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# Effect of seed rate and varieties on yield and yields components of cowpea (*Vigna unguiculata* (*l.*) *Walp.*) in northern guinea savannah region of Nigeria.

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## Abstract

**Introduction: The effect of seed rate on three cultivars were investigated in field trial in two successive seasons (2019/20 and 2020/21) at northern guinea savannah region of Nigeria, to determine the optimum seed rate for yield and yield components of cowpea. SAMPEA-11, SAMPEA-12 and Kanannado Varieties were sowed in four seed rates of 6, 12, 18 and 24 kg ha$^{-1}$.**

**Methods: The experiment was laid out in a randomized complete block design (RCBD) in four replications.**

**Results: The results showed that, increased seed rate significantly increased seed yield per unit area, however the number of pods per plant, seed yield per plant and harvest index reduced with increased seed rate.**

**Conclusion: Among the improved variety, SAMPEA-12 was outstanding for earliness especially in drought prone areas.**

**Keywords**: *Seed rate, Vegetative growth, Cowpea.*

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## Introduction

Cowpea (*Vigna unguiculata L. Walp*) Cowpea originated in Africa, where a large genetic diversity of wild types occurs throughout the continent, southern Africa being the richest. The greatest genetic diversity of cultivated cowpea is found in West Africa, in the savannah region of Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria and Cameroon. It is known under different names in different countries viz: black-eye pea, Southern pea and Crowder pea, thou the legume is of Africa origin it was later was moved to Asia and America [1], then distributed to other parts of Africa and other continents by the migration of people and trades from the West Africa. It is rather difficult to obtain reliable data on cowpea cultivated area and production because it is grown in mixture with other crops. It could be estimated that, the total area under production amounts to about 12.5 million hectares with an annual production of over 3 million tonnes worldwide. Cowpea is widely distributed throughout the tropics, but Central and West Africa amounts to 64 per cent of the area with about 8 million hectares followed by about 2.4 million hectares in Central and South America, 1.3 million hectares in Asia and about 0.8 million hectares in East and Southern Africa. The leading cowpea producing countries are Nigeria, Niger, Mali, Burkina Faso, Senegal, Ghana, Togo, Benin, Cameroon, and Chad in Central and West Africa; Sudan, South Sudan, Somalia, Kenya, Malawi, Uganda, Tanzania, Zambia, Zimbabwe, Botswana and Mozambique in East and Southern Africa; India, Bangladesh, Nepal, Myanmar, Sri Lanka, Indonesia, China and Philippines in Asia; Cuba, Haiti, and West Indies in Central America; Brazil in South America and USA in North America. Production level in countries like Brazil, Cuba, Ghana, Mozambique, Nigeria, Sri Lanka, Sudan, Zambia and Zimbabwe is increasing due to availability of improved cowpea varieties. Cowpea can be used as a feed (grazed, or harvested for fodder), or its pods can be harvested before maturity stage and eaten as a vegetable. The beans are nutritious and provide complementary proteins to cereals. Some people eat both fresh pods and leaves and the dried seeds are popular ingredients in various dishes. Cowpea seed contains (20 - 24%) protein, 63.3% carbohydrates and 1.9% fat. Cowpea hay is a rich feed for livestock in the dry season. Also as a legume, cowpea improves soil fertility and can be used as a trap crop in areas where Striga is a problem [2]. Cowpea grain and fodder yields are very low in West Africa and Sudan, the main problems limiting aw production and expansion of cowpea as pointed out by [3] are: Low yield potential of existing cultivars, low density of cowpea and Limited use of certified seeds by the cowpea growers, due to deficient marketing and failure to convince the farmers about the advantages of planting certified seeds versus their own seeds. The current study carried out investigates the effect of different seed rates and cultivars on yield, yields components and harvest index of cowpea.

## Materials and Methods

### *Field experiment*

Field experiment was conducted for two successive rainy seasons (2018/19-2019/20) at the experimental fields, sited at the Teaching and Research farm, College of Agriculture, Jalingo (COAJ), Taraba state, (Longitude 11 50'E, Latitude 80 50'N; altitude 144 m a.s. l). The climate of the area is arid and semi-arid zone. The mean annual rainfall ranges between 350 -500 mm. The study area is characterized by a mono modal rainfall with an average annual rainfall of about 800 to 1200 mm·yr-1 which peaks between August and September and ends in October. The soils belong to the Kumayili series and are commonly classified as Ferric Luvisols.

The experiment was laid out in a randomized complete block design with four replications. The experimental plot was 4×4meters. Treatments consisted of four levels of seed rates 6, 12, 18 and 24 kg ha$^{-1}$, designated as S 1, S 2, S 3 and S 4

respectively. Three cultivars of cowpea: Kanannado (local), Sampea-11, Sampea-12 (improved) were used and designated as V 1, V 2 and V 3 respectively. Sowing was on 27th of July, 2019 and 2020. Seeds were sown in holes at spacing of 60×30 cm. Manual weeding was practiced twice during both seasons.

Data collections

A sample of five plants was taken randomly from central row in each experimental unit at 30 days after sowing (DAS), and then continued at an interval of 15 days to measure the following growth attributes:

• Plant height (cm): The height of the main stem from the ground level to the tip of the plant.

• Stem diameter (cm): measured by using a Venire (calliper) at the first node.

• Number of leaves/ plant: by counting the number of leaves per plant.

• Leaf area index: Leaf area index (L. A. I) is a dimensionless quantity. It is the leaf area (upper side only) per unit area of land below. It is expressed as m 2 leaf area per m 2 ground area.

• Seed yield (g/plant).

• Final seed yield (t/ha).

## Data analysis

The data collected were subjected to analysis of variance using randomized complete block design (RCBD). Means were compared using standard error at 5% level of probability.

## Results and Discussion

Increasing seed rate increased plant height at all sampling occasions (Table 1). Similar results were obtained by [1] who found that the plants produced at highest densities were taller and more sparsely branches. On the contrary, [4] reported that plant population had no significant effect on plant height. The local cultivar (kananado) had significantly taller plants in the two seasons compared to others. Differences among cultivars in plant height were reported by [3] and [1]. Increasing seed rate decreased number of leaves per plant (Table 2). These results are in agreement with the previous findings reported by many workers [1,5]. They showed that increased plant densities reduced the number of leaves per plant. The local cultivar (kananado) had the greatest number of leaves per plant than others. The leaf area index increased with the increasing seed rate. Similar results were obtained by [6] who found that leaf area index tends to increase with increasing seeding rate. This is because decreased seed rate resulted in increasing ground area more than increasing total leaf area of plant. The local cultivar (Buff) had the greater leaf area index than others. These results confirmed the findings of El [1].

Generally, increasing the plant population increased competition among plants for soil moisture, nutrient, light and carbon dioxide. Moreover, the low population plants grew as isolated units for most of their early life and interfered less with each other than at higher densities. This might explain the significant effect of seed rate on most of the parameters measured in the present study. Difference in growth attributes observed among cultivars may be to the growth habit and to the genetically potential

***Table 1**: Effect of seed rate and varieties on plant height (cm) of cowpea.*

| | | 2019/2020 | | | 2020/2021 | | | |
|---|---|---|---|---|---|---|---|---|
| **Treatment** | **30** | **45** | **60** | **75** | **30** | **45** | **60** | **75** |
| | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** |
| S1 | 12.9 $^{a}$ | 36.8$^{a}$ | 49.1$^{c}$ | 60.3 $^{d}$ | 13.9$^{a}$ | 26.9 $^{b}$ | 50.5 $^{c}$ | 57.4 $^{bc}$ |
| S2 | 15.0 $^{a}$ | 27.3$^{b}$ | 53.6 $^{a}$ | 62.8 $^{c}$ | 13.9 $^{a}$ | 27.7 $^{b}$ | 52.3 $^{b}$ | 64.0 $^{b}$ |
| S3 | 15.2 $^{a}$ | 29.6 $^{b}$ | 53.3 $^{a}$ | 65.1 $^{b}$ | 14.2 $^{a}$ | 29.1 $^{a}$ | 53.9 $^{b}$ | 64.8 $^{b}$ |
| SE4 | 15.9 $^{a}$ | 30.6 $^{b}$ | 55.4 $^{a}$ | 69.6 $^{a}$ | 15.3 $^{a}$ | 31.2 $^{a}$ | 56.0 $^{a}$ | 70.9$^{a}$ |
| SE ± | 0.51 | 0.59 | 0.54 | 1.07 | 0.44 | 0.41 | 0.61 | 0.46 |
| V1 | 18.3$^{a}$ | 35.4$^{a}$ | 75.7$^{a}$ | 109.1$^{a}$ | 183$^{a}$ | 35.9$^{a}$ | 75.0$^{a}$ | 109.9$^{a}$ |
| V2 | 12.3$^{b}$ | 24.1$^{bc}$ | 39.8$^{b}$ | 39.7$^{b}$ | 12.2$^{b}$ | 23.4$^{b}$ | 39.3$^{b}$ | 38.8$^{b}$ |
| V3 | 12.2$^{cb}$ | 25.4$^{c}$ | 44.2$^{c}$ | 44.3$^{c}$ | 12.5$^{cb}$ | 25.6$^{c}$ | 44.5$^{c}$ | 44.8$^{c}$ |
| SE | ± 0.42 | 0.48 | 0.45 | 0.91 | 0.36 | 0.34 | 0.52 | 0.39 |
| CV% | 6.2 | 16.6 | 9.4 | 9.4 | 7.2 | 8.2 | 5.1 | 3.1 |
| Similar letters are not significantly different at the 0.05 level of probability according to Duncan multiple range test | | | | | | | | |

***Table 2:** Effect of seed rate and varieties on stem diameter (cm) of cowpea.*

| | | 2019/2020 | | | 2020/2021 | | | |
|---|---|---|---|---|---|---|---|---|
| **Treatment** | **30** | **45** | **60** | **75** | **30** | **45** | **60** | **75** |
| | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** |
| S1 | 0.22$^{a}$ | 0.36$^{a}$ | 0.41$^{a}$ | 0.49 $^{a}$ | 0.24$^{a}$ | 0.36 $^{b}$ | 0.47 $^{c}$ | 0.47 $^{bc}$ |
| S2 | 0.21$^{a}$ | 0.27$^{b}$ | 0.32 $^{a}$ | 0.33 $^{bc}$ | 0.17$^{a}$ | 0.27 $^{b}$ | 0.34 $^{b}$ | 0.33 $^{b}$ |
| S3 | 0.23$^{a}$ | 29.6 $^{b}$ | 0.35 $^{ab}$ | 0.31 $^{cd}$ | 0.16 $^{a}$ | 0.24 $^{a}$ | 0.24 $^{b}$ | 0.33 $^{b}$ |
| SE4 | 0.21$^{a}$ | 0.30 $^{b}$ | 0.40 $^{a}$ | 0.27 $^{d}$ | 0.01 | 0.21 $^{a}$ | 56.0 $^{a}$ | 0.23$^{a}$ |
| SE± | 0.01 | 0.01 | 0.01 | 0.01 | 0.1 | 0.01 | 0.61 | 0.46 |
| V1 | 019.$^{a}$ | 0.35$^{a}$ | 0.40$^{a}$ | 0.40$^{a}$ | 0.17$^{a}$ | 0.27$^{a}$ | 0.31$^{a}$ | 0.32$^{a}$ |
| V2 | 0.24$^{b}$ | 0.24$^{bc}$ | 0.36$^{b}$ | 0.36$^{a}$ | 0.23$^{b}$ | 0.30$^{b}$ | 0.42$^{b}$ | 0.38$^{b}$ |
| V3 | 0.21$^{b}$ | 0.25$^{c}$ | 0.29$^{c}$ | 0.29$^{b}$ | 0.17$^{cb}$ | 0.22$^{c}$ | 0.31$^{c}$ | 0.44$^{c}$ |
| SE | ± 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.004 |
| CV% | 3.2 | 3.3 | 2.5 | 3.4 | 2.5 | 5.2 | 6.8 | 20.4 |
| Similar letters are not significantly different at the 0.05 level of probability according to Duncan multiple range test. | | | | | | | | |

***Table 3**: Effect of seed rate and cultivars on number of leaves per plant of cowpea.*

| | | 2019/2020 | | | 2020/2021 | | | |
|---|---|---|---|---|---|---|---|---|
| **Treatment** | **30** | **45** | **60** | **75** | **30** | **45** | **60** | **75** |
| | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** | **DAS** |
| S1 | 12.9 [a] | 15.8[a] | 43.1[c] | 40.3 [d] | 11.9[a] | 15.9 [b] | 38.5 [c] | 43.4 [a] |
| S2 | 11.0 [a] | 13.3[ac] | 30.6 [a] | 34.8 [c] | 10.9 [a] | 15.7 [b] | 32.3 [b] | 35.6 [bd] |
| S3 | 9.2 [ac] | 10.6 [cd] | 24.7 [c] | 33.7 [b] | 8.9 [a] | 12.1 [a] | 23.9 [b] | 32.8 [c] |
| SE4 | 7.9 [9] | 10.6 [d] | 27.4 [d] | 37.2 [d] | 8.3 [a] | 11.2 [a] | 27.0 [a] | 33.9[d] |
| SE± | 0.65 | 0.63 | 0.59 | 0.79 | 0.48 | 0.41 | 0.98 | 0.46 |
| V1 | 13.3[a] | 16.4[a] | 53.7[a] | 72.1[a] | 12.5[a] | 16.9[a] | 53.7[a] | 67.9[a] |
| V2 | 8.3[bc] | 11.1[bc] | 22.8[b] | 22.7[bc] | 8.3[bc] | 11.4[b] | 22.3[b] | 24.8[b] |
| V3 | 8.5[c] | 10.4[c] | 17.2[c] | 14.3[c] | 8.2[cb] | 12.6[c] | 16.5[c] | 15.8[c] |
| SE ± | 0.56 | 0.53 | 0.69 | 0.41 | 0.41 | 0.46 | 0.85 | 0.34 |
| CV% | 2.6 | 2.6 | 8.4 | 3.7 | 7.2 | 13.2 | 5.1 | 3.9 |

***Table 4**: Effect of seed rate and varieties on seed yield per plant (g) of cowpea.*

| | | 2019/2020 | | | 2020/2021 | | | |
|---|---|---|---|---|---|---|---|---|
| Treatment | V1 | V2 | V3 | mean | V1 | V2 | V3 | mean |
| $S_1$ | 20.3[a] | 7.9[d] | 12.3[c S] | 13.5[a] | 20.7[a] | 7.9[d] | 13.3[c] | 13.8[a] |
| $S_2$ | 20.1[a] | 6.2[e] | 12.1[e] | 12.8[b] | 18.7[b] | 6.7d | 12.7[c] | 12.7[b] |
| $S_3$ | 19.3[b] | 6.3[e] | 11.3[e] | 12.2[b] | 18.4[b] | 6.1[c] | 11.5[c] | 12.2 |
| $S_4$ | 18.2[b] | 6.2[c] | 11.1[c] | 11.8[b] | 17.5[b] | 6.2[c] | 11.0[c] | 11.7[b] |
| mean | 19.52[a] | 6.7[c] | 11.5[b] | | 18.2[a] | 6.2[c] | 12.1 | |
| SE ± (P) | 0.46 | | | | 0.37 | | | |
| SE ± (V) | 0.39 | | | | 0.32 | | | |
| SE ± (PX V) | 0.26 | | | | 0.27 | | | |
| CV% | 7.7 | | | | 9.5 | | | |

of each genotype. Generally, increasing seed rate decreased seed yield per plant (Table 3). This was primarily because of reduced number of pods per plant and number of seeds per pod at the higher seed rate. Similar results were obtained by many workers [3, 4, 7]. The local cultivar (kananada) had significantly higher seed yield per plant than the improved. This is because of heavier seed weight of the buff cultivar. The final seed yield per unit area was greatly affected by seed rate (Table 4). Thus, increasing seed rate increased seed yield per unit area. This may be attributed to the highest number of plants per unit area. Similar result was obtained by many workers)[4,8,9]. They found that the highest seed yield was obtained with the higher seed rate. The local cultivar (kananada) gave the highest seed yield per unit area compared to the other two cultivars during the two seasons.

## Conclusion

In this study, the improved varieties performed better than the local varieties in Jalingo the Northern guinea zone of Taraba State for the improved varieties had significant higher grain yield per plant and per hectare and matured earlier to escape drought in this agro ecological zone. Among the improved variety, IT 90K-82-2, IT 89-KD-391 and IT 97K-499-35 were outstanding.

## Conflict of Interest Statement

The authors whose names are listed certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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