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THE RESPONSE OF NPK15:15:15 ON GROWTH AND YIELD OF TOMATO IN BALI TARABA STATE

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ABSTRACT

Field experiment was conducted in Federal polytechnic Bali research farm during the 2022 raining season to determine the Response of NPK 15:15:15 on growth and yields of Tomato. The treatments consist of three level of NPK 15:15:15 fertilizer (50kg 100kg and 150kg). The trial was laid out in randomized complete block design (RCBD) and replicated three times. Observations were made on plant height, number of leaves, Individual fruit weight, and fruit weight per plot

INTRODUCTION

Tomato (Lycopersicon esculentum Mill) belongs to the family Solanacae, is a native of South America. Genetic evidence shows that progenitors of tomatoes where herbaceous green plants with small green fruits and centre of diversity in the high land of Peru. One species Solanum lycopersicon was transported to Mexico where it was grown and consumed by Meso-American Civilization (Jaliya, 2008).

Tomato is one of the most widely eaten vegetables in the world which popularly stems from the fact that they can be eaten fresh or in multiple of associated with prevention of several diseases mainly due to the content of antioxidant including carotene, lycopene, as well as B-Carotene, ascorbic acid and phenolic compounds. The world production figure of tomatoes in 2012 was 145.8 metric tons with China leading producer with the production of 39.5 metric tons and Nigeria is the fourth in Africa and lead in West Africa sub region with an estimated output of 1.10 metric tons and average yield of 10 tons per hectare, (Abdulmajeed *et al* 2012). Tomato grows best under temperature between 20-27°C, fruit setting is poor when average temperature exceeds 30°C or fall below 10°C (Walker, 2007), tomato prefer a well-drained soil because they are sensitive to water logging, optimum soil pH for tomato production is 60-70. Disorder such as blossom and root rot are common if the soil PH is lower than 5.5. The varieties of tomato

and yield tons per hectare. All data was subjected to statistical analysis. Results revealed that 150kg/ha of NPK fertilizer had the highest mean values in all growth and yield parameters. Based on the results obtained from this research it could be concluded that 150kg/ha has appeared to be best dose of NPK fertilizer to be used on tomato production in the study area. Therefore, farmers at Bali could use 150kg/ha of NPK 15:15:15 fertilizer of tomato in order to produce maximum yield of tomato.

Keywords: *Growth, Yield, NPK fertilizer, Tomato*

are many, but three are the most common; Fresh market tomatoes, small size ''cherry'' tomatoes and processing tomatoes have a bright red color and high solid content that make them suitable for making soup, paste. Tomato can also be classified based on the plant habits as: determinates, semi determinates which produce stems that end with a flower: determine grows slightly taller. In determinates varieties which continuously produces new leaves and flowers can grow very tall (smith 2000). Economically speaking Tomatoes are worth a tremendous amount of money because they give more yields. Tomatoes are also one the main ingredients in thousands dishes and product that are sold in supermarket throughout the developing and developed world (smith 2000). Tomatoes are popular choice by people who wish to grow fruits and gardens, not only they can be used raw in salad, but they are also essential parts of many recipes as well as many products such as tomatoes ketchup and chutney. Despite the benefit of the crop, the plant cannot withstand frost and high relative humidity. Also light intensity affects pigmentation, fruit color and fruit set. The plant is highly affected by adverse climate condition. It requires different climate range for seed germination, seedlings growth, flower and fruit, and fruit quality above all.

Objectives of the Study

Based on the above facts there is need to identify the best level of NPK to be used on tomato by the farmers in the study area. The objectives of this research work were as follows;

a. To determine the Response of NPK 15:15:15 fertilizer on the growth of tomato
b. To study the Response of NPK 15:15:15 fertilizer on the yield of tomato.

Statement of the problem

NPK 15:15:15 is essential on growth and yield of tomato, if not appropriately or carefully selected; it will adversely affect growth and yield of tomato crop. Therefore, there is need

to investigate the appropriate dose to be used in order to produce optimum yield of tomato in the study area.

Significant of the study

This research is aimed to expose the farmers of this Local Government area on the dose of NPK 15:15:15 to be used in order to give maximum crop yield.

There is little/absence of research that aimed at Response of NPK 15:15:15 fertilizer on growth and yield of tomato. The research was conducted in the area of the study in order to promote growth and yield of tomato by providing production techniques to small and medium scale growers of tomato in the area of the study.

Scope and Limitation of the Study

The study therefore, will be concentrated on Response of Growth and Yield of Tomato to NPK 15:15:15 fertilizer in Bali Local Government Area. This research work is limited to Bali Local Government Area, during 2022 rainy season because of time factor.

Literature Review

Response of NPK 15:15:15 fertilizer on Growth of Tomato

Edward *et al* (2002), reported that Roma VF with NPK 15:15:15 Fertilizer recorded the highest mean number of leaves and highest branch numbers, followed by Tandino, UTC significantly recorded the lowest mean number on leaves and flowers. Elizabeth and John, (2001) reported that UTC variety flower at Six weeks after transplanting earlier than Roma VF and Tandino varieties. Abdullah *et al.*, (2009) reported that Roma VF and Zungeru local varieties recorded highest mean number on plant height, followed by UTC, Bosso local gave the lowest means number. However, UTC significantly recorded the highest leaves number than Roma VF with NPK 140kg/ha rate and Zugeru local variety. Many factors have been reported to be responsible for this poor growth performance of tomato (Sangoyemi *et al*., 2011). Muhammad *et al.*, (2011) reported that Roma VF ' significantly produced the highest mean number of plant height and number flowers. UTC recorded the lowest mean numbers on height, number of flowers but produced highest mean number of branches. According to Ali and Kabiru (2013). Roma VF. Jalingo local variety recorded the highest mean number of branches, plant height and number of leaves, whereas UTC and Wukari local variety produced significantly the lowest means number. Akanbi *et al.,* (2010) reported that UTC and Ibadan local variety started flowering exactly Six weeks after transplanting earlier than Roma VF and Beske local varieties. Isah *et al* (2014) reported that both varieties responded linearly in growth stages at 5 and 7 weeks after transplanting on plant height, number of leaves and crop growth rate (CGR). However,

UTC proves superior over Roma VF on plant height at 5-7, (WAT) number of leaves at 7-9 (WAT) but Roma VF flower at 9-10 (WAT) earlier than UTC variety. Mehla *et al,* (2000), reported that Roma VF had significantly higher mean number on plant height (72.8cm) than the UFC variety (64.9cm). The significant differences in plant between Needs the two varieties could be due to their distinct growth habit. Mohammad *et al.,* (2013) reported that Roma VF recorded the highest plant height and highest mean number of branches, While UTC, and Kaduna local variety proves superior on mean number of flowers Edward et al, (2002) reported that Roma VF gave highest mean number of leaves and highest flower number, followed by Tandino, UTC recorded lowest' mean number on both leaves and flowers. Odunze *et al*., (2002), reported that UTC gave the highest plant height, whereas Roma VF recorded the highest number of leaves at six weeks after transplanting. Akanbi *et al.,* (2010) reported that UTC was superior to Roma VF and Asaba local varieties tested with mean height of 52cm, mean leaves number while Roma VF recorded the highest mean number: on flowers. Roma VF performed 'competitively better than UTC tomato variety. Akanbi *et al*, (2010) reported also that UTC and Ibadan local started flowering exactly 6WAT earlier than Roma VF, but Roma vf fruit earlier than UTC variety of tomato.

Response of NPK 15:15:15 fertilizer on yield of tomato

Akanbi *et al*, (2010) reported that selection of suitable variety and treated with NPK 15:15:15 fertilizer at the rate of 160kg/ha result in highest yields and post-harvest quality, and maximum economic return for tomato grown in guinea and Sahel savannah in Nigeria. According to Fawusi, (2013) tomato UTC variety is the best variety to be grown in northern Nigeria. Dethman and Huet (2011), reported that Roma VF variety of tomato is the best variety as the plant fruit early and individual fruit can be weigh about 80.26g.

Varieties differ in their yield potential depending mainly on the physiological process which is controlled by interplay of both genetic make-up, Nitrogen fertilizer and the environmental conditions (Ahmad and Singh 2005). Muhammad *et al*, (2011) reported that Roma VF variety recorded higher mean fruit page weight and yield of tomato while UTC had lower mean number of fruit weight and yield Ali and Kabiru, (2013) reported that Roma VF, generally produced significantly (P 0.05) greater number of fruits/plant and fresh weight of fruits/plant than the variety UTC and Dan baga which produced the lowest fruits yields. Akanbi *et al*., (2010) reported that higher fruit yield was recorded from UTC variety, closely followed by Ogbomoso local. Although, there is consistence in the results of the nutritional composition of tomato fruits. the Roma VF recorded most of the nutritional values more than the other varieties. Therefore, Roma VF in that descending

order are better in terms fruit quality and UTC is better in yield quantity, and both can be successfully grown in the Northern part of Nigeria.

Edward *et al.*, (2002) reported that tomato varieties had significant (P=0.001) effects on yield. Mehla *et al.*, (2000) reported that UTC variety recorded the highest fruit yield. Followed by Roma VF. Similarly, a report from Elizabeth and Miller (2001), UTC variety which is hybrid type Proves superior over Roma VF, with individual weight about 68g and Roma VF weight about 52.6g. Odunze *et al.*, (2002) reported that the highest value' of individual fruit weight. and fruit yield was obtained from Roma VF, that this Roma VF variety has the potential for good performance in the northern Nigeria. Ali and Kabiru, (2013) reported that Roma VF significantly recorded the highest individual fruit weight, fruit weight per plot and fruit yield tone per hectare. Abdullah *et al.*, (2009), reported that highest mean number was recorded from Roma VF. in time of individual fruit weight: fruit weight per plot followed by UTC, the lowest mean number was produced by Zungeru local variety. Odunze *et al.*, (2002), reported that UTC variety of tomato gave the highest mean number of individual fruit weight. Fruit weight 'per plot while Roma VF recorded the highest number on fruit yield tone per hectare.

Experimental Design

Material and Methods

Material and Tools

Tape: The tape was used for measuring the length and width of the beds for the spacing of the plants within the beds

Hoes: This was used for the preparation of the soil, making beds and leveling of beds

Rope and Pegs: These were used to drawn rows for seed planting.

Ruler: Ruler was used for measuring the height and leaves of the tomato plant.

Seed: The seed was commercially obtained at premier seed store behind Taraba State University gate ATC. The variety obtained was Roma VF variety.

Experimental Area

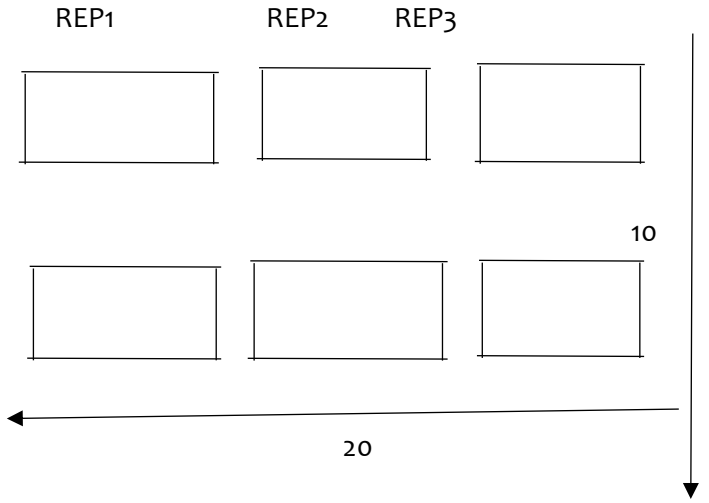
The experiment was conducted in 2022 raining season between June to September at Federal Polytechnic Bali research farm. The site is located between the latitude of 7.8533N and 10.9685 and longitude of **07.25E and 0727E**. The study area was characterized by moderate raining season last for about 180-210 days with annual rainfall of 1000-1200MM. The vegetation in the study area consist short grasses, shrub, trees Crops, animals, and the soil is sandy loamy.

Land preparation

The land was cleared manually using native hoes and rake were all existing weeds, shrubs and stumps from various crops were removed and burnt. The soil in the area was tilled and broken in to fine and smooth. The land was levelled uniformly by using rake, tape and

pegs where used to create blocks with their respective plots. Each plots were space 1.5x3m (discard) in order to allow easy access to the plots for inspection, application, observation and data recording.

Land allocation: the depth allocated is 10×20-meter plot for the project. Land was prepared, weeding, ploughing and demarcated in to 5×10M



Cultural Practices

Nursery bed

The nursery bed size of 2m x 1m was prepared and the seeds obtained from Premier store ATC behind TASU gate were broadcast on 18 June, 2022 after pre-irrigating the bed, after broadcasting, the bed were then covered with dry grasses which served as mulching material. The bed was then watered at two days' intervals. Germination occurred 6-7 days after sowing the seeds, about 25g/ Of N.P.K (15:15:15) was incorporated into the nursery beds.

Transplanting operation

Five weeks after sowing, the nursery was watered and the seedlings were removed with a ball of earth and were transplanted into the experimental plots on 25th July, 2022. Single seedlings were transplanted in each hole at a spacing of 60cm × 60cm. the operation was conducted in the evening after pre-irritating the plots.

Fertilizer application

The application of Nitrogen fertilizer as treatments was conducted three weeks after transplanting on 16th August, 2022. The first half of the fertilizer levels were 9.5, 11.25,162

grams per plot respectively and were applied three weeks after transplanting, while the second half of the Nitrogen levels were applied six weeks after transplanting 7th September, 2022. Urea (46% N) was the source of nitrogen.

Weeds control

Hoe weeding was regularly carried out, complemented by regular hand pulling of weeds.

Pest and disease control

Pest control was conducted at eight weeks after transplanting (8WAT) and at 10 WAT by spraying with cypermethrin at 15ml/ha equivalent to 0.06ml/per plot.

Harvesting

Harvesting was done manually by using hand at the initial fruit ripening and was then continued at seven days' intervals.

Sampling techniques

Data from three plants were collected from each of the experimental plot in which the parameters tested were observed.

Data collection

Data from the four growth parameters were taken, plant height, number of leaves, number of branches and number of flowers. Measurement of these data were taken on each of the three sampled plants and were observed and recorded at each two weeks' intervals which started (4) weeks after transplanting, and the data on yield parameters observed and recorded were individual fruit weight, fruit weight per plot and fruit tone per hectare (t/ha)

Plant height (cm)

The height of the (3) sampled plants were each obtained by measuring in centimeters (cm) from the base to the apex of the plant by using meter rule.

Number of leaves

The data on number of leaves were obtained by counting the number of compound leaves (both big and small) from each of three (3) sampled –plants.

Number of branches

The data on number of branches of each of the three (3) sampled plants were obtained by counting

Number of flower

Record on number of the flowers of each of the three (3) sampled plants were obtained by counting.

Average individual fruit weight (g)

One fruit from each three sampled plant was weight in order to obtained individual fruit weight balance by using electronic weighing balance

Fruit weight per plot (g)

The data on fruit weight per plot were obtained by multiplying the average fruit per plant population per plot in each treatment level

Fruit yield (tone per hectare)

Total fruit per plot were converted to tone per hectare basis using the appropriate conversion factor

Data analysis

Data collected were subjected to analysis of variance (ANOVA). Treatment means that were statistically significant were compared using Duncan multiple Range Test (DMRT) as reported by steel and Torrie (2005)

Results and Discussion

Plant height

Table 4.1: Response of tomato on growth and yield to NPK 15:15:15 fertilizer in terms of plant height (cm) at 4,6 8 weeks after transplanting.

NPK Treatment	plant height (cm)		
	4WAT	6WAT	8WAT
50kg/ha	21	24	29
100kg/ha	29	32	39
150kg/ha	34	39	44
P Value	0.00598	0.00990	0.06557
	NS	*	NS

NS=Not significance

*=significance 4% level of confidence

The mean values of number of plant height for NPK fertilizer on tomatoes are present in Table 4.1 but the increase is not statistically significant at four and eight weeks, was only

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statistically significant at 6 weeks after transplanting when subjected to ANOVA (p=0.05). The highest mean number of plant height was obtained by the plot treated with 150kg/ha.

Number of leaves

Table 4.2: Response of tomato on growth and yield to NPK 15:15:15 fertilizer in terms of number of leaves at 4,6 and 8 weeks after transplanting

NPK Treatment	number of Leaves		
	4WAT	6WAT	8WAT
50kg/ha	16	24	29
100kg/ha	19	29	34
150kg/ha	22	33	39
P value	0.0579	0.3236	0.0328
	NS	*	NS

NS= Not significant

* =significant of 5% level of confidence

The mean value of number of leaves per plant for the NPK Fertilizer treatment on tomatoes is presented in Table 4.2. The response of tomato to NPK fertilizer application on number of leaves was statistically significant at 6 WAT. (P>0.05) the highest mean number of leaves was obtained from 150kg/ha and 0kg/ha recorded the lowest. While the increase is not statistically significant at 4 and 8 WAT.

Number of branches

Table 4.3: Response of tomato on Growth and yield to NPK fertilizer in terms of number branches at 4, 6 and 8 weeks after transplanting

NPK Treatment	number of branches		
	4WAT	6WAT	8WAT
50kg/ha	6	9	12
100kg/ha	9	13	18
150kg/ha	13	17	23
P value	0.0204	0.0301	0.0382
	NS	*	

NS

NS = Not significant

* = significant at 5% level of confidence

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The mean values of number of branches per plant for the NPK Fertilizer treatments of tomatoes are presented in Table 4.3. Number of branches at 4 and 8 weeks after transplanting was not statistically significant when subjected to ANOVA but there was significant different in number of branches at 6 weeks after transplanting.

Number of flowers

Table 4.4: Response of tomato on growth and yield to NPK 15:15:15 Fertilizer in terms of number of flowers at 4, 6 and 8 weeks after transplanting.

NPK Treatments	number of flowers		
	4WAT	6WAT	8WAT
50kg/ha	9	11	14
100kg/ha	11	14	16
150kg/ha	17	21	24
P value	0.0361	0.0201	0.0472
	NS	*	NS

NS = Not significant

* = significant at 5% level of confidence

The results of number of flowers per plant for the NPK Fertilizer treatment on tomato are presented in Table 4.4 the NPK treatment in terms of number of flowers at 6 WAT was statistically significant (P=0.05). when subjected to ANOVA. The highest number of flowers was obtained by 150k/ha plot and 50kg/ha recorded lowest. While at 4 and 8 WAT no significant differences were recorded.

Individual fruit weight (g)

Table 4.5: Response of tomato on growth and yield to NPK Fertilizer treatment in terms of individual fruit weight (g)

NPK Treatment	Individual fruit weight of tomato (g)
50kg/ha	60
100kg/ha	69
150kg/ha	80
P. value	0.0473
Significant	**

Note ** = significant at 1% level of confidence

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In terms of individual fruit weight of the NPK Treatments on tomato there was statistically significant (P=0.01). The highest fruit weight in grams (80) was produced by 150kg/ha plot. While the lowest individual fruit weight (60) was obtained by 50kg/ha plot. (Table 4.5)

Fruit weight per plot (kg)

Table 4.6: Response of tomato on growth and yield to NPK Fertilizer in terms of fruit weight per plot (kg).

NPK Fertilizer treatment		Fruit weight per plot (kg)
50kg/ha		3.4
100kg/ha		4.1
150kg/ha		5.2
P value	0.6521	
Significant		*

Note NS = Not significant

* = significant at 5% level of confidence

There was significant difference (p=0.05) in fruit weight per plot between the level of NPK treatments. Highest average fruit weight per plot was obtained by 150kg/ha plots. While the 50kg/ha gave the lowest value. (Table 4.6)

Fruit yield tone per hectare

Table 4.7 Response of tomato on fruit yield tone per hectare (t/ha).

NPK Fertilizer treatments	fruit yield tone per hectare (t/ha)
50kg/ha	6821.66
100kg/ha	7723.11
150kg/ha	8124.24
P. value	0260.12
Significant	**

Note. ** = significant at 1% level of confidence

There was highly significance (p=0.01) in tomato fruit yield tone per hectare (t/ha).

The highest fruit yield tone per hectare was obtained with 150kg/ha treatment, while the lowest value was produced by 50kg/ha. (Table 4.7

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Discussion

Plant height

150kg/ha NPK Fertilizer gave the highest plant height throughout the sampling periods. This may likely be due to individual growth habit. This finding is similar to that of Abdullah et al, (2009) who reported that 160kg/ha of NPK Fertilizer significantly recorded the highest plant height.

Number of leaves

Effects of NPK Fertilizer on tomato mean number of leaves was statistically significant only at 6 weeks after transplanting. The highest mean number of leaves was obtained from 150kg/ha throughout the sampling periods. 50kg/ha recorded the lowest mean number of leaves. This finding is similar to that of Edward et al, (2002) who reported that 140kg/ha of NPK fertilizer recorded the highest mean number of leaves and flower.

Number of branches

The highest mean number of branches per plant were obtained from 150kg/ha of fertilizer, and the lowest recorded mean number from 50kg/ha. This finding is similar to that of Muhammad et al, (2011) who reported that Roma VF variety supplemented with 160kg/ha of fertilizer recorded highest mean number of branches.

Number of flowers

The effect of NPK Fertilizer on growth and yield of tomato on number of flowers was statistically significant at 6WAT, the highest mean number of flowers was obtained from 150kg/ha throughout the sampling periods. This finding is similar to that of Akanbi (2010) who reported that Roma VF and Ibadan local variety started flowering at (6WAT) earlier than UTC variety.

Individual fruit weight of tomato (g)

The effect of NPK fertilizer on individual fruit weight per plant of tomato was statistically significant. 150kg/ha gave the highest individual fruit weight while 50kg/ha recorded lowest.

Fruit weight per plot (kg)

The effect of NPK Fertilizer on fruit weight per plot was statistically significant, 150kg/ha gave the highest fruit weight per plot. While, the lowest fruit weight per plot from 50kg/ha. This finding is similar to that of Edward et al (2002) who reported that tomato varieties had significant effect on yield with appropriate dose of NPK Fertilizer.

Fruit Yield tone per hectare (t/ha)

The effect of NPK Fertilizer on fruit yield tone per hectare (t/ha) was statistically significant. The highest fruit yield tone per hectare was obtained from 150kg/ha. While 50kg/ha gave the lowest fruit yield tone per hectare. This finding is similar to that of Ali and Kabiru (2013).

CONCLUSSION AND RECOMMENDATIONS

Growth and Yield of tomato as response to NPK Fertilizer research was conducted in 2022 rainy season at Federal Polytechnic Bali Research Farm. The site was located at 7.8533N and 10.9685 and longitude of **07.25E and 0727E**. The objectives of the research were to study the Growth and Yield of tomato as response to NPK 15:15:15 Fertilizer. The variety used was Roma VF variety. The field experiments consisted of three replications with two treatments. A randomized complete block design (RCBD) was used in the testing the experiments. The results showed that NPK Fertilizer had significant effects on growth and yield parameters such as plant height, number of leaves, number of branches, number of flowers, individual fruit weight, fruit weight per plot and fruit yield tone per hectare of tomato. 150kg/ha gave highest mean values throughout the sampling periods.

Conclusion

The present investigation showed that 150kg/ha of NPK Fertilizer had the highest mean values in all the growth and yield parameters. Based on the results obtained from the experiments, it could be concluded that 150kg/ha has appear to be the appropriate dose of NPK Fertilizer for tomato production in the study area.

Recommendations

The results obtained from this study, it has appeared that 150kg/ha of NPK Fertilizer gave the maximum fruit yield. Therefore, Farmers of Bali Local Government could use 150kg/ha of fertilizer in order to produced maximum yield of tomato. Further research also needs to be carried out to ascertain the above.

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