticalvaluesofthecowdungusedforthestudyareshowninthe Table2 Theresultshowedthatthequantitiesofmacroandmicronutrientsinthecow dung were adequate to enhance increased growthandyieldofcrops,includinggroundnut.

Table 2: Chemical properties of the cow dung used for the study

Nutrient elements	Values obtained
N (%)	1.40
P (%)	1.0
K (%)	0.42
Ca (%)	3.30
Mg (%)	0.32
Fe ($mgkg^{-1}$)	1584
Mn ($mgkg^{-1}$)	474
Zn ($mgkg^{-1}$)	592
Cu ($mgkg^{-1}$)	480

Effect of variety and rates of cow dung on percentage emergence of groundnut in 2022 and 2023

The response of percentage emergence of groundnut to variety and rates of cow dung in 2022 and 2023 is shown in Table 3 In 2022, significant differences were observed in percentage emergence of the two groundnut varieties investigated. Samnut - 21 had higher percentage emergence (91.2%) than Samnut – 22 which had 86.2%. Similar trend was observed in 2023 where Samnut – 21 had higher percentage emergence (92.4%) than Samnut – 22 which had 87.4% emergence.

With respect to rate of application of cow dung, plants that received 20 tha^{-1} of manure had the highest percentage emergence (96%) in 2022, while plants that did not receive manure (control plot or 0tha^{-1}) had the lowest percentage emergence of 88%. The trend did not change in 2023, where groundnut plants that received 20tha^{-1} of cow dung had the highest percentage emergence (98%) while plants that received 0tha^{-1} had the lowest percentage emergence (88%).

The interaction effects (Tables 8 and 9) indicated that variety, rate, and variety x rate were significantly ($p < 0.05$) different in both years of evaluation.

Table 3: Effects of variety and rates of cow dung on percentage (%) emergence of groundnut in 2022 and 2023.

	Percentage emergence		
	2022	2023	Mean
Variety			
Samnut -21	91.2_{a}	92.4_{a}	91.8
Samnut -22	86.2	87.4	86.8
Rates of application of cow dung (tha^{-1})			
0	88_{dd}	88_{de}	88
5	89_{C}	89_{d}	89
10	90_{C}	92_{C}	91
15	93_{b}	95_{b}	94
20	96_{a}	98_{a}	97

Meanswiththesameletter(s)undersamecolumnarenotsignificantlydifferentat5%levelofprobabilityusingDuncanMultipleRange Test(DMRT).

Effects of variety and rates of cow dung on plant height of groundnut in 2022 and 2023.

Table 4 shows the effects of variety and rates of cow dung on plant height of groundnut in 2022 and 2023. There were significant differences in plant height in both years of evaluation. In 2022, Samnut – 21 had higher plant height (8.5cm) than Samnut – 22 which had height of 6.1cm at 30 days after planting. Similar trend was observed in 2023 where Samnut – 21 was 8.8cm higher than Samnut – 22 which was 6.5cm at 30DAP.

At 60DAP, Samnut – 21 had superior plant height (12.4cm) than Samnut – 22 which had plant height of 10cm in 2022. The trend was the same in 2023 when Samnut – 21 plants were superior in height (12.8cm) than Samnut – 22 plants with value of 10.4cm.

At 90DAP, Samnut – 21 also had higher of 16.2cm while Samnut – 22 had lower height of 12.4cm in 2022. In 2023, similar trend was observed. Samnut – 21 had plant height of 16.6cm while Samnut – 22 had plant height of 12.4cm.

With respect to rates of cow dung applied, plants that received manure application rate of 20tha^{-1} were outstanding at 30DAP, 60DAP and 90DAP with values of 13.6cm in 2022, 13.8cm in 2023, 15.8cm in 2022 and 16.0cm in 2023, 16.6cm in 2022 and 16.8cm in 2023, respectively. Plants that received 0tha^{-1} of manure (control) had lowest plant height at 30DAP, 60DAP and 90DAP with values of 8.5cm in 2022, 8.7cm in 2023, 10.0cm in 2022 and 10.2cm in 2023, 11.4cm in 2022 and 11.6cm in 2023, respectively.

Interaction effects (Tables 8 and 9) showed that in both years of evaluation, variety, rate, variety x rate all significantly ($p < 0.05$) different.

Table 4 Effects of variety and rates of cow dung on plant height (cm) of groundnut in 2022 and 2023.

	Days after planting								
	Plant height (cm)								
	30			60			90		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
Variety									
Samnut -21	8.5_a	8.8_a	8.65	12.4_a	12.8_a	12.6	16.2_a	16.6_a	16.4
Samnut -22	6.1_b	6.5_b	6.30	10.0_b	10.4_b	10.2	12.4_b	12.6_b	12.5
Rates of application of cow dung (tha^{-1})									
0	8.5_C	8.7_C	8.6	10.0_C	10.2_C	10.1	11.4_C	11.6_C	11.5
5	8.8_C	9.0_C	8.9	10.4_C	10.6_C	10.5	11.6_C	11.8_C	11.7
10	9.0_C	9.2_C	9.1	11.1_C	11.3_C	11.2	12.0_C	12.2_C	12.1
15	11.1_b	11.5_b	11.3	13.6_b	13.2_b	13.4	14.2_b	14.4_b	14.3
20	13.6_a	13.8_a	13.7	15.8_a	16.0_a	15.9	16.6_a	16.8_a	16.7

Meanswiththesameletter(s)undersamecolumnarenotsignificantlydifferentat5%levelofprobabilityusingDuncanMultipleRange Test(DMRT).

Effects of variety and rates of cow dung on number of branches/plant of groundnut in 2022 and 2023.

The response of number of branches/plant of groundnut to variety and rates of cow dung in 2022 and 2023 is shown in Table 5. At 30 DAP of 2022,Samnut – 21 variety had higher number of branches/plant (4.4) than Samnut – 22 which had 4.2 branches/plant. There were no significant differences in number of branches/plant between the two varieties. With respect to manure

application rates, both plants that received 15tha^{-1} and 20tha^{-1} of cow dung had highest but equal number of branches/plant (4.2 branches) which plants that received other manure application rates (0tha^{-1}, 5tha^{-1} and 10tha^{-1}) had 4.1 braches/plant. Significant differences were not also observed. Similar trend was observed in 2023. Samnut – 21 variety had 4.4 branches/plant; while Samnut – 22 had 4.2 branches/plant. There were no significant differences in number of branches/plant of the two varieties investigated. Plants that received 20tha^{-1} of cow dung were superior to plants that received other manure application rates with value of 4.6 branches/plant while plants that received 0tha^{-1}, 5tha^{-1} and 10tha^{-1} had 4.1 branches/plant.

At 60DAP of 2022 and 2023, Samnut – 21 was superior to Samnut – 22 with respect to higher number of branches/plant of 5.5 and 5.9, respectively; while Samnut – 22 had lower number of branches/plant of 5.2 and 5.2, respectively. Plants that received 20tha^{-1} of cow dung were also superior in number of branches/plant with values of 5.8 in 2022 and 6.4 in 2023, respectively while plants that did not receive cow dung had lowest number of branches/plant of 5.3 in 2022 and 5.5 in 2023, respectively. Significant differences were only observed in number of branches/plant of the varieties and manure application rates in 2023 at 60DAP.

At 90DAP in 2022 and 2023, significant differences were observed in number of branches/plant of both varieties tested and rates of application of cow dung. Samnut – 21 had higher number of branches/plants than Samnut – 22 with values of 6.5 in 2022 and 6.7 in 2023, respectively; while Samnut – 22 had lower number of branches/plant with values of 6.2 in 2022 and 6.4 in 2023. With respect to manure application rates, plants that received 20tha^{-1} had highest number of branches/plant with 6.2 in 2022 and 6.8 in 2023, respectively while plants that received 0tha^{-1} of cow dung had lowest number of branches/plant with values of 5.4 in 2022 and 5.6 in 2023, respectively.

The interaction effects (Tables 8 and 9) showed that variety, rate of application of cow dung were only significantly ($p < 0.05$) different at 60DAP of 2023, at 90DAP of 2022 and 2023.

Table 5 Effects of variety and rates of cow dung on number of branches/plant of groundnut in 2022 and 2023.

	Days after planting →								
	Number of branches/plant →								
	30			60			90		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
Variety									
Samnut -21	4.4_a	4.4_a	4.4	5.5_a	5.9_a	5.7	6.5_a	6.7_a	6.6
Samnut -22	4.2_b	4.2_a	4.2	5.2_a	5.2_b	5.2	6.2_b	6.4_b	6.3
Rates of application of cow dung (tha^{-1})									
0	4.1_a	4.1_a	4.1	5.3_a	5.5_b	5.4	5.4_b	5.6_b	5.5_b
5	4.1_a	4.1_a	4.1	5.4_a	5.6_b	5.5	5.4_b	5.6_b	5.5
10	4.1_a	4.1_a	4.1	5.5_a	5.7_b	5.6	5.6_b	5.6_b	5.6
15	4.2_a	4.2_b	4.2	5.5_a	5.7_b	5.6	5.6_b	6.0_b	5.8
20	4.2_a	4.6_a	4.4	5.8_a	6.4_a	5.7	6.2_a	6.8_a	6.5

Meanswiththesameletter(s)undersamecolumnarenotsignificantlydifferentat5%levelofprobabilityusingDuncanMultipleRange Test(DMRT).

Effects of variety and rates of cow dung on number of leaves/plant of groundnut in 2022 and 2023.

The effects of variety and rates of cow dung on number of leaves/plant of groundnut in 2022 and 2023 is shown in Table 6 At 30DAP of 2022 and 2023, Samnut – 21 had higher number of leaves/plant with values of 36.2 in 2022 and 38.4, respectively while Samnut – 22 had lower number of leaves/plant with values of 29.5 in 2022 and 32.3, respectively.

Based on rates of application of cow dung, plants that received 20tha^{-1} were outstanding in number of leaves/plant with values of 36.6 in 2022 and 38.0 in 2023. Significant differences were observed between the varieties investigated and rates of manure applied in both years of evaluation.

At 60DAP, similar trend was observed. Samnut – 21 had higher number of leaves/plant with values of 42.4 in 2022 and 43.2 in 2023, while Samnut – 22 had lower number of leaves/plant with values of 38.2 in 2022 and 40.0 in 2023. Manure application rates indicated that plants which received 20tha^{-1} were superior to other rates of application with values of 42.6 leaves/plant in 2022 and 43.0 leaves/plant in 2023. Plants in the control plots which received 0tha^{-1} of cow dung had the lowers number of leaves/plant with values of 30.2 in 2022 and 32.6 in 2023. There were significant differences in number of leaves/plant between the varieties and rates of manure investigated in the two years of assessment.

At 90DAP, Samnut – 21 was also superior in number of leaves/plant with values of 49.4 in 2022 and 50.2 in 2023, while Samnut – 22 had lower number of leaves/plant with values of 45.2 in 2022 and 47.2 in 2023. Based on manure application rates, plants that received 20tha^{-1} had highest number of leaves/plant with values of 48.8 in 2022 and 50.8 in 2023, while plants that did not receive cow dung had lowest number of leaves/plant with values of 34.0 in 2022 and 38.2 in 2023, respectively. Significant differences were generally observed in number of leaves/plant between the varieties tested and manure application rates in the two years of evaluation.

The interaction effects (Tables 8 and 9) indicated that variety, rate of application of cow dung were significantly ($p < 0.05$) different in both years of evaluation.

Table 6. Effects of variety and rates of cow dung on number of leaves/plant of groundnut in 2022 and 2023.

	Days after planting								
	Number of leaves/plant								
	30			60			90		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
Variety									
Samnut -21	36.2_a	38.4_a	37.3	42.4_a	43.2_a	42.8	49.4_a	50.2_a	49.8
Samnut -22	29.5_b	32.3_b	30.9	38.2_b	40.0_b	39.1	45.2_b	47.2_b	46.2
Rates of application of cow dung (tha^{-1})									
0	23.6_e	26.2_e	24.9	30.2_e	32.6_e	31.4	34.0_e	38.2_e	36.1
5	26.2_d	31.2_d	28.7	33.4_d	35.2_d	34.3	38.2_d	41.4_d	39.8
10	28.4_C	33.6_C	31.0	36.2_C	38.4_C	37.3	43.4_C	45.2_C	44.3
15	33.4_b	35.4_b	34.4	40.1_b	40.9_b	40.5	46.2_b	47.2_b	46.7
20	36.6_a	38.0_a	37.3	42.6_a	43.0_a	42.8	48.8_a	50.8_a	49.8

Meanswiththesameletter(s)undersamecolumnarenotsignificantlydifferentat5%levelofprobabilityusingDuncanMultipleRange Test(DMRT).

Effects of variety and rates of cow dung on leaf area of groundnut in 2022 and 2023.

The response of leaf area of groundnut to variety and rates of cow dung in 2022 and 2023 is shown in Table 7 At 30DAP of 2022 and 2023, Samnut – 21 had higher leaf area (298cm^2 in

2022 and 306cm^2 in 2023) than Samnut – 22 which had leaf area of 264cm^2 in 2022 and 270cm^2 in 2023. Manure application rates indicated that plants that received 20tha^{-1} were outstanding in leaf area with values of 300cm^2 in 2022 and 304cm2 in 2023, while plant that received 0tha^{-1}had the lowest leaf area with values of 252cm^2 in 2022 and 260cm^2 in 2023. The trend did not change at 60DAP. Samnut – 21 had higher leaf area (1420cm^2 in 2022 and 1430cm^2 in 2023) than Samnut – 22 which had leaf area of 1240cm^2 in 2022 and 1252cm^2 in 2023. Based on rate of cow dung applied, plants that received 20tha^{-1} had highest leaf area of 1420cm^2 in 2022 and 1430cm^2 in 2023, while plant which did not receive cow dung had lowest leaf area (1372cm^2) in 2022 and 1382cm^2 in 2023.

At 90DAP, Samnut – 21 had higher leaf area of 1510cm^2 in 2022 and 1522cm^2 in 2023, than Samnut – 22 which had 1424cm^2 in 2022 and 1434cm^2 in 2023. Manure application rates showed that plant that received 20tha^{-1} had the highest leaf area of 1510cm^2 in 2022 and 1522cm^2 in 2023 while plants that did not receive cow dung had the lowest leaf area of 1442cm^2 in 2022 and 1452cm^2 in 2023. Significant differences were generally observed in leaf area of between the varieties of groundnut assessed and the rates of manure applied in 2022 and 2023.

The interaction effects (Tables 8 and 9) showed that variety, rate of cow dung were significantly ($p < 0.05$) different in both years of the investigation.

Table 7 Effects of variety and rates of cow dung on leaf area of groundnut in 2022 and 2023.

	Days after planting								
	Leaf area (cm^2)								
	30			60			90		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
Variety									
Samnut -21	298_a	306_a	302	1420_a	1430_a	1425	1510_a	1522_a	1516
Samnut -22	264_b	270_b	267	1240_b	1252_b	1246	1424_b	1434_b	1429
Rates of application of cow dung (tha^{-1})									
0	252_e	260_e	256	1372_e	1382_e	1377	1442_e	1452_e	1447
5	278_d	282_d	280	1308_d	1384_d	1382	1468_d	1474_d	1471
10	284_C	288_C	286	1392_C	1404_C	1398	1480_C	1488_C	1484
15	296_b	300_b	298	1400_b	1420_b	1410	1492_b	1498_b	1495
20	300_a	304_a	302	1420_a	1430_a	1425	1510_a	1522_a	1516

Meanswiththesameletter(s)undersamecolumnarenotsignificantlydifferentat5%levelofprobabilityusingDuncanMultipleRange Test(DMRT).

Table 8: Effects of interaction of variety and rates of cow dung on growth characters of groundnut in 2022.

		Days after planting											
		30				60				90			
	Rate of cow dung (tha^{-1})	Plant height (cm)	No. of Branches	No. of Leaves	Leaf area (cm^2)	Plant height (cm)	No. of Branches	No. of Leaves	Leaf area (cm^2)	Plant height (cm)	No. of Branches	No. of Leaves	Leaf area (cm^2)
Variety													
Samnut - 21	0	8.5	4.1	23.6	252	10.0	5.3	30.2	1372	11.4	6.4	34.0	1442
	5	8.8	4.2	26.2	278	10.4	5.4	33.4	1380	11.6	6.4	38.2	1468
	10	9.0	4.4	29.4	284	11.1	5.5	37.2	1392	12.0	6.6	43.4	1490
	15	11.1	4.6	35.2	298	13.6	5.5	42.1	1440	14.2	6.6	47.3	1542
	20	13.6	4.8	38.6	320	15.8	5.8	44.6	1480	16.6	6.8	50.8	1590
	Mean	10.2	4.4	30.6	286.4	12.1	5.5	37.5	1413	13.2	6.6	42.7	1506.4
Samnut - 22	0	6.10	4.0	21.4	186	8.2	4.2	27.6	1040	9.0	4.4	32.0	1320
	5	7.2	4.1	23.0	208	8.6	4.4	30.0	1010	9.8	4.6	36.2	1360
	10	8.0	4.2	25.0	220	9.4	5.1	33.0	1160	10.2	5.2	40.1	1380
	15	9.0	4.3	27.2	242	10.2	5.3	36.2	1240	11.0	5.4	42.2	1410
	20	10.0	4.4	29.8	276	11.4	5.4	38.6	1280	13.2	5.6	45.5	1440
	Mean	8.1	4.2	25.3	226.4	9.6	4.9	33.1	1146	10.6	5.04	39.2	1382
Variety		*	ns	*	*	*	*	*	*	*	*	*	*
Rate		*	ns	*	*	*	*	*	*	*	*	*	*
Variety x Rate		*	ns	*	*	*	*	*	*	*	*	*	*

*Legend * = significant at 0.05 level of probability, ns = not significant*

Table 9: Effects of interaction of variety and rates of cow dung on growth characters of groundnut in 2023.

			Days after planting										
			30			60				90			
	Rate of cow dung (tha^{-1})	Plant height (cm)	No. of branches	No. of leaves	Leaf area (cm^2)	Plant height (cm)	No. of branches	No. of leaves	Leaf area (cm^2)	Plant height (cm)	No. of branches	No. of leaves	Leaf area (cm^2)
Variety													
Samnut - 21	0	8.7	4.1	26.2	260	10.2	5.5	32.6	1382	11.6	5.6	38.2	1452
	5	9.0	4.1	31.2	282	10.6	5.6	35.2	1384	11.8	5.6	41.4	1474
	10	9.2	4.1	33.6	288	11.3	5.7	38.4	1404	12.2	5.6	45.2	1488
	15	11.5	4.2	35.4	300	13.2	5.7	40.9	1420	14.4	6.0	47.2	1498
	20	13.8	4.6	37.3	304	16.0	6.4	43.0	1430	16.8	6.8	50.8	1522
	Mean	10.4	4.2	32.7	287	12.3	5.8	38.0	1404				
Samnut - 22	0	6.2	4.0	22.8	196	8.0	5.1	30.2	1202	10.2	5.2	34.6	1320
	5	6.8	4.0	24.0	206	8.6	5.1	32.0	1220	10.5	5.2	38.2	1360
	10	7.2	4.1	26.0	220	9.2	5.2	34.1	1260	10.8	5.3	40.7	1380
	15	9.0	4.2	28.1	242	10.4	5.3	36.3	1310	12.0	5.4	43.2	1418
	20	11.2	4.5	39.6	268	12.2	5.6	38.8	1340	14.0	5.8	45.8	1460
	Mean	8.1	4.2	26.3	226	9.7	5.3	34.3	1266	11.6	5.4	40.5	1388
Variety		*	ns	*	*	*	*	*	*	*	*	*	*
Rate		*	ns	*	*	*	*	*	*	*	*	*	*
Variety x Rate		*	ns	*	*	*	ns	*	*	*	ns	*	*

*Legend * = significant at 0.05 level of probability, ns = not significant*

Effects of variety and rates of cow dung on growth characters of groundnut

Growth parameters of groundnut including percentage emergence, plant height, number of leaves and leaf area, increased as cow dung application rate increased. This may be adduced to increased supply of nutrients, better utilization of carbon and synthesis of assimilates which as reported by Eifediya and Remison (2010) on growth characters of cucumber. It could also be attributed to mineralization of ammonia present in cow dung, leading to the release of nitrogen for enhancement of crop, vegetable growth. This is similar to the findings of Mehedi*et al* (2012) and Enujeke*et al*. (2022) who traced the increase in vine length, number of leaves and branches of watermelon to possible release of nitrogen from mineralized ammonia present in cow dung. It is also synonymous to the report of Shao *et al.* (2023)who recommended a synergetic application in fertilizer (DAP) and bioslurry to potato farmers for soil fertility management and enhanced crop productivity. This is also similar to the report of Heydarzadeh*et al.* (2023) which recommended that organic fertilizers such as vermi compost and poultry manure be used to substitute chemical fertilizers with a view to popularizing organic crops using rainfed and supplementary irrigation. Similar report was forwarded by Ranjan*et al*. (2023) which indicated that integrated use of chemical fertilizers and organic manures on a long-term basis improves soil fertility and crop productivity with the potential to enhance soil sustainability.It is consistent with the findings ofGudugi (2013),Thakur*et al*. (2002), Stevens *et al*. (2018) and Tilley (2012)which reported increased vegetative growth of vegetables due to addition of nitrogen released from organic fertilizers. It also affirmed the report of Sow *et al.* (2023) which posited that the application of animal manure to crops (organic farming) averts the challenges and hazards associated with the continuous use of chemical fertilizers as well as helps to achieve sustainable agriculture.

Conclusion

The study was carried out to assess the impact of impact of variety and variable rates of cow dung on growth characters of groundnut in Abraka, Nigeria. It was specifically aimed at determining the best rate of manure for the most suitable variety of groundnut in the study area. The varieties of groundnut were Samnut-21 and Samnut-22, while the rates of cow dung were O tha^{-1}, 5 tha^{-1}, 10 tha^{-1}, 15 tha^{-1} and 20 tha^{-1}. It was a 2 x 5 factorial experiment in randomized complete block design with three replications. Seven parameters were investigated to achieve the objectives of the study, including initial physico-chemical properties of the experimental site, percentage emergence, plant height, number of branches per stand, number of leaves per stand, leaf area and chemical properties of the cow dung used for the study the results of the study showed that Samnut-21 was superior in all the parameters assessed, while manure application rate of 20 tha^{-1} was outstanding in performance of the growth characters. It was therefore recommended that farmers in the study area adopt Samnut-21 and 20 tha^{-1} of cow dung for groundnut production in Abraka, Delta State, Nigeria.

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