

Influence of Cowdung Fertilization and Spacing on Growth and Yield of Cowpea (*Vigna Unguiculata* L. Walp) Varieties in Teaching and Research Farm of Federal University, Dutsin-Ma, Nigeria

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ABSTRACT

Field trials were conducted during 2021/2022 and 2022/2023 wet seasons at Teaching and Research Farm of Federal University, Dutsin-Ma, Katsina State to evaluate the growth, Yield and Yield Components of Cowpea varieties as influenced by cowdung fertilization and spacing in n Teaching and Research Farm of Federal University Dutsin-Ma, Nigeria. The treatments consisted of five cowdung fertilizer rates (0 ton ha⁻¹, 5 ton ha⁻¹, 10 ton ha⁻¹, 15 ton ha⁻¹ and 20 ton ha⁻¹), three intra intra-row Spacings (10cm, 15cm and 20cm) and two cowpea varieties (SAMPEA 11 and SAMPEA 12). Treatments were laid out in Split plot design with three replications. The Growth and Yield attributes measured in the field include plant height, number of leaves, number of branches and biomass yield. Others include number of pods plant⁻¹, 100 seed weight, pod weight kg plot⁻¹ and grain yield kg ha⁻¹. Data collected were analyzed using ANOVA procedures and means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability using SAS package. The results indicated that cowdung manure at 20 ton ha⁻¹ significantly outperformed other rates applied in terms of all growth and yield parameters evaluated and 20 cm spacing performed better on almost all growth and yield parameters than other spacings evaluated. SAMPEA 12 had performed significantly better than SAMPEA 11 in terms of plant height, number of leaves, number of branches, Biomass Yield, others are number of pods plant⁻¹, 100 seed weight, pod weight kg plot⁻¹ and Grain Yield kg ha⁻¹. Based on the result obtained from this study, it can be concluded that the combination of SAMPEA 12 with 20 ton ha⁻¹ of cowdung fertilizer and 20 cm intra-row spacing could be adopted for cowpea production in Teaching and Research Farm of Federal University Dutsin-Ma, Nigeria.

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INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is one of the most ancient human protein food sources that have probably been used as a crop plant since Neolithic times (Futuless and Bake, 2009). It is a tropical herbaceous annual leguminous crop. It is one of the most important source of plant based protein in the hot-dry tropics and sub-tropics especially in sub-Saharan Africa (Singh, 2007). Nigeria is one of the world's largest producer of cowpea with an average production of 2.92million tons followed by Niger with 1.10million tons (FAO, 2012). Cowpea is a major staple protein food crop grown in sub-sahara Africa, especially in the dry savannah regions of West Africa. It is known to be the most economically significant African traditional legume (Iteima *et al.*, 2015). Cowpea plays a critical role in the lives of millions of people in Africa and other parts of the world. According to IITA (2019), about 7.6 million tonnes of cowpea are produced annually on about 12.8 million hectares of land worldwide. Cowpea contains 20-25 % of protein, about twice the protein content of most cereals, minerals and vitamins. The leaves, immature pods and seeds are all used as food, and this is an indication that when the crop is given a careful attention, it would be able to support 850 million people in the world, and the high incidence of under nourishment in sub-saharan Africa would reduce (FAO, 2006). The cowpea grains are major source of plant proteins and vitamins for man, feed for animals, young leaves and immature pods are eaten as vegetable and also source of cash income (Muhammed *et al.*, 2013).

The average yield/ha also followed the same trend from 409 kg/ha between 2000 and 2005 to about 851 kg/ha from 2014 to 2017 (FAO, 2017). Studies conducted by Ndor *et al.* (2012) revealed that in Nigeria, more urban households (72%) consume cowpea than any other grain legume, such as groundnut and soybean, an indication that there is a good domestic market, providing an important opportunity to increase incomes and employment and reduce poverty in rural areas. Despite its importance, cowpea production in the West African savannas is faced with numerous constraints such as non-adherence to proper agronomic production practices, poor soil fertility (Haruna *et al.*, 2011), and intermittent drought to mention a few (Nkaa *et al.*, 2014). The combination of these stresses can cause complete crop loss if not properly managed. Researchers in the sub-region have developed several varieties that are either resistant/or tolerant to these stresses (NAERLS, 2012). These varieties, along with improved management practices, have been found to substantially increase yield in West Africa (Kamara *et al.*, 2018).

Farmers use inorganic fertilizer as a means of improving the fertility of poor savannah soil but inorganic fertilizer recently is expensive, sometimes adulterated, sometimes unavailable due to politics in its supply and most importantly could be injurious to environment. Cowdung as an alternative in the proper rates could improve soil fertility level as it's readily available and cheap. Cowdung is an organic (in nature) manure that supplies all the needed plant nutrients for improving soil fertility as well as improving the soil condition

for plant growth (Komolafe,2025). Farmers in the study area do not also adhere strictly to the appropriate spacing required by cowpea and proper spacing is an important yield determining factor thus, resulting in low cowpea yields rather they plant their crops without minding the required spacing of cowpea for better growth and yield performance (Ndor *et al*, 2012). Farmers hardly adhere to proper spacing when cultivating cowpea in Sudan Savannah, this is an important yield determinant that could lead to low yield of cowpea at harvest. Therefore, the use of improved varieties of cowpea in place of the local unimproved varieties by farmers in conjunction with application of proper rates of Cowdung manure and proper spacing in cultivating Cowpea around Dutsinma could increase yield of cowpea.

The combined use of cowdung manure rates, improved cowpea varieties and appropriate spacing as a strategy for high yield will be tried in this trial. It is in view of these factors, this research seeks to exploit the response of cowpea varieties to rates of cowdung fertilizer and spacing in Sudan savannah of Nigeria for better growth and yield performance.

MATERIALS AND METHODS

Field trials were conducted during the 2021/2022 and 2022/2023 wet seasons at the research farm of the Federal University Dutsinma located at the Permanent site, latitude 12°32'0''N, Longitude 7°28'53 E. the site is situated in the northern guinea savanna of ecological zone of Nigeria. The treatment consisted of two improved cowpea varieties V₁-IT89KD-288 (SAMPEA-11) and V₂ -IT89KD-391 (SAMPEA-12)-, five rates of cowdung manure (0.0 ton ha⁻¹, 2 ton ha⁻¹, 4 ton ha⁻¹, 6 ton ha⁻¹ and 8 ton ha⁻¹) and three different intra-row spacings (10, 15 and 20cm).the treatments were combined and laid out in a split plot design with three replications. Cowdung rates and spacing were allocated to main plots while varieties were in the subplots. Soil samples from the study area were collected prior to experimentation with the aid of auger between 0-30 cm from each plot in a diagonal transect from two spots. The samples were bulked and air-dried at room temperature of between 25 and 27 °C for five days, crushed to pass through a 2 mm sieve before they were neatly packed in a properly labeled air tight polythene bags for physical and chemical analysis in a procedure as described by Black, (1965) at the Soil Laboratory, Department of Soil Science, Federal University, Dutsin Ma, Katsina State. The details of weather data for 2021/2022 and 2022/2023 wet seasons are hereby presented as appendixes I and II

Crop Husbandry

A relatively flat, fairly wide area of land without rocky stones was 4 selected; the land was not with waterlogged, stony or undulating, but evenly sprayed out for easy cultivation. The field was cleared by hand held hoe, there after ridges were constructed according to the field layout into gross and net

plots. Planting was carried out at depth of 5cm at spacing of 15 cm x 75cm inter and intra row spacing on 4.5 m/ 4m = 18m² gross plot and 4.5m / 3m= 12m² net plot. The cowpea seeds were treated prior to planting with apron star to make sure that these are free from seed, water and air borne diseases also insect pest attack or damage (without damage holes or wrinkles) or any inert materials. Cow dung as a source of nutrients was applied as par treatment two weeks prior to land preparation to facilitate release of required plant nutrients early to the growing crop. Cowpea varieties obtained from seed unit of Institute for Agricultural Research (IAR) A.B.U-Zaria were sown on 12 Aug 2022 and 5th Aug 2023 according to spacing treatments and weeding was carried out with hands-held hoe at three (3) and six (6) weeks after sowing for a weed free environment. The Cowpea varieties were of medium duration with profuse branching/ spreading habit, which matures between 70-75 days (V₁) , 80-85days (V₂) and has a potential seed yield of 1 ton ha⁻¹ (Odey., 2018). Two seeds were manually sown at Dutsin-ma at spacing of 20 cm x 75cm inter and intra row spacing on 4.0 m/ 3m = 12m² net plot. Thereafter, thinning was carried out at 2 WAS to 1 plant par stand. Incidence of pest and disease was be closely monitored and action would be taken when the need arises. Fully matured cowpea varieties were harvested when the leaves had turned yellow and pod change to yellow and dry. The pods of cowpea do not all mature at the same time thus, the pods are handpicked at different intervals and dried, two or more picked may be required. Data was collected at 4, 8, and 12 WAS on growth parameters like plant height, number of leaves, number of branches, days to 50% flowering, Biomass Yield. Others include number of pods per plant, 100 seed weight, pod weight kg plot⁻¹ and Grain Yield kg ha⁻¹. Data collected were analyzed using ANOVA procedures and means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability using SAS package (Duncan, 1955).

RESULTS AND DISCUSSION

Soils Physical/Chemical Properties of the Experimental Site and Cowdung Analysis

The result of physical and chemical analysis of the soil obtained from the experimental site for the two year trial (Table 1), and revealed that the soil has a Sandy loam textural class that was slightly acidic in nature. It has a low Nitrogen content with moderate content of Organic carbon as well as available phosphorus. There was a low content of exchangeable bases that led to a low cation exchange capacity. Table 1 further showed the result of cow-dung manure analysis carried out on the cowdung manure used during the course of the two year trial. It revealed that a high Nitrogen content was obtained with a moderate phosphorus content as well as low amounts of exchangeable bases were obtained from the poultry manure used in this experiment.

Table 1: Physico-Chemical Proportion of Soil (0-30cm) Taken From the Experimental Sites at Teaching and Research Farm Federal University Dutsin-Ma during 2021/2022 and 2022/2023 Wet Seasons

Soil characteristics	2021/2022	2022/2023
Particle size dissoluble (g.kg ⁻¹)		
Sand	600	580
Silt	360	340
Clay	40	80
Chemical Composition		
PH water (1:2.5)	6.15	6.40
PH in 0.01m CaCl ₂ (1:2.5)	5.45	5.20
Organic carbon (g.kg-1)	15.53	15.84

Total Nitrogen (g.kg-1)	1.85	1.96
Available Phosphorus (g.kg-1)	12.10	16.60
Exchangeable Bases (g.kg-1)		
Calcium (Ca)	3.25	3.40
Magnesium (Mg)	0.65	0.68
Potassium (K)	0.20	0.20
Sodium (Na)	0.16	0.16
Aluminum (Al)	0.50	0.40
Cation Exchange capacity (CEC)	4.72	4.84

Source: Soil Analytical Laboratory, Department of Agronomy, Federal University Dutsinma

Table 2: Nutrient Content of the Cow Dung Manure Used For the Experiments during 2021/2022 and 2022/2023 Wet Seasons at Dutsinma

Chemical compound (g/kg)	2021/2022	2022/2023
Nitrogen (N)	19.80	20.80
Phosphorus (P)	14.60	15.10
Potassium (K)	13.75	13.65
Calcium (Ca)	6.10	5.60
Magnesium (Mg)	5.15	3.61

Source: Agronomy Analytical Laboratory, Federal University Dutsinma, Nigeria.

Plant Height (cm)

The effect of cowdung manure and spacing on plant height of cowpea variety at Dutsin-ma during 2021/2022 and 2022/2023 wet season was presented as table 3. There was a significant response to cowdung fertilizer at 4 WAS only in 2023 on cowpea plant height where 8.0 tons ha⁻¹ resulted in taller plants relative to others evaluated. Cowdung manure application at 8.0 ton ha⁻¹ amongst other rates evaluated in this trial recorded the highest values in all growth and yield parameters evaluated but also had delayed days to 50% flowering. This is probably it contains higher amount of nutrients needed for better and vigorous plant growth thus producing higher yield and yield characters over other rates. Komolafe (2025) reported that higher rates of cowdung application readily releases more nutrients needed for plant growth and development apart from improving the soil physical and chemical properties of the soil.

The effect of spacing on plant height of cowpea was significant at 8 WAS only in 2023 where 20 cm intra-row spacing produced taller plants over others evaluated. Intra-row spacing at 20 cm outperformed other spacings evaluated in all growth including higher biomass yield and yield parameters evaluated though not significant in few parameters evaluated. This was found to be adequate and

support the growing plant to harness and capture all available resources for proper growth, development for higher biomass yield and better yield and yield parameters recorded in this trial. This is similar to the report of Odey, (2018).

The varietal response was also significant at 8WAS only in 2023 where SAMPEA 12 produced taller plants over SAMPEA11SAMPEA 12 outperformed SAMPEA 11 in plant height, number of leaves and number of branches. This could be due to the genetic compositional make up of SAMPEA 12 which has an intermediate maturing duration (80-85 days) while SAMPEA 11 (70-75 days) an extra early maturing variety. SAMPEA 12 stayed a little longer in the field thereby continually harnessing all the available growth factors like adequate moisture, nutrients, sunlight etc. longer than the other variety thus having a higher value of plant height, number of leaves and branches than other varieties evaluated. This is in line with the report of Tran Thi (2003) who reported that the longer the crop variety stays in the field, the more time to take in and harness all the resources necessary for better growth and yield performance. Umoetok *et al.*, (2007) also observed the varietal effect on increased in growth variables including plant height. There was no interaction between the variables on plant height.

Table 3: Effect of Cow Dung Manure, Spacing and Variety on Plant Height (Cm) At Dutsinma during 2021/2022 and 2022/2023 Wet Seasons

Treatment	Plant height (cm)		
	4WAS 2022 - 2023	8WAS 2022 - 2023	12WAS 2022 -2023
Cow dung (C) ton ha ⁻¹			
0	19.11 – 21.21d	29.2 – 34.72	50.32 – 53.21
2	21.32 – 23.66c	31.2 – 36.71	52.65 – 06.70
4	21.87 – 23.98bc	33.2 – 38.75	53.61 – 63.34
6	23.87 – 24.66b	35.2 – 41.70	54.77 – 64.43
8	24.31 – 27.87a	38.2 – 34.75	55.23 – 66.73
SE ±	0.582 – 1.941	1.383 – 2.517	0.896 – 2.73
Significance	NS - *	NS - NS	NS - NS
Spacing (S)			
S ₁ (20cm)	20.13 – 24.22	35.22 – 42.97a	54.86 – 63.94
S ₂ (15cm)	19.58 – 21.62	33.42 – 37.67b	53.84 – 56.49
S ₃ (10cm)	17.62 – 18.72	31.92 – 32.87c	51.82 – 53.96

SE ±	0.431 – 0.398	1.384 – 2.710	0.887 – 2.74
Significance	NS - NS	NS - *	NS - NS
Variety (V)			
V ₁	21.43 – 23.14	34.23 – 36.73b	35.8 – 54.96
V ₂	25.74 – 26.84	37.12 – 38.74a	62.8 – 63.97
SE ±	0.513 – 1.933	1.388 – 2.710	0.898 – 2.92
Significance	NS - NS	NS – NS	NS - NS
Interaction			
C x S	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS
C x S x V	NS - NS	NS - NS	NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, WAS-weeks after sowing.

Number of Leaves plant⁻¹

The effect of cowdung manure and spacing on number of leaves of cowpea variety at Dutsin-ma during 2021/2022 and 2022/2023 wet season was presented as table 4. There was a significant response to cowdung fertilizer at 8 and 12 WAS only in 2023 on cowpea number of leaves where 8.0 tons ha⁻¹ resulted in more leaves relative to others evaluated. Application of higher cowdung manure rate significantly influenced the responses of growth parameters such as plant height, number of branches, leaf area, and shoot dry weight. This agrees with the observation of (Bhangou, *et al.*; 1998, Howard and Albregth, (2003) who reported that plants responded well to improved soil condition with high cowdung manure application. Deepa *et al.*, (2016) had similar results.

The effect of spacing on number of leaves of cowpea was significant at 12 WAS only in 2023 where 20 cm intra-row spacing produced more leaves over others evaluated. This is possible as 20 cm allows the young growing plant to carryout its internal and external responses optimally due to an

environment provided that devoid of unnecessary completion. This is similar to the report of Odey, (2018) who reported that proper spacing (20cm) affords the plant to exhibit better performance in both growth and yield parameters.

The varietal response was also significant at 4 and 8 WAS only in 2023 where SAMPEA 12 produced taller plants over SAMPEA11. SAMPEA 12 stayed a little longer in the field thereby continually harnessing all the available growth factors like adequate moisture, nutrients, sunlight etc. longer than the other variety thus having a higher value of plant height, number of leaves and branches than other varieties evaluated. This is in line with the report of Tran Thi (2003) who reported that the longer the crop variety stays in the field, the more time to take in and harness all the resources necessary for better growth and yield performance. Umoetok *et al.*, (2007) also observed the varietal effect on increased in growth variables including plant height. There was no interaction between the variables on Number of leaves.

Table 4: Effect of Cow Dung Manure, Spacing and Variety on Cowpea Number of Leaves at Dutsinma during 2021/2022 and 2022/2023 Wet Seasons

Treatment	Number of Leaves plant ⁻¹		
	4WAS 2022 - 2023	8WAS 2022 - 2023	12WAS 2022 - 2023
Cow dung (C) ton ha ⁻¹			
0	13.11 – 24.21	29.28 – 34.42d	71.32 – 83.21d
2	14.32 – 27.66	33.24 – 35.71c	72.65 – 86.70c
4	15.87 – 28.98	34.62 – 36.75bc	75.61 – 93.34bc
6	15.87 – 29.66	35.72 – 38.70b	84.77 – 97.43b
8	16.31 – 29.87	38.12 – 40.75a	85.23 – 101.73a
SE ±	0.982 – 1.091	1.831 – 1.887	2.296 – 3.103
Significance	NS - NS	NS - *	NS - *
Spacing (S)			
20	16.13 – 28.22	34.22 – 40.97	84.86 – 103.94a
15	14.58 – 23.62	32.42 – 37.67	73.84 – 96.49b
10	12.62 – 19.72	30.92 – 31.87	71.82 – 93.96bc
SE ±	0.931 – 0.398	1.984 – 1.810	2.687 – 2.64
Significance	NS - NS	NS - NS	NS - NS
Variety (V)			
V ₁	24.43 – 27.14b	47.23 – 47.73b	45.8 – 45.96
V ₂	28.74 – 31.84a	44.12 – 45.74a	42.8 – 43.97
SE ±	0.213 – 1.933	0.388 – 0.710	0.898 – 0.924
Significance	NS - NS	NS - NS	NS - NS
Interaction			
C x S	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS

C x S x V

NS - NS

NS - NS

NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, WAS-weeks after sowing.

Number of Branches plant⁻¹

The effect of cowdung manure and spacing on number of branches of cowpea variety at Dutsin-ma during 2021/2022 and 2022/2023 wet season was presented as table 5. There was a significant response to cowdung fertilizer at 4 and 12 WAS only in 2022 on cowpea number of branches where 8.0 tons ha⁻¹ resulted in plants with more branches relative to others evaluated. This is in line with the report of Howard and Albregth, (2003) who reported that plants responded well to improved soil condition with high cowdung manure application. The effect of spacing on number of branches of cowpea was significant at 12 WAS only in 2023 where 20 cm

intra-row spacing produced plants with more branches over others evaluated. This is possible as 20 cm allows the young growing plant to carryout its internal and external responses optimally due to an environment provided that devoid of unnecessary competition. The varietal response was also significant at 8 WAS only in 2023 where SAMPEA 12 produced plants with more branches over SAMPEA11. This is similar to a report by Subbaro *et al.*, (2014) long duration variety had enough time to utilize all resources for better growth performance thus, higher yield. There was no interaction between the variables on Number of branches.

Table 5: Effect of Cow Dung Manure, Spacing and Variety on Cowpea Number of Branches at Dutsinma during 2021/2022 and 2022/2023 Wet Seasons

Treatment	Number of Branches plant ⁻¹		
	4WAS 2022 - 2023	8WAS 2022 - 2023	12WAS 2022 - 2023
Cow dung (C) ton ha ⁻¹			
0	2.11d – 2.60	3.02 – 3.12	4.32 – 5.21
2	2.32c – 2.76	3.04 – 3.16	5.65 – 6.30
4	2.57bc – 2.78	3.06 – 3.25	5.71 – 6.74
6	2.77b – 2.86	3.07 – 3.35	5.87 – 6.83
8	2.81a – 2.89	3.92 – 3.75	5.93 – 6.93
SE ±	0.154 – 0.081	0.583 – 0.817	0.146 – 0.153
Significance	* - NS	NS - NS	* - NS
Spacing (S)			
S ₁ (20cm)	2.73 – 2.87	3.49 – 4.27	4.86 – 6.11a
S ₂ (15cm)	2.68 – 2.72	3.22 – 3.67	4.44 – 5.49b
S ₃ (10cm)	2.32 – 2.43	3.19 – 3.27	3.82 – 5.29c
SE ±	0.14 – 0.08	0.084 – 0.114	0.171 – 0.14
Significance	NS - NS	NS - NS	NS - NS
Variety (V)			
V ₁ (Sampea 11)	2.23 – 2.54	3.43 – 3.63b	5.18 – 5.46
V ₂ (Sampea 12)	2.54 – 28.14	3.72 – 3.84a	6.28 – 6.37
SE ±	0.133 – 1.333	1.088 – 1.110	0.128 – 0.192
Significance	NS - NS	NS - NS	NS - NS
Interaction			
C x S	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS
C x S x V	NS - NS	NS - NS	NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, WAS-weeks after sowing.

Biomass Yield

The effect of cowdung manure and spacing on Biomass Yield of cowpea variety at Dutsin-ma during 2021/2022 and 2022/2023 wet season was presented as table 6. There was a significant response to cowdung fertilizer at 4 WAS only in 2023 on cowpea plant height where 8.0 tons ha⁻¹ resulted in taller plants relative to others evaluated. This is corroborated with the report of Kolawole *et al.*, (2002) who reported that cowpea responded well to improved soil condition with high cowdung manure application thereby exhibiting higher performance in growth attributes for higher biomass yield. The effect of spacing on plant height of cowpea was

significant at 8 WAS only in 2023 where 20 cm intra-row spacing produced taller plants over others evaluated. This is possible as 20 cm encourages the young growing plant to carryout photosynthesis and other responses optimally due to an environment provided that devoid of unnecessary competition. The varietal response was also significant at 8WAS only in 2023 where SAMPEA 12 produced taller plants over SAMPEA11. This could be due to genetic makeup of SAMPEA 12 which differs to SAMPEA 11 that allows the latter to accumulate enough assimilate over time thus more biomass yield as postulated by Subbaro *et al.*, (2014). There was no interaction between the variables on Biomass yield.

Table 6: Effect of Cow Dung Manure, Spacing and Variety on Biomass Yield at Dutsinma during 2021/2022 and 2022/2023 Wet Seasons

Treatment	Biomass Yield (g)		
	4WAS 2022 - 2023	8WAS 2022 - 2023	12WAS 2022 -2023
Cow dung (C) ton ha ⁻¹			
0	17.11 – 20.21d	24.24 – 34.72	50.32 – 53.21
2	18.82 – 22.56c	26.24 – 36.71	52.65 – 60.70
4	20.97 – 23.88bc	29.29 – 38.75	53.61 – 63.34
6	22.87 – 24.76b	30.24 – 41.70	54.77 – 64.43
8	23.31 – 26.87a	34.24 – 43.75	55.23 – 66.73
SE ±	0.282 – 0.941	1.383 – 0.517	0.896 – 0.73
Significance	NS - *	NS - NS	NS - NS
Spacing (S)			
S ₁ (20cm)	21.13 – 24.22	32.22 – 40.97a	54.86 – 63.94
S ₂ (15cm)	19.58 – 21.62	30.42 – 37.67b	53.84 – 56.49
S ₃ (10cm)	17.62 – 18.72	29.92 – 32.87c	51.82 – 53.96
SE ±	0.431 – 0.398	1.384 – 1.710	0.887 – 2.74
Significance	NS - NS	NS - NS	NS - NS
Variety (V)			
V ₁ (Sampea 11)	20.43 – 23.14	34.23 – 36.73b	53.8 – 54.96
V ₂ (Sampea 12)	24.74 – 26.84	37.12 – 38.74a	62.8 – 63.97
SE ±	0.313 – 0.233	0.388 – 0.810	0.898 – 2.92
Significance	NS - NS	NS - NS	NS - NS
Interaction			
C x S	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS
C x S x V	NS - NS	NS - NS	NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, * = significance, ** = highly significance WAS = weeks after sowing.

Days to 50% Flowering

Significant difference was observed in cowpeas response to variety as regards days to 50% flowering at 6 WAS only (Table 7) in Dutsinma during 2022 and 2023 wet season. SAMPEA 12 took more days to attain 50% flowering than SAMPEA 11. This could be due to its genetic composition as

it takes longer time to grow and matures than other varieties evaluated in both locations. Odey, (2018) reported a significant difference in varietal response on days to 50% flowering in cowpea. There was no significant interaction between the variable observed in this trial.

Table 7: Effect of Cow dung Manure, Spacing and Variety on Days To 50% flowering at Dutsinma during 2021/2022 And 2022/2023 Wet Seasons

Treatment	Days to 50% Flowering		
	4WAS 2022 - 2023	8WAS 2022 - 2023	12WAS 2022 -2023
Cow dung (C) ton ha ⁻¹			
0	49.11 – 48.21	49.82 – 48.72	47.23 – 48.21
2	48.32 – 47.66	46.72 – 46.71	46.65 – 47.70
4	47.87 – 47.98	46.62 – 45.75	45.61 – 46.34
6	45.87 – 44.66	43.52 – 44.70	44.77 – 44.43
8	43.31 – 42.87	43.52 – 43.75	43.23 – 43.73
SE ±	1.582 – 0.941	0.383 – 0.517	0.896 – 0.73
Significance	NS - NS	NS - NS	NS - NS
Spacing (S)			
S ₁ (20cm)	42.13 – 44.22	42.22 – 42.97	44.86 – 43.94
S ₂ (15cm)	44.58 – 45.62	46.42 – 43.67	45.84 – 46.49
S ₃ (10cm)	46.62 – 48.72	47.92 – 42.87	46.82 – 47.96
SE ±	0.431 – 0.398	1.384 – 2.710	0.887 – 0.74
Significance	NS - NS	NS - NS	NS - NS
Variety (V)			
V ₁ (Sampea 11)	46.43 – 45.14	47.23 – 47.73b	45.8 – 45.96
V ₂ (Sampea 12)	43.74 – 43.84	44.12 – 45.74a	42.8 – 43.97
SE ±	0.513 – 0.933	0.388 – 0.710	0.898 – 0.924
Significance	NS - NS	NS - NS	NS - NS

Interaction			
C x S	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS
C x S x V	NS - NS	NS - NS	NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, * = significance, ** = highly significance WAS-weeks after sowing.

Yield Parameters

Number of pods/plants, 100 seed weight (g) plot⁻¹, pod weight/plot (g), grain yield kg ha⁻¹

Table 8 showed the effect of cowdung manure, spacing and varieties on number of pods/plants, 100 seed weight (g) plot⁻¹, pod weight/plot (g), grain yield kg ha⁻¹ of Cowpea at Dutsinma during 2021/2022 and 2022/2023 wet seasons. The significant effect of cowdung rate of 8.0-ton ha⁻¹ resulted in a significant and higher differences only in 100 seed weight (g) in 2023 over other rates in this trial. The effect of spacing had a significant impact only on 100 seed weight (g) plot⁻¹ (2022), pod weight/plot (g) (2023), grain yield kg ha⁻¹ (2022) of Cowpea on cowpea in this trial, where Cowdung application at the rate of 8-ton ha⁻¹ over other rates resulted in better growth and yield performance in this trial. This is probably it contains higher amount of nutrients needed for better and vigorous plant growth thus producing higher yield and yield characters over other rates. Komolafe (2025) had similar

results 20cm ensured better performance of cowpea in almost all the yield parameters and yield. This is possible as 20 cm encourages the young growing plant to carryout photosynthesis and other responses optimally due to an environment provided that devoid of unnecessary competition. The varietal effect was significant only on 100 seed weight and pod yield kg ha⁻¹ where SAMPEA 12 outperformed SAMPEA 11 in terms of afore mentioned parameters at harvest at number of pods plant⁻¹ (2023) and 100 seed weight (2023). This could be as mentioned earlier due to the genetic difference of the varieties used in this trial. Similarly, 20 cm spacing provides a better avenue for good yield and parameters. Thus 20 cm spacing was found to present a better avenue for effectively harnessing all the required nutrients and other avenues for growth and yield performance of cowpea. This is similar to the report of Odey, (2018) who had similar results.

Table 8: Effect of Cowdung Manure, Spacing and Variety on Number of Pods/Plants, 100 Seed Weight (G) Plot⁻¹, Pod Weight/Plot (G), Grain Yield Kg ha⁻¹ of Cowpea at Dutsin-Ma during 021/2022 and 2022/2023 Wet Seasons

Treatment	Number of pods/plants 2022 - 2023	100 seed weight (g) plot ⁻¹ 2022 - 2023	Pod Weigh/plot (g) 2022 - 2023	Grain Yield kg ha ⁻¹ 2022 - 2023
Cow dung (C) ton ha ⁻¹				
0	14.11 - 15.21	12.82 - 13.72d	12.32 - 14.21	1.19 - 1.31
2	15.32 - 15.66	12.72 - 14.71cd	14.65 - 16.70	1.28 - 1.32
4	16.87 - 17.98	13.62 - 15.75c	16.61 - 17.34	1.32 - 1.43
6	15.87 - 18.66	14.52 - 16.70b	17.77 - 19.43	1.43 - 1.61
8	17.31 - 18.87	17.52 - 18.75a	19.23 - 20.73	1.65 - 1.83
SE ±	1.582 - 0.941	0.383 - 0.517	0.896 - 0.73	1.201 - 1.229
Significance	NS - NS	NS - NS	NS - NS	NS - NS
Spacing (S)				
S ₁ (20cm)	18.13 - 18.22	16.22a - 17.97	17.86 - 18.94a	1.32a - 1.43
S ₂ (15cm)	17.58 - 14.62	14.42b - 15.67	16.84 - 17.49b	1.22b - 1.32
S ₃ (10cm)	16.62 - 12.72	12.92c - 14.87	12.82 - 14.96c	1.17c - 1.19
SE ±	0.631 - 3.398	1.384 - 2.710	0.387 - 0.343	1.795 - 0.981
Significance	NS - NS	NS - NS	NS - NS	NS - NS
Variety (V)				
V ₁ (Sampea 11)	15.43 - 16.14b	12.23 - 14.73b	13.8 - 14.96	1.21 - 1.34
V ₂ (Sampea 12)	17.74 - 17.84a	18.12 - 19.74a	18.8 - 19.97	1.54 - 1.78
SE ±	0.513 - 0.933	0.388 - 0.710	1.898 - 1.124	1.132 - 1.023
Significance	NS - NS	NS - NS	NS - NS	NS - NS
Interaction				
C x S	NS - NS	NS - NS	NS - NS	NS - NS
C x V	NS - NS	NS - NS	NS - NS	NS - NS
S x V	NS - NS	NS - NS	NS - NS	NS - NS
C x S x V	NS - NS	NS - NS	NS - NS	NS - NS

Means followed by different letters in a column or row of any set of treatment are significantly different at $p < 0.05$ using DMRT, * = significance, ** = highly significance WAS-weeks after sowing.

CONCLUSION

Application of cowdung at 8-ton ha⁻¹ resulted in better growth and yield performance of cowpea varieties relative to other rates evaluated. Application of 20 cm spacing produced the highest plant height, number of leaves and branches, with

delayed days to 50% flowering, number of pods per plant biomass yield and seed yield than other spacing applied. Varietal differences observed in this research showed that SAMPEA 12 had a better performance over SAMPEA 11 in terms of plant height, number of leaves per plant and number

of branches per plant, delayed days to 50% flowering, number of pods per plant, 100 seed weight, biomass yield (t/ha) and total seed yield (t/ha) than SAMPEA 11. Thus, SAMPEA 12 showed to be best variety among the tested ones with application of 2-ton ha⁻¹ and 20 cm spacing is adequate for the growth and yield of SAMPEA 12 in the study area

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