

Effects of Different Rates of NPK 15:15:15 Fertilizer on Growth and Yield of Okra (*Abelmoschus Esculentus* (L.) Moench) in Mubi North Local Government Area of Adamawa State, Nigeria

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Abstract

This study was carried out at the Faculty of Agriculture, Adamawa State University Mubi, during the 2022 cropping season to determine the effects of different rate of NPK 15:15:15 fertilizer on the growth and yield components of okra [*Abelmoschus esculentus* (L.) Moench]. The experimental treatments consist of five different rates of NPK 15:15:15 fertilizer viz; (0 kg/ha, 25 kg/ha, 50 kg/ha, 75 kg/ha and 100 kg/ha) respectively, which was laid in a Randomize Complete Block Design (RCBD) with three replications. The plots size was measured 3m x 3m with alley of 1m between replication and 1m between plots, carried out at 3, 6 and 9WAS with five individual plants randomly selected from the middle of the center rows of each plot. At the 9WAS, the number of leave was insignificantly different ($P < 0.05$) from the other fertilizer rates and the control. The analysis of the study confirms that the number of branches was insignificantly ($p > 0.05$) influenced by the application of NPK 15:15:15 fertilizer at and rate had significant effect on days to 1st flowering, treatment four (75kg/ha) exhibited maximum number of days to 1st flowering with mean value of 54 while treatment one (0kg/ha) recorded the minimum number of days to 1st flowering with 51.3. Days to 50% flowering was insignificant different between the five treatments, implying that increase in the rate of NPK 15:15:15 do not significantly increased days to 50% flowering. Fresh fruit weight/net plot treatment five 100kg/ha) exhibited maximum fresh fruit weight/net plot with mean value of 7524, while treatment one (0kg/ha) recorded the minimum fresh fruit weight/net plot with 4397. It was concluded that, plants from the plots received 100kg/ha of N.P.K 15:15:15 performed significantly higher. We, therefore recommends the application of 100kg/ha. At 6-9 WAS as suitable dose to Okra farmers in Mubi environs for optimum fruit yield.

Keywords: Fertilizer, growth, yield of Okra, rate, NPK. RCBD.

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] is an herbaceous annual plant in the family Malvaceae which is grown for its edible fruit. Okra plants have small erect stems that can be bristly or hairless with heart-shaped leaves (Aguiar & Amador, 2011). The leaves are 10 - 20 cm long with 5 - 7 lobes. The plant produces flowers with five white to yellow petals which are 4- 8 cm in diameter. The fruit is a capsule up to 18 - 25 cm long, containing numerous seeds. Calyx of 3 - 4 cm long with 5 short linear teeth and stamina tube 12 - 20 mm long free parts of filaments up to 0.5 mm long (Rao & Northup, 2009). Okra can grow 2 - 4m tall and

as an annual plant, survives only one growing season. Okra is self-pollinating plants which produce flowers that contain both male and female parts and are fertilized by their own pollen. This means they do not require wind or insects to pollinate properly (Craig *et al.*, 2014). Okra may also be referred to as lady's fingers and is believed to have originated in Ethiopia. Okra is a heat-loving plant that cannot tolerate low temperatures for very long and frosts can be very dangerous to the plant (Biazen *et al.*, 2021). The crop grows well in warm climates with a minimum temperature 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 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 (Ngala, 2013). 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 (65°F) (El Hawary *et al.*, 2014). In commercial okra production, seeds are planted in rows spaced 0.65 - 1.0 M (26 - 40 in) 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 (Castro *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 fruit are generally ready to harvest 4 - 6 days after flowering and fruit should be harvested every 2 - 3 days (Castro *et al.*, 2011).

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 (Zainab *et al.*, 2016). Okra is mainly cultivated for its young immature fruits and consumed as a vegetable, raw, cooked or fried in countries like Sudan, Egypt and Nigeria; it is also important in other tropical areas including Asia central and South America often used as ingredient of soups and sauces. The fruits can be conserved by drying or pickling, the roasted seed is considered as coffee substitute; the leaves, flower buds, flowers and calyces can be eaten cooked as greens (Ajari *et al.*, 2004). The okra crop is grown on about 2 million hectares producing almost 10 million tons of pods worldwide. The largest producer is India with about 6 million tons of fresh fruit harvested, followed by Nigeria with about 2 million tons. According to (Ufere, *et al.*, 2013), it can be found in almost every market all over Africa (Zhu *et al.*, 2000), and most of okra is eaten in cooked or processed form and the young fruits may be eaten raw (Omotoso & Shittu, 2007). Okra is a nutritious vegetable that is low in calories and rich in protein, vitamins, minerals and dietary fiber. It is worth noting that compared with other fresh vegetables, okra protein content, mainly found in okra seeds is relatively high approximately 21% protein (Tiamiyu *et al.*, 2012). The research showed that the main amino acid in okra protein was aspartic acid, and there were eleven essential amino acids in the tested amino acids, (Sami *et al.*, 2013). Although the content of essential amino acids was less than that of non-essential amino acids, the ratio of essential amino acids to non-essential amino acids was close to soybean (Sami *et al.*, 2013).

At present, plant protein is mainly obtained from soybean, while okra has high protein efficiency and can provide unique taste, which may be used as an alternative and sustainable source of plant protein (Rao & Northup, 2009). Moreover, it is well known that vitamins are a kind of organic compounds necessary to maintain the health of the body and play a very important role in the metabolism, growth, development and health. Long term deficiency of certain vitamins can lead to physiological disorders and some diseases (Rao & Northup, 2009). Okra is rich in essential vitamins for human body: vitamin A and vitamin C. In addition to vitamin A, okra is also rich in carotene, which is the precursor of vitamin A synthesis. And vitamin C content in per 100g okra fruit is about 20% of the recommended daily intake (Sami et al., 2013). Furthermore, okra is full of minerals, including a large number of trace elements such as Fe and Zn (Petropoulos et al., 2016). In particular, okra is good source of Zn, which is crucial to the health of human immune system. Besides, okra is packed with dietary fiber, especially viscous dietary fiber which increase the viscosity of gastric food, slow down gastric emptying, reduce food intake and play a positive role in controlling blood glucose and losing weight after mixing with chime (Fekadu Gemed, 2015, Anderson et al., 2004)

The inherently low fertility status of tropical soils, characterized by low activity clay, organic matter, nitrogen, phosphorus and exchangeable bases, has necessitated growing search for professionally sound soil fertility (Ngala, 2013), improvement practices, which in recent time, have included adoption of appropriate and adequate fertilizer packages, involving the use of organic and / or inorganic fertilizers (Osundare & Fawole, 2018). The use of inorganic or mineral fertilizers in improving and maintaining soil fertility has been reported to be ineffective, due to certain limitations. Some of these limitations include: low efficiency declined soil organic matter content, nutrient imbalance, soil acidification, as well as soil physical degradation and attendant increased incidence of soil erosion. (Naidu et al., 2009) Asides, high cost and occasional scarcity of mineral fertilizers have posed a lot of problem to their use as nutrient sources (Osundare & Fawole, 2018).

Materials and methods

Experimental Site Location

The research was earned out at Food and Agricultural Organization/Tree Crop Plantation (FAO/TCP) farm, Department of Crop Science Faculty of Agriculture Adamawa State University Mubi, Mubi North Local Government during the 2022 rainy season. Mubi is located in the Northern Guinea Savanna of Nigeria situated between latitude 10° 10' and 10° 30' North of the Equator and between longitude 13° 10' and 13° 30' East of Greenwich meridian and at an altitude of 696m above sea level (Mohammed, 2020, Handy et al., 2022). The annual mean rainfall of Mubi is 965mm per year, and a minimum temperature of 12.48°C during Hamatan period and 38.27°C maximum in June (Mustapha et al., 2012, Ogundipe et al., 2017).

Treatment and Experimental Design

The treatments consist of five different levels of NPK 15:15:15 fertilizer viz; (okg/ha., 25kg/

ha., 50 kg/ha., 75 kg/ha. and 100 kg/ha.) respectively. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replication (Olusegun, 2014). The gross plots size was measured 3M x 3M and net plot size 1.8M x 1.8M with alley of 1M between replications and 0.5m between plots. There were fifteen experimental plots.

Source of Materials

The seeds of okra and inorganic fertilizer NPK 15:15:15 were obtained from Mubi main market.

Land Preparations

The land was cleared and tilled to obtain fine tilt. The field was laid out according to experimental design. Plot size was between 3m x 3m and a distance of 1m between replicates and 0.5m between two plots. The plot was cleared with using hoe and measuring tape.

Sowing planting

Okra seeds were sown directly to the soil two seeds per hole. The seeds were sown at row to row 60 x 60 cm and plant to plant 60 cm x 60 cm spacing. Sowing was done by hand using hoe, seeding were thinned to obtain required plant population (Aluko, 2020).

Fertilizer Application and Weeding

NPK 15:15:15 fertilizer was applied in two equal dozes; first application was carried out three weeks after sowing and the second application after six weeks of sowing. Method of application was by dibbling to facilitate easy dissolution and to minimize volatilization of the fertilizer (Adiaha & Agba, 2016, Gul et al., 2015).

Weed Control

Regular weeding up to 4 weeks after sowing (WAS), the first weeding was done at 3 WAS and the second, third, and fourth weeding was done at 6, 9 and 12 WAS and weed free (Mekonnen, 2017).

Data Collection

Data was collected on the following parameters:

- i. Plant height at
- ii. Number of leaves per plant at
- iii. Number of branches per plant 6
- iv. Leaf area per plant at
- v. Leaf area index
- vi. Number of days to first flowering
- vii. Number of days to 50 % flowering
- viii. Number of fruits (capsule) per plant at.

- ix. Fruit length per plant at
- x. Fresh fruit weight per net.
- xi. Number of seeds per fruit at
- xii. 100 seed weight at

Measurement was carried out at 3, 6, 8, 9 and 10 WAS on five individual plants randomly selected from the middle of the center rows of each plot. 5 plants in each plot were used for collection of data.

Data Analysis

Data was analyzed using analysis of variance (ANOVA) appropriate to RCBD as described by (Gomez and Gomez 1984) and means would be separated using Duncan Multiple Range Test (DMRT) at 0.05% level of probability (Ibrahim & Abdullahi, 2023).

Results and Discussion

Results on the effects N.P.K 15:15:15 fertilizer rates on plant height at 3 - 9 weeks after sowing (WAS) is presented in Tables.1. Results revealed that plants treated with 100 kg/ha fertilizer⁺ recorded the highest leaf area of 75.29 cm, followed by plants treated with 50 kg/ha with 69.75 cm at 3 weeks after sowing. Similarly, at 6 and 9 was after sowing, plants treated with 100 kg/ha recorded significantly highest leaf area of 727.98 cm and 2269.70 cm respectively.

Effect of NPK 15:15:15 Fertilizer on plant height of Okra at 3, 6 and 9 WAS

The effect of N.P.K 15:15:15 on plant height was found to be significant treatment five 100 kg/ha exhibited highest plant height with mean value of 39.33 cm followed by treatment three (50 kg/ha) with mean value of 39.30 cm, 75 kg/ha with 38.70, 25 kg/ha with 38.03 cm while the shortest plant height was recorded with okg/ha treatment one with mean value of 29.80 cm. The data on the plant height as affected by NPK 15:15:15 fertilizer application at 3, 6 and 9 WAS in 2022 is shown in Table 2. (Ojo et al., 2014, Kanneh et al., 2016). Insignificant differences ($P>0.05$) was observed between the treated plots and the control at three and six weeks after sowing, implying that the application of fertilizer at 3 and 6 WAS does not increase plant height. At 9 WAS significant differences ($P<0.05$) was observed between the treated plots and the control, the tallest plant was 39.33cm recorded from 100kg/ha followed by 50 kg/ha with plant height of 39.30cm and 75kg/ha with of 38.70cm, 25kg/ha with 30.03 cm while the shortest plant of 29.80cm was obtained from okg/ha. The analysis revealed that, plants that received higher rate with 100 kg/ha of NPK fertilizer attained height that was significantly higher than those recorded with okg/ha and 25 kg/ha, 50 kg/ha and 75kg/ha NPK application. (Handy et al., 2022). This indicated that, increase in the level of fertilizer ^plication could cause significant increase in plant height at 9 WAS of plant growth.

Table.1: Effect of NPK 15:15:15 Fertilizer on plant height of Okra at 3, 6 and 9 WAS

Treatment NPK rate (kg/ha.)	Weeks after Sowing (WAS)		
	3	6	9
0	5.87	15.33	29.80b
25	5.60	17.67	38.03a
50	5.40	17.03	39.30a
75	5.37	16.03	38.70a
100	5.07	17.70	39.33a
SEM	0.65	0.73	1.32

(Ojo et al., 2014, Kanneh et al., 2016)

Effect: of NPK 15:15:15 fertilizer on leaf area index of Okra 3, 6 and 9 Weeks

Table.4 represents results on leaf area index of okra at 3 - 9 weeks after sowing. Results revealed that there was no significant difference at 3 weeks after sowing among plant treated with different quantities of N.P.K 15:15:15. However, at 6 weeks after sowing, significantly highest leaf area index of 0.20 was observed when plants were treated with 100 kg/ha with leaf area index of 0.12 when plants were treated with 0 kg/ha fertilizer.

Table 2: Effect: of NPK 15:15:15 fertilizer on leaf area index of Okra 3, 6 and 9 Weeks

Treatment/NPK rate (kg/ha.)	Weeks after Sowing (WAS)		
	3	6	9
0	3.80	6.87b	16.20
25	3.60	7.33b	18.47
50	3.60	7.07b	19.20
75	3.73	6.93b	18.07
100	4.00	7.93a	20.40
SEM	0.15	1.17	1.32

(Kanneh et al., 2016, Ojo et al., 2014)

Effect of NPK 15:15:15 fertilizer on number of branches of Okra at 3, 6 and 9 WAS

Table.5 reveals that the number of branches was insignificantly ($p>0.05$) influenced by the application of NPK 15:15:15 fertilizer at all rate of application. Increase in the rate of fertilizer application does not increase the number of branches. At 9 WAS with lookg/ha treatment five (T₅) there was increase in the number of branches with 3.75 mean.

Table 3: Effect of NPK 15:15:15 fertilizer on No. of branches of Okra at 3, 6 and 9 WAS

Treatment / NPK rate (kg/ha.)	Weeks after Sowing (WAS)		
	3	6	9
0	67.30	439.10c	1084.9b
25	59.37	632.00b	1706.2ab
50	69.75	520.08c	1771.5ab

75	52.52	539.50c	1609.8ab
100	75.29	727.98	2269.70a
SEM	9.79	43.28	231.14

(Kanneh et al., 2016, Ojo et al., 2014)

Effect of NPK 15:15:15 fertilizer on days to 15' flowering, days to 50% flowering, fresh fruit weight/net plot

During the year 2022 growing season days to first flowering Treatment four (75kg/ha) exhibited maximum number of days to 1st flowering with mean value of 54, followed by treatment three (25 kg/ha) with mean value of 53.33, treatment two (25 kg/ha) with mean value of 53.00, while treatment one (0kg/ha) recorded the minimum number of days to 1st flowering with 51.3. Days to 50% flowering was insignificant different between the five treatments, implying that increase in the rate of NPK 15:15:15 do not significantly increased days to 50% flowering. Fresh fruit weight/net plot treatment five (100kg/ha) exhibited maximum fresh fruit weight/net plot with mean value of 75.24, followed by treatment two (25 kg/ha) with mean value of 63.33, treatment three (50 kg/ha), treatment four (75 kg/ha) while treatment one (0kg/ha) recorded the minimum fresh fruit weight/net plot with 4397.

Table 4: Effect of NPK 15:15:15 fertilizer on days to 15' flowering, days to 50% flowering, fresh fruit weight/net plot

Parameters	0	25	50	75	100	SEM
Days of first flowering	51.33b	53.00ab	53.33ab	54.00a	53.00a	0.47
Days of 50% flowering	64.67	63.33	61.33	63.33	62.33	0.91
Fresh fruit weight/net plot	4397b	6355ab	5482ab	5257ab	7524a	6647.67

(Kanneh et al., 2016, Ojo et al., 2014)

Effect of NPK 15:15:15 fertilizer on Fruit length per fruit, Number of fruits per plant, seed wt/gm and 100 seed wt/gm. of okra

During the year 2022 growing season treatment one (0 kg/ha), Treatment two (25 kg/ha), treatment three (50 kg/ha), treatment four (75 kg/ha) and treatment five (100 kg/ha) were insignificantly different between them. Treatment five (100kg/ha) recorded the maximum fruit length per fruit with 6.77cm while treatment one (0kg/ha) recorded the minimum fruit length with 6.27cm. Treatment five (100kg/ha) registered the maximum number of fruit per plant with 17.07 mean, followed by Treatment two (25 kg/ha), treatment three (50 kg/ha), treatment four (75 kg/ha) while treatment one (0 kg/ha) recorded the minimum number of fruit per plant with 12.13 mean. Treatment one (0kg/ha) recorded the maximum seed wt/gm with 71.27gm while treatment five (100 kg/ha) recorded the minimum seed wt/gm with 66.40gm. Also the maximum 100 seed wt/gm was recorded from treatment five (Ts) 100kg/ha with 6.03gm, followed by treatment one (0 kg/ha), treatment two (25 kg/ha), treatment four (75 kg/ha), while the lowest was registered from treatment three (50 kg/ha) with 5.39gm.

Table 5: Effect of NPK 15:15:15 fertilizer on Fruit length per fruit, Number of fruits per plant, seed wt/gm and 100 seed wt/gm of okra

Parameters	0	25	50	75	100	SEM
Fruit length per fruit	6.27	6.53	6.57	6.27	6.77	0.25
No. of fruit per plant	12.13	14.40	14.20	14.07	17.07	1.86
No. of seeds per fruit	71.27	7373	69.87	71.00	66.40	2.53
100 seed wt/gm	6.02	5.86	5.39	5.83	6.03	0.20

(Kanneh et al., 2016, Ojo et al., 2014)

Discussion

The analysis of the study revealed that the number of leaves was influenced by the application of NPK 15:15:15. The result revealed that the number of leave was insignificantly different ($p < 0.05$) at 3 weeks after sowing from the other fertilizer rates and the control. This implies that, the application of fertilizer at 3 WAS with any rate does not influence the number of leaves. At 6 WAS it was significantly at 5% with control, the highest number of leaves was obtained from the application of lookg/ha with 7.93, 50kg/ha with 7.07 mean value, 75kg/ha with 6.93 mean value okg/ha with 6.87 mean value was recorded the lowest value. At the 9 weeks after sowing (WAS) the number of leave was insignificantly ($P < 0.05$) from the other fertilizer levels and the control. This also implies that, high rate of fertilizer application could improve the number of leaves because it can be seen that by applying lookg/ha the highest number of leave was obtained, both at 6 and okg/ha registered the lowest number of leaves. This study disagreed with the finding of (Otieno *et al.*, 2017), who indicated that the level of fertilizer application has no significant effect on Numbers of Leaves in Jos, but agrees with that of (Olaniyi & Ojetayo, 2010), who confines that number of leaves with the higher the amount of fertilizer applied the higher the number of leave of okra will be obtained. (Aguiar & Amador, 2011)

The study indicated insignificant differences ($P > 0.05$) of plant height between the treated plots and the control at three and six weeks after sowing, implying that the application of fertilizer at 3 and 6 WAS does not increase plant height. At 9 WAS significant differences ($P < 0.05$) was observed between the treated plots and the control, the tallest plant with 39.33 cm was recorded from lookg/ha followed by 50 kg/ha with 39.30cm and 75kg/ha with 38.70cm, 25kg/ha with 30.03 cm while the shortest plant height of 29.80cm was obtained from okg/ha. The analysis revealed that, plants that were treated with 100 kg/ha of NPK 15:15:15 fertilizer attained height; that were significantly higher than those recorded with 0 25, 50, and 75kg/ha. (Zainab *et al.*, 2016). This indicated that, increase in the rate of fertilizer application caused signified increase in plant height at 6 and 9 WAS of plant growth because it might have enhanced cell division and formation of more tissues resulting in luxuriant vegetative growth and thereby increased plant height. This study is in conformity with the study of (Castro *et al.*, 2011), who revealed that plant height increased with the increasing rate of N up to 120 kg/ha although responses of 100 and 120 kg N/ha differed with other two doses of nitrogen and also (Omotoso & Shittu, 2007), who indicated that okra plants were

taller in those plants that received 300 NPK kg ha⁻¹ than those that received lower rates of application due to higher nitrogen content which induced higher plant height. (P & N, 2012) The result shows insignificant difference of leaf area at 3 WAS, implying that the application of fertilizer at 3 WAS does not increase plant height, but significant differences ($P > 0.05$) of leaf area between all the treatments at 6 and 9 weeks after sowing. (Okonwu & Mensah, 2012) At 6 weeks the highest (727.98cm) leaf area was obtained from the application of 100kg and the lowest (439.10cm) from okg. At 9 WAS the widest plant was 2269.70cm recorded from the application of 100kg/ha while the lowest leaf area of 1084.9cm was obtained from okg/ha. (P & N, 2012). The analysis revealed that, plants that were treated with 100 kg/ha of NPK 15:15:15 fertilizer attained widest leaf area that were significantly wider than those recorded with 0 and 25, 50 and 75kg/ha. This indicated that, increase in the rate of fertilizer will significantly increase the leaf area of okra both at 6 and 9 WAS of plant growth (P & N, 2012). This disagreed and agreed with the findings (Isaac, 2015), who reported that revealed that okra leaf area increases with application of NPK fertilizer at 3 WAS and also revealed that okra leaf area as affected by different NPK fertilizer application regimes in 2013 and 2014 cropping. (Akintomide, *et al*; 2015). The mean values of okra leaf area data across the two years of experimentation indicated that, NPK fertilizer application regimes significantly increased okra leaf area from 1.08 to 0.79m² per/plant for NPK, fertilizer application at 6 and 9 WAS, respectively. The leaf area index was significantly different ($P < 0.05$) at 6 and 9 weeks after sowing with the control. At 6 WAS the highest (0.20cm) leaf area index, followed by 25kg with 0.18cm, 75kg with 0.15cm, 50kg with 0.14cm and okg with 0.12cm which was the lowest. This implies that, high application of fertilizer could improve the leaf area index because it indicated that by applying 100kg/ha the highest leaf area index was obtained at 6 and 9, also the okg/h recorded the lowest leaf area index as reported by (Omotoso & Shittu, 2007), that the leaf area index was significantly ($p < 0.05$) increased when 150 NPK kg/ha.

The analysis of the study confirms days to 1st flowering treatment four (75 kg/ha) exhibited maximum number of days to 1st flowering with mean value of 54, followed by treatment three (50 kg/ha), treatment two (25 kg/ha), while treatment one (0 kg/ha) recorded the minimum number of days to 1st flowering with 51.3. The number of branches was insignificantly ($p > 0.05$) influenced by the application of NPK 15:15:15 fertilizer at all rate of application. Increase in the rate of fertilizer application does not increase the number of branches. At 9 WAS with 100kg/ha (treatment five) there was increase in the number of branches with 3.75 mean. This findings is not in line with that of (Medeiros *et al.*, 2019), who reported that application of higher doses of NPK increased the number of branches per plant and was maximum with 120 kg P₂O₅/ha and that of (Yousaf *et al.*, 2017a) who revealed that the number of branches per plant showed a general trend of gradual increase with the increasing level of NPK fertilizer (Okonwu & Mensah, 2012).

Days to 50% flowering was insignificant different between the five treatments, implying that increase in the rate of NPK 15:15:15 do not significantly increased days to 50% flowering.

Fresh fruit weight/net plot T₅ (100kg/ha) exhibited maximum fresh fruit weight/net plot with mean value of 7524, followed by treatment two (25 kg/ha) treatment three (50 kg/ha), treatment four (75 kg/ha), while treatment one (0kg/ha) recorded the minimum fresh fruit weight/net plot with 4397. During the year 2022 growing season treatment one (0.kg/ha), Treatment two (25 kg/ha), treatment three (50 kg/ha), treatment four (75 kg/ha) insignificantly different between them. Treatment five (100kg/ha) recorded the maximum fruit length per plant with 6.77cm while treatment one (0kg/ha) recorded the minimum fruit length with 6.27cm. Treatment five (100kg/ha) registered the maximum number of fruit per plant with 17.07 mean, followed by treatment two (25 kg/ha), treatment three (50 kg/ha), treatment four (75 kg/ha), while treatment one (0kg/ha) recorded the minimum number of fruit per plant with 12.13 mean. Treatment one (0kg/ha) recorded the maximum seed wt/gm with 71.27gm while treatment five (100kg/ha) recorded the minimum seed wt/gm with 66.40gm. Also the maximum 100 seed wt/gm was recorded from treatment five (100 kg/ha) with 6.03gm, followed by treatment one (0 kg/ha), treatment two (25 kg/ha), treatment four (75 kg/ha). While, the lowest was registered from treatment three (50 kg/ha) with 5.39gm. This agreed with the study of (Omotoso & Shittu, 2007), who shows that fresh fruit weight per plant were significantly ($p < 0.05$) increased when 150 NPK kg/ha is applied (Ibrahim & Abdullahi, 2023), who reported that highly significant differences observed in fresh fruit weight because as the rate of NPK fertilizer increases the fresh fruit weight also increases this could be attributed to genetic differences and ability to take up essential elements for translocation to economic yield of okra and the study of (Okonwu & Mensah, 2012, Kanneh et al., 2016) who indicated that differences observed in seed weight and 100 seed weights due to different level of NPK fertilizer application this might be related to possibility of possession of higher stomata inductance, better partitioning of photosynthetic materials towards economic yield and better genetic structure (Medeiros et al., 2019), who observed that the significant effect of NPK fertilizer highly Significant of the number of green fruits per plants. (Yousaf et al., 2017), also "Ported that there was highly significant effect on the fresh fruit length due to the application different level of NPK .The NPK levels of 160 kg and 0kg/ha gave the longest (13.987cm) and the shortest (11.250 cm) fresh fruit length respectively (Ibrahim & Abdullahi, 2023)

Conclusion

The Effects of different rates of NPK 15:15:15 fertilizer on growth and yield of okra (*Abelmoschus esculentus* (L.) Moenchin), in Mubi North Local Government Area Adamawa State, has been successfully conducted. From the results obtained application of 100kg/ha of N.P.K 15:15:15 fertilizer improve growth and yield components significantly 100kg/ha gives sufficient nutrients needed for optimum growth and yield of okra.

Recommendation

- We therefore recommend 100kg/ha of N.P.K 15:15:15 fertilizer to be used by farmers in Mubi Local Government for optimum yield of Okra.

Conflict of Interests

The authors have not declared any conflict of interest.

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