EFFECT OF COW DUNG AND NPK 15:15:15 FERTILIZER ON THE GROWTH AND YIELD OF OKRA [*Abelmoschus esculentus* (L.) Moench] IN MUBI NORTH, ADAMAWA STATE, NIGERIA

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ABSTRACT

A field experiment was conducted at the Food and Agriculture Organization (FAO)/ Tree Crop Production (TCP) Teaching and Research Farm, Adamawa State University, Mubi, during the 2025 rainfall cropping season to evaluate the effects of fertilizer sources on the growth and yield of okra (Abelmoschus esculentus L. Moench). Treatments included 300 kg/ha Nitrogen Phosphorus and Potassium (NPK) 15:15:15 (T_1), 20 t/ha cow dung (T_2), and a control (T_3), arranged in a Randomized Complete Block Design with three replications. Growth and yield parameters were recorded at 3, 6, 8, 9, and 10 weeks after sowing (WAS). Results showed that NPK significantly ($p \leq 0.05$) enhanced plant growth and yield. at 9 WAS, T_1 recorded the highest plant height (65.41 cm), number of leaves (18.73), and stem girth (2.43 cm), compared to T_2 (60.33 cm, 16.42 leaves, 2.18 cm) and T_3 (46.27 cm, 13.25 leaves, 1.74 cm). Days to first and 50% flowering were shortest under T_1 (41.22 and 47.35 days, respectively), longer under T_2 (43.14 and 49.61 days), and longest in the control (46.88 and 53.42 days). Yield components followed the same trend: number of fruits per plant (9.41, 8.26, 6.23), fruit length (14.22 cm, 13.15 cm, 11.05 cm), fruit weight (18.64 g, 16.52 g, 13.84 g), and 100-seed weight (6.83 g, 6.15 g, 5.42 g**) for T_1, T_2, and T_3, respectively. In conclusion, NPK 15:15:15 at 300 kg/ha significantly improved okra growth and yield, while cow dung at 20 t/ha offered moderate improvement over the control. These results indicate that NPK is the most effective fertilizer for optimum okra production in Mubi Northern Guinea Savannah environment. It could be recommended that farmers in Mubi and similar agro-ecological zones should adopt Treatment T_1 for better growth and yield performance.

Key words: Cow dung, Okra, Growth, yield and NPK fertilizer

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is an important vegetable crop widely grown in tropical and subtropical regions, including Nigeria. It is valued for its nutritional benefits, contributing significantly to human diets as a source of vitamins A, C, and K, along with minerals such as calcium, magnesium,

and potassium (Akinyele and Temikotan, 2020). The crop is also a source of income for many smallholder farmers and plays a role in food security in rural and urban areas. Despite its economic and nutritional importance, the production of okra is often constrained by declining soil fertility, poor nutrient management, and inadequate fertilization practices (Olowe and Busari, 2019).

Okra is a heat-loving plant that cannot tolerate low temperatures for very long time and frosts can be very dangerous to the plant (FAOSTAT, 2018). The crop grows well in warm climates with a minimum temperature range of 18-22°C and maximum temperature of 35°C. Although okra is highly resistant to drought, it still requires a considerable evenly distributed annual rainfall of up to 1000mm for optimum growth and yield. The plant requires a light well-drained sandy loam soil rich in organic matter. Soils with slightly acidic pH between 6.0-8.0 are recommended for optimum growth (FAOSTAT, 2018). Okra is typically propagated from seed. Seed soaked overnight prior to planting helps the plants to germinate early. Germination occurs between 5-8 days after sowing. In the home garden, seeds should be sown at a depth of 2.5 cm between rows only after the soil has reached a temperature of 18°C (Aguair *et al.,* 2011). In commercial okra production, seeds are planted in rows spaced 0.65-1.0m apart. Okra seed is commonly planted at a rate of 4-6kg per acre but this quantity is vastly reduced by the use of precision planting methods (Aguair *et al.,* 2011). Okra reaches maturity in 50 to 65 days and can produce for 10 -12 weeks and fruit are usually ready for harvesting 2 months after planting. Okra fruits are generally ready to harvest 4 to 6 days after flowering and fruit should be harvested every 2-3 days (Craig, 2014). In Nigeria, okra is grown in both wet and dry season but attract a larger profit in the dry season when the demand is often in excess with limited supplies (Ayeni *et al.*, 2012).

Soil fertility depletion is a major challenge for agricultural productivity in Nigeria, especially in Mubi North, Adamawa State, where continuous cropping, erosion, and low organic matter content contribute to declining crop yields (Usman and Bello, 2018). To enhance productivity, farmers use organic and inorganic fertilizers. Cow dung is a readily available organic manure that improves soil structure, increases microbial activity, and enhances nutrient retention (Yakubu and Umar, 2020). On the other hand, NPK 15:15:15 is a synthetic fertilizer that provides essential macronutrients—nitrogen (N) for vegetative growth, phosphorus (P) for root development, and potassium (K) for flowering and fruiting (Ojo *et al.,* 2021). While both fertilizers have been used independently, the combined effect of cow dung and NPK 15:15:15 on okra growth and yield in Mubi North remains unclear.

Integrating organic and inorganic fertilizers is a promising approach to sustainable soil fertility management. The combination of cow dung and NPK 15:15:15 may enhance soil nutrient availability, improve crop growth, and increase yield more effectively than using either fertilizer alone (Ahmed *et al.*, 2021). Research on fertilizer application strategies can help optimize productivity while reducing dependency on chemical fertilizers, which can degrade soil health over time. This study, therefore, seeks to assess the effect of cow dung and NPK 15:15:15 on the growth and yield of okra in Mubi North, Adamawa State, and provide recommendations for improving soil fertility management and crop production in the region. The study was aimed at assessing the effects of cow dung and NPK 15:15:15 on the growth and yield of okra in Mubi North, Adamawa State.

Objective of the Study are:

i. To evaluate the effect of cow dung on the growth and yield of okra (*Abelmoschus esculentus* L. Moench) in Mubi North, Adamawa State.
ii. To determine the effect of NPK 15:15:15 fertilizer on the growth and yield performance of okra in the study area.
iii. To compare the effectiveness of cow dung and NPK 15:15:15 fertilizer on the growth and yield of okra in order to determine the most suitable fertilizer for optimum production in Mubi North, Adamawa State.

Problem Statement

Okra (*Abelmoschus esculentus* L. Moench) is an important vegetable crop widely cultivated in Nigeria for its nutritional and economic value. However, its production in many parts of Adamawa State, including Mubi North, is often low due to poor soil fertility and inadequate nutrient management. Farmers commonly rely either on organic manure such as cow dung or inorganic fertilizers like NPK 15:15:15 without clear knowledge of their comparative effectiveness on crop growth and yield under local conditions. The lack of adequate information on the appropriate fertilizer source for optimum okra production in the area may result in reduced productivity. Therefore, it is necessary to evaluate the effect of cow dung and NPK 15:15:15 fertilizer on the growth and yield of okra in Mubi North, Adamawa State, in order to determine the most effective nutrient source for improved production.

Experiments Site

Field experiment was conducted at the Department of Crop Science, Teaching and Research farm, Food and Agricultural Organization/Tree Crop Program (FAO/TCP) farm, Adamawa State University Mubi, Nigeria under rain fed condition in 2025 cropping season. Mubi located in the Northern Guinea Savannah of Nigeria is situated between latitude 10 ° 11" and 10 ° 30" North of the equator and between longitude 13 ° 10" and 13 ° 30" East of the Greenwich meridian and at altitude of 969m above mean sea level (MSL). (Adebayo *et al.,* 2012 and 2021), Mubi has an average annual rainfall **of 579 mm,** relative humidity varies between **50% and 80%** and annual temperature is **27°C** (ADSU Meteorological station, 2024).

Land Preparation

The land was sprayed with herbicide (paraquat) to control the weed before ploughing which was done using tractor and leveling was done manually using hoe to pulverize the soil before layout.

Sowing and Cultural Practice of Okra

The seed was sown by using line sowing method at the spacing of 60 cm x 40 cm between rows and later thinned at 2 WAS to 1 plant per stand. Weeding was carried out to reduce the competition of weeds with okra plants. Insect pest control was done using cypermethrine (10%) powder to control insect pest from attacking the okra plants.

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Treatments and Experimental Design

The treatments consists of four different sources of fertilizers viz; 300 kg/ha NPK 15:15:15 (T_1) cow dung 20 t/ha (T_2), and T_3 the control plot as treatment. All plots with cow dung were applied 7 days before sowing for the organic fertilizer to decompose. All NPK 15:15:15 fertilizers was applied during sowing. The experiment was laid out in a Randomized Complete Block Design (RCBD) and replicated three times. The total experimental land was 10 m x 12 m (120 m^2), the gross plot size was 3 m × 3 m and the net plot size 1.5 m x 1.5 m and 1 m^2 was left between replicates and 0.5 m between plots.

Data Collection

Data on Growth and Yield parameters were collected at 3, 6, 8, 9, and 10 weeks after sowing (WAS). The following parameters were measured:

Growth parameters

1. *Plant height (cm):* was measured from the base to the terminal bud using a meter rule from five tagged plants at 3, 6 and 9 weeks after sowing (WAS) and the mean calculated and recorded.
2. *Number of leaves per plant:* was counted manually from five tagged plant at 3, 6 and 9 weeks after sowing (WAS) and the mean was calculated and recorded.
3. *Stem girth (cm):* was measured with a Vernier caliper from five tagged plant at 3, 6 and 9 weeks after sowing (WAS) and the mean was calculated and recorded.

Phonological Parameters

1. Number of days to first flowering: was recorded by counting
2. Number of days to 50 % flowering: was recorded by counting

Yield and Yield Attributes Parameter's

1. *Number of fruits per plant:* fruits were counted manually at 8, 9 and 10 WAS.
2. Fruit length per plant was taken at 8, 9 and 10 WAS by measuring the length of fruits using ruler in cm.
3. *Fruit weight (g):* was determined using an electronic weighing scale.
4. 100 seed weight at harvest was done by measuring weight using weighing balance.

Statistical Analysis

Data collected was subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS) software version 9.4. Treatment means was separated using Fisher's Least Significant Difference (LSD) test at a 5% probability level.

RESULTS

The Effect of cow dung and NPK 15:15:15 on plant Hpeight (cm) at 3, 6, and 9 WAS

The effect of cow dung and NPK 15:15:15 on Plant Height (cm) at 3, 6, and 9 WAS is presented in (Table 1). The result showed a significant difference among the treatment with the highest plant height

(18.54 cm, 38.62 cm and 65.41 cm respectively) recorded by T_1 (300 kg/ha NPK 15:15:15), followed by T_2 (cow dung) with a mean value of (16.42 cm, 34.75 cm and 60.33 cm respectively) and the least plant height (12.86 cm, 26.14 cm and 46.27 cm respectively) observed in the control indicating slow growth due to nutrient deficiency.

The Effect of cow dung and NPK 15:15:15 on number of leave/plant at 3, 6, and 9 WAS

The effect of cow dung and NPK 15:15:15 on number of leave/Plant at 3, 6, and 9 WAS showed a significant difference with the highest number of leaves (6.40, 11.55 and 18.73 respectively) was observed in T_1, followed by **T2** (5.82, 10.31 and 16.42 respectively) and the control recorded the least mean values for number of leaves (4.51, 7.64 and 13.25 respectively).

The Effect of cow dung and NPK 15:15:15 on Stem Girth (cm) at 3, 6, and 9 WAS

The Effect of cow dung and NPK 15:15:15 on Stem Girth (cm) at 3, 6, and 9 WAS showed That the thickest stem girth (1.14 mm, 1.59 cm and 2.43 cm respectively) was recorded by T_1, followed by T_2(1.07 cm, 1.44 cm and 2.18 respectively) and the thinnest stem (0.88 cm, 1.21 cm and 1.74 cm respectively) was recorded in the control plot. The result observed showed a significant difference ($p < 0.05$) among the treatment recorded (Table 3).

The Effect of cow dung and NPK 15:15:15 Days to First and 50% flowering

Days to First Flowering

Table 4 present the effect of cow dung and NPK 15:15:15 days to first and 50% says to first flowering. For days to first and 50% flowering, the result shows a significant difference among all the treatment observed in which T_1 (41.22 and 47.35 days respectively) recorded the shortest time for both days to first and 50% flowering, followed by T_2 with a mean value of (43.14 and 49.61 days respectively) while the least mean values was recorded by the control plot (46.88 and53.42 days respectively).

Table 1: Effects of NPK and Cow Dung on Plant height of Okra at 3, 6 and 9 WAS

Treatments	PH 3 WAS (cm)	PH 6 WAS (cm)	PH 9 WAS (cm)
T_1: 300 kg/ha NPK 15:15:15	18.54	38.62	65.41
T_2: 20 t/ha Cow dung	16.42	34.75	60.33
T_3: Control	12.86	26.14	46.27
LSD (0.05)	1.82	2.96	4.14
SE±	0.61	1.03	1.44

Key: PH = Plant height

Table 2: The Effect of cow dung and NPK 15:15:15 on Number of Leaves/Plant at 3, 6, and 9 WAS

Treatments	NL 3 WAS	NL 6 WAS	NL 9 WAS
T_1: 300 kg/ha NPK 15:15:15	6.40	11.55	18.73
T_2: 20 t/ha Cow dung	5.82	10.31	16.42
T_3: Control	4.51	7.64	13.25
LSD (0.05)	0.74	1.21	1.63

Treatments	NL 3 WAS	NL 6 WAS	NL 9 WAS
SE±	0.25	0.39	0.54

Key: NL = Number of leaves, WAS=Week after sowing

Table 3: The Effect of cow dung and NPK 15:15:15 on Stem Girth (cm) at 3, 6, and 9 WAS

Treatments	SG 3 WAS (cm)	SG 6 WAS (cm)	SG 9 WAS (cm)
T_1: 300 kg/ha NPK 15:15:15	1.14	1.59	2.43
T_2: 20 t/ha Cow dung	1.07	1.44	2.18
T_3: Control	0.88	1.21	1.74
LSD (0.05)	0.13	0.18	0.24
SE±	0.04	0.06	0.08

Key: SG = Stem girth, WAS=Week after sowing

Table 4: The Effect of cow dung and NPK 15:15:15 on Days to First and 50% Flowering

Treatments	DFF	D50%F
T_1: 300 kg/ha NPK 15:15:15	41.22	47.35
T_2: 20 t/ha Cow dung	43.14	49.61
T_3: Control	46.88	53.42
LSD (0.05)	1.67	2.11
SE±	0.55	0.71

Key: DFF = Days to first flowering and D50%F = Days to fifty percent flowering

The Effect of cow dung and NPK 15:15: on Number of Fruits per Plant at 8, 9, and 10 WAS

The effect of cow dung and NPK 15:15: number of Fruits per plant at 8, 9, and 10 WAS is presented in (Table 5). The result shows a significant difference ($p < 0.05$) across all the treatment with the highest number of fruits (5.63, 7.82 and 9.41 respectively) recorded by T_1, followed by T_2 (4.94, 6.75 and 8.26 respectively) while the control had the lowest number of fruits of (3.11, 4.84 and 6.23 respectively).

The Effect of cow dung and NPK 15:15: on Fruit Length (cm) at 8, 9, and 10 WAS

The effect of cow dung and NPK 15:15: on Fruit Length (cm) at 8, 9, and 10 WAS (Table 6) revealed a significant different ($p < 0.05$) among all the treatment studied with the longest fruits (10.88 cm, 12.45 cm and 14.22 respectively) produced by T_1, followed by T_2 (9.74 cm, 11.32 cm and 13.15 cm respectively) and the shortest fruits was recorded in the control plot (8.12 cm, 9.63 cm and 11.05 cm respectively).

The Effect of cow dung and NPK 15:15: Fertilizers on Fruit Weight (g) and 100-Seed Weight (g)

The effect of cow dung and NPK 15:15: fertilizers on fruit weight (g) and 100 seed weight (g) (Table 7) recorded a significant difference ($p < 0.05$). The highest fruit weight and the heaviest 100 seed weight (18.64 g and 6.83 g respectively) was recorded by T_1, followed by T_2 (16.52 g and 6.15 g respectively) while the control recorded the lowest weight and lowest seed weight (13.84 g and 5.42 g respectively)

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Table 5: The Effect of cow dung and NPK 15:15: on Number of Fruits/Plant at 8, 9, and 10 WAS

Treatments	NFP 8 WAS	NFP 9 WAS	NFP 10 WAS
T_1: 300 kg/ha NPK 15:15:15	5.63	7.82	9.41
T_2: 20 t/ha Cow dung	4.94	6.75	8.26
T_3: Control	3.11	4.84	6.23
LSD (0.05)	0.64	0.91	1.14
SE±	0.21	0.30	0.39

Key: NFP = Number of fruits per plant, WAS=Week after sowing

Table 6: The Effect of cow dung and NPK 15:15: on Fruit Length (cm) at 8, 9, and 10 WAS

Treatments		FL 8 WAS (cm)	FL 9 WAS (cm)	FL 10 WAS (cm)
T_1: 300 kg/ha NPK 15:15:15		10.88	12.45	14.22
T_2: 20 t/ha Cow dung		9.74	11.32	13.15
T_3: Control		8.12	9.63	11.05
LSD (0.05)		0.92	1.18	1.35
SE±		0.31	0.40	0.46

Key: FL = Fruit Length, WAS=Week after sowing

Table 7: The Effect of cow dung and NPK 15:15: Fertilizers on Fruit Weight (g) and 100 Seed Weight (g)

Treatments	FW (g)	100 SW (g)
T_1: 300 kg/ha NPK 15:15:15	18.64	6.83
T_2: 20 t/ha Cow dung	16.52	6.15
T_3: Control	13.84	5.42
LSD (0.05)	1.53	0.47
SE±	0.51	0.16

Key: FW = Fruit Weight

DISCUSSION

The results obtained from this study shows that, the application of NPK 15:15:15 fertilizer and cow dung had significant effects on the growth and yield performance of okra in Mubi, Northern Guinea Savannah. In all the growth parameters measured, plant height, number of leaves, and stem girth, the NPK fertilizer (T_1) consistently produced the highest values across all sampling periods. This trend agrees with the findings of Adeniyan and Ojeniyi (2015), who reported that inorganic fertilizers supply readily available nutrients that enhance rapid vegetative growth in okra.

At 3, 6, and 9 WAS, plant height increased significantly under NPK treatment compared to cow dung and the control. The superior performance of NPK could be attributed to the immediate availability of nitrogen, phosphorus, and potassium, which promote cell elongation and vegetative vigor in crops, as noted by Ayeni *et al*. (2012). Although cow dung improved plant height relative to the control, the

increase was lower than that recorded under NPK, likely because nutrients in organic fertilizers are released more slowly as they decompose, a phenomenon reported by Salau *et al*. (2020).

Similarly, the number of leaves per plant followed the same pattern, with NPK yielding the highest number of leaves across all sampling periods. Leaves play a critical role in photosynthesis; thus, treatments with higher leaf production tend to support better plant growth and yield. The improved leaf number observed under cow dung compared to the control agrees with the findings of Adekiya and Agbede (2016), who reported that, cow dung enhances soil structure and microbial activity, leading to improved nutrient availability.

Stem girth also showed a significant increase under NPK treatment compared to the other treatments. A thicker stem indicates stronger vegetative development and better translocation of nutrients and water within the plant. This observation aligns with earlier studies by Olowolaju *et al*. (2018), who reported that okra plants grown under balanced inorganic fertilizer develop more vigorous stems and stronger root systems.

Phenological observations revealed that okra plants fertilized with NPK reached first flowering and 50% flowering earlier than those treated with cow dung or left unfertilized. Early flowering in okra is desirable, as it supports better fruit formation and timely harvesting. According to Uwah and Iwo (2011), nitrogen and phosphorus play crucial roles in promoting early flowering and reproductive efficiency. The delayed flowering in cow dung and control plots may be due to slower nutrient mineralization, which postpones the transition from vegetative to reproductive stages.

The yield and yield components number of fruits per plant, fruit length, fruit weight, and 100-seed weight were also significantly higher under NPK, followed by cow dung and lastly the control. The highest number of fruits recorded in NPK-treated plots agrees with the findings of Hussaini *et al*. (2017), who noted that balanced NPK fertilization enhances flowering, fruit set, and pod development in okra. Cow dung improved all yield parameters compared to the control, which concurs with the report of Ogedegbe *et al*. (2020) that organic manure increases soil organic matter, moisture retention, and micronutrient availability.

Fruit length and fruit weight were highest under NPK treatment, demonstrating the role of potassium in fruit development and elongation, as previously highlighted by Ogunlela *et al*. (2014). The control consistently gave the lowest values for all yield parameters, reflecting nutrient deficiency in the soil. This agrees with Adebayo *et al*. (2012), who reported that soils in the Northern Guinea Savannah are low in organic matter and essential nutrients, leading to reduced crop performance when no fertilizers are applied.

The 100-seed weight followed the same trend, with NPK performing best, followed by cow dung and the control. Higher seed weight under NPK application corresponds to the findings of Abubakar and Suleiman (2018), who reported that adequate plant nutrition enhances assimilate partitioning into seeds, resulting in better grain filling and seed development.

The discussion indicates that NPK 15:15:15 fertilizer offers superior performance in promoting growth and yield of okra compared to cow dung and no fertilizer. However, cow dung still significantly improved plant performance relative to the control, suggesting that it remains a beneficial organic amendment for farmers who may not afford inorganic fertilizers. This supports the recommendations of

Chude *et al*. (2020) that integrated nutrient management combining organic and inorganic fertilizers offers a sustainable pathway to improve soil fertility and crop productivity in northern Nigeria.

CONCLUSION

This research concludes that treatments had a marked effect on growth and yield performance. Treatment A proved most effective, producing significantly higher growth and yield values than other treatments and the control. The findings indicate that adopting Treatment A under the agro-ecological conditions of Mubi will enhance overall crop productivity. Therefore, Treatment A is recommended for farmers aiming at increased output and improved crop vigor.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made:

i. Farmers in Mubi and similar agro-ecological zones should adopt Treatment T_1 for better growth and yield performance.
ii. Future research should evaluate the long-term effect of these treatments across multiple seasons to determine consistency.
iii. Economic analysis should be conducted to confirm the cost-effectiveness of Treatment T_1 before large scale adoption.
iv. Researchers should explore combining the most promising treatment with other management practices (e.g., irrigation, spacing, integrated pest management).
v. Extension agents should disseminate the findings to local farmers through demonstrations and training.

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