INTERNATIONAL JOUNAL OF: AGRICULTURAL RESEARCH AND BIOTECHNOLOGY

TIMBOU-AFRICA ACADEMIC PUBLICATIONS
INTERNATIONAL JOURNAL, NOVEMBER, 2022 EDITIONS
VOL. 11 NO. 1 ISSN: 3438-2901

EFFECT OF PHOSPHATE ON GROWTH AND YIELD SOYA-BEAN 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 Effect of phosphorous on growth and yield of soya-beans. The treatments consisted of three level of phosphorous fertilizer ok,150 and 300kg/ha). The trial was laid out in randomized complete block design (RCBD) and replicated

Introduction

Soya-bean Glycine max is an important food legumes crop, it is a drought resistant crop with better growth in warm climate and most popular in the semi-arid region of the tropic where food legumes do not form well. Soya-bean is a major important crop to the livelihood of millions of relatively poor people in less developed countries of the tropics. From production of this crop, rural families derived food, animal feeds and cash together with spill over benefits to their farmland and part of the plant can be used for food providing proteins, vitamins and minerals.

As tropical crop, it requires higher temperature, intensive sunshine with evenly distributed rainfall between 750mm and 150mm during the growing phase. Very heavy rainfall extends its vegetative growth phase. Soya-bean is adapted to wide range soil. It grows almost equally well on sandy soil as well as on clay soil and can stand poor soil condition better than most crop. Reason for low soya-bean yields includes insect, pest and diseases, drought, excessive moisture, low fertility, weed and mixed cropping. Research work has shown

three times. Observations were made on plant height, number of leaves, and soya-bean yield per plot and yield tonne per hectare. All data was subjected to statistical analysis. Results revealed that 300kg of phosphorous had the highest mean values in all growth and yield parameters. Based on the results obtained from this research it could be concluded that 300kg has appeared to be best level in the study area. Therefore, farmers at Bali could use 300kg of phosphorous fertilizer in order to produce maximum yield soya-bean.

Keywords: *Phosphorous Fertilizer, Legume, Growth, Yield.*

that fertilizer used with adequate protection measures and the used of improved cultivation would in tremendous increase in yield of soya-bean. (Tene et al., 2003) reported that there are variation in the usage of phosphorus by crops, some require high while some require low dosage.

However, the variation in soil phosphate supply will depends on the concentration of phosphorous in the solution and the buffer capacity or ability to replenish pool. Crops need adequate phosphorus supply throughout the growing season but importance has been attributed to adequate phosphate for young plants (Abdulmajeed et al., 2007).

Objectives of the study

Base on the above facts, there is need to identify the level of phosphorous to be used in the study area. The objectives of the study were as follows.

a. To determine the response of soya-bean to different levels of phosphorous fertilizer in the research area.
b. To create room for future research on the effects of phosphorous on the growth and yield of soya-bean in the study area.
c. To determine the quality and quantity records in order to serve as study reference in the future.

Statement of the problem

Fertilizer is essential on growth and yields of soya-bean, if not appropriately or carefully applied, it will adversely affect growth and yield of soya-bean crop. Therefore, there is need to investigate the appropriate level to be applied in a different agro-climatically region in order to produce optimum yield in the study area.

There is little/absence of research that aimed at effect, performance and response of phosphorous fertilizer on soya-bean production conducted in the area of the study in order to promote growth and yield of soya-bean by providing production techniques to small and medium scale growers in the area of the study

Scope and Limitation of the study

The study covers effect of phosphorous fertilizer on growth and yield of soya-bean in the field. Therefore, this research is limited to Bali Local Government, Taraba State during raining season.

Literature Review

(Nzeribe AD 2003) stated that soya-bean (Glycine max) being a leguminous crop requires little or no nitrogen fertilizer. Top dressing with super phosphate and nitrate of potash three weeks after germination is recommended. As reported by (Sing et al 2002) Glycine max is a major important crop to livelihood of millions of relatively poor people in less developed countries of tropics. From production of this crop rural families derived food, cash and animal feeds together with spill over benefits to their farm land (Anyawu AC 2004). Abdulmajeed and Smith (2003) also stated that the soil should be tilled and harrowed properly. Soya-bean can be planted on ridges, heaps or even flats soil, so that it will have access to fertilizer application. They further lamented that soya-bean is in July-August in the north and in September in the Southern

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ISSN: 3438-2901

of Nigeria. Seed rate of 20-25kh/ha at the rate of three seeds per hole at the depth of 2.5cm spacing of 20x50cm for the Zamfara variety, germination occurs within five to seven days after sowing (Tene et al 2003). Yield of 3271 and 3222 kg/ha were recorded in 2001/2002 cropping season respectively at Federal University of Technology Yola (FUTY) research farm as a result of phosphorous fertilizer application on soya-bean (Adediran and Banjoko 2001). Pods mature as from four months after planting, harvesting is done manually or mechanically. They further pointed out that soya-bean under maximum management yields between 600-700kg/ha. (Square 2001) pointed out that soya-bean grains are highly attack by weevil hence they are either stored in sealed drums or polythene bags which prevents the survival of the weevils or they may be fumigated and then stored in bags. It has been reported by (Muhammad and Hussain 2011) that soya-bean is an important source of vegetable protein. It is used in making cowbell powder for our daily tea. They also pointed out that phosphorous application increases the yield of soya-bean. Hence it was pointed out that phosphorous of 60kg/ha will increase the yield of soya-bean in the study area. Ahmad and Sing (2006) stated that soya-bean perform best on sandy soil, loamy and drained clay soil. High temperature and sunshine are beneficial for optimum production. Rainfall requirement ranges from 80-160cm annually. They further pointed out that with adequate required phosphate fertilizer application will lasting the growth and development of the crop also maximum yield be obtained. According (Nzeribe AD 2003) gave his own view that soya-bean is a drought tolerant crop with better growth in warm climates and most popular in the semi-arid region of the tropics where other legumes do not perform well.

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

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ISSN: 3438-2901

Hoes: This was used for the preparation of the soil, making beds and levelling 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 soya-bean plant.

Seed: The seed were commercially obtained at premier seed store behind Taraba State University gate ATC. The variety obtained was soya-bean (Zamfara).

Single super phosphate fertilizer: The application of phosphorous fertilizer as treatment was conducted four weeks after planting (WAP). The application dose was 0, 150 and 300kg/ha were applied respectively.

Experimental Area

The experiment was conducted in 2022 raining season June to October at Federal Polytechnic Bali research farm. The site is located between the latitude of 120-29N and 120-20130N 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 1×2

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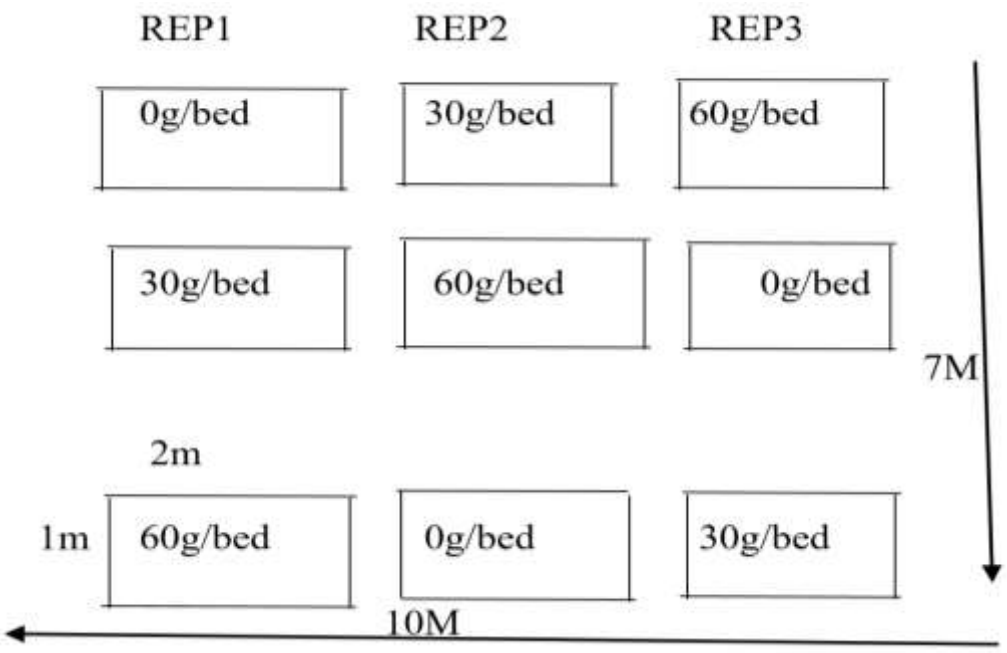
ISSN: 3438-2901



Planting: The seed of soya-bean was firstly sown on 25th July, 2022. Then supplied of missing plants was carried out on the 9th August, 2022 using the recommended spacing of row 25cm and column 75cm.

Treatment Design

The treatments consist of fertilizer applied in 4 four different levels (0,20,40 and 60kg/ha) which where replicated three times. The treatments where assigned in a Randomized complete block design (RCBD)

Soya-bean variety

The variety used in this experiment was soya-bean (ZAMFARA) and the variety was more pest and disease tolerant than many other varieties in Northern Nigeria (Iliyasu and Jamilu 2009)

Fertilizer application

The application of phosphorous fertilizer was conducted four weeks after planting (WAP). The application dose was 0, 150 and 60kg/ha were applied per plot respectively.

Weed control

Early weeding is paramount using small hoe, walking from furrow up to ridges, complemented by regular hand pulling of weeds, and this is done after three weeks of planting respectively, second weeding is six weeks after planting.

Pest and Disease control

Pest control was conducted by spraying with cypermethrim at 15ml /ha equivalent to 0.06ml per plot.

Harvesting

Harvesting was done manually by using hand at the initial ripening and when the plants have dried up.

Sampling Techniques

Data from plants were collected from each of the experimental plots in which the parameters tested were observed and recorded.

Data collection

Data collection from the full growth parameters were plants height, number of leaves and number of branches. Measurements of these data were taken on each of three sample plants and where observed and recorded at each of two weeks' intervals. Data on yield parameters observed and recorded are number of pods per plant, grain yield per plot and yield per hectare).

Plant Height

The data of plant height were recorded by measuring 3 samples in centimetres (CM) from the base to the apex of the plant by using measuring tape.

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 the 3 three sample plants.

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ISSN: 3438-2901

Number of branches

The data on number of branches of each of the three samples plants were obtained by counting.

Soya-bean weight per plot (kg)

The data on soya-bean weight per plot were obtained by multiplying the average soya-bean weight per plant by ten (plant population per plot) in each treatment level.

Soya-bean yield tone per hectare (t/ha)

Total soya-bean per plot was converted to tonnes per hectare basis using the appropriate conversation factors.

Data Analysis

Data collected was subjected to analysis of variance (ANOVA). Treatment means that were statistically significant were compare using Least significant difference (LSD) as reported by steel and Torrie (1981).

Results

Plant Height

Table 1: Effect of phosphorous fertilizer on soya-bean in terms of plant height (CM) 4,6 and 8 weeks after planting (WAT).

Treatment	phosphorous fertilizer kg/ha	Plant height (CM)	
	4WAP	6WAP	8WAP
0kg/ha	12.5	17.4	19.3
150kg/ha	21.5	26.6	29.4
300kg/ha	23.5	27.5	32.4
P-VALUE	0.0775	0.00187	0.3753
Significant	NS	*	NS

NS =Not significant

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ISSN: 3438-2901

* = Significant at 4% level of confidence

There was increase of height of soya-bean in response of phosphorous fertilizer application, with the increase of the amount of fertilizer per hectare, but the increase is not statistically significant at four and eight weeks after planting. ($p<0.05$) and was statistically significant at 6 weeks after planting ($p>0.05$. The highest mean plant was obtained with treatment which received 300kg/ha and the lowest in the treatment with 0kg/ha which is control treatment.

Number of leaves

Table 2: Performance of phosphorous fertilizer on soya-bean in terms of number of leaves at 4,6 and 8 weeks after planting (WAT).

Treatment phosphorous kg/ha	Number of leaves		
	4WAP	6WAP	8WAP
0kg/ha	6	8	11
150kg/ha	7	10	11
300kg/ha	8	12	14
P-VALUE	0.00285	0.08904	01137
Significant	NS	*	NS

NS =Not significant

* = Significant at 5% level of confidence

The response of soya-bean to phosphorous fertilizer application on number of leaves was statistically significant at 6 weeks after planting ($p>0.05$). And the lowest mean number of leaves was obtained from the treatments with 0kg/ha. The increase of number of leaves is not statistically significant at 4 and 8 weeks after planting.

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ISSN: 3438-2901

Plant branches

Table 3: Effects of phosphorous fertilizer on soya-bean in terms of plant branches (CM) 4,6 and 8 weeks after planting (WAT).

Treatment phosphorous fertilizer kg/ha	Plant height (CM)		
	4WAP	6WAP	8WAP
0kg/ha	6.63	8.00	17.20
150kg/ha	13.17	17.10	24.83
300kg/ha	19.17	19.17	28.33
P-VALUE	0.0885	0.00197	0.3753
Significant	NS	*	NS

NS =Not significant

* = Significant at 4% level of confidence

There was increase of height if soya-bean in response of phosphorous fertilizer application, with the increase of the amount of fertilizer per hectare, but the increase is not statistically significant at four and eight weeks after planting. ($p<0.05$) and was statistically significant at 6 weeks after planting ($p>0.05$. The highest mean plant was obtained with treatment which received 300kg/ha and the lowest in the treatment with 0kg/ha which is control treatment.

Soya-bean weight per plot (kg)

Table 4: Effects of phosphorous fertilizer on soya-bean in terms of individual maize

Treatment	soya-bean weight per plot(kg)
0kg/ha	9.56
150kg/ha	15.39
300kg/ha	18.45
P-VALUE	0.01003
Significant	*

NS =Not significant

* = Significant at 1% level of confidence

TIJARBT
ISSN: 3438-2901

The response phosphorous fertilizer application in term of soya-bean weight per plot (kg) was statistically significant ($p<0.01$). The highest soya-bean weight in kilogram was produced with the application of 300kg/ha of fertilizer and the lowest individual soya-bean weight was obtained in plots with 0kg/ha (control).

Soya-bean Yield tone per hectare (t/ha)

Table 5: Shows response of soya-bean to phosphorous fertilizer application in yield tonne per hectare

phosphorous fertilizer kg/ha	soya-bean tone yield per hectare (t/ha)
0kg/ha	7676.52
150kg/ha	8967.53
300kg/ha	9255.22
P-VALUE	0.7958
Significant	*

NS =Not significant

* = Significant at 1% level of confidence

Average soya-bean weight per plot was obtained from 300kg/ha on phosphorous fertilizer application while 0kg/ha of phosphorous fertilizer application gave the lowest value.

Discussion

Plants height

The application of 300kg/ha of phosphorous fertilizer gave the highest plant height throughout the sampling periods. Phosphorous fertilizer level with 300kg/ha only increased in plant height at 6 and 8 weeks after planting. This may likely due to the fact that phosphorous fertilizer plays an important role in growth and development of plants. This finding is similar to that of (Sangoyemi

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et al 2011) who reported that the application of phosphorous fertilizer increases plant height significantly.

Number of leaves

The application of phosphorous fertilizer on mean number of leaves was statistically significant only at 6WAP. The mean number of leaves obtained at 300kg/ha throughout the sampling period. This differences are due to the fact that phosphorous fertilizer promotes cell multiplication and the ability of soya-bean plants to develop more leaves. It also plays a vital role in the formation of chlorophyll (a green pigment in leaves that helps during photosynthesis). This finding is similar to that of (Edward 2002) who reported that application of phosphorous fertilizer promotes leaves shoot and other vegetative parts.

Number of Branches

The application of phosphorous fertilizer showed significant effect on mean number of branches at 6WAP, while the treatments effect was not statistically significant at 8WAP. The highest mean number of branches per plants was obtained with the application of 300kg/ha of phosphorous fertilizer throughout the sampling periods. This finding is similar with that of (May and Gonzales 2004) who reported that the application of 400kg/ha of phosphorous fertilizer will promote growth of shoot and branches

Soya-bean weight per plot (kg)

The response of phosphorous fertilizer application on soya-bean weight per plot was statistically significant, the application of 300kg/ha of phosphorous fertilizer gave highest weight per plot while the lowest weight per plot was recorded in a plot treated with 0kg/ha. This finding is similar to that of (Ali and Kabiru 2013) who reported that soya-bean weight Were significantly influence by the application of 200kg/ha of phosphorous Fertilizer.

Soya-bean Yield tons per hectare (t/ha)

The response of soya-bean to phosphorous fertilizer application in terms of yield tone per hectare was statistically significant. The highest yield tone per

hectare was obtained in a plot treated with 300kg/ha of phosphorous fertilizer application, while 0kg/ha gave the lowest yield tone per hectare. The finding was similar to that of (Abdullahi et al 2009) who reported that there is increase in yields when phosphorous fertilizer applied at early stage of soya-bean farming.

CONCLUSION AND RECOMMENDATIONS

The effect of phosphorous on the growth and yield of soya-bean (Glycine max) research was conducted in 2021/2022 during raining season in the Federal Polytechnic Bali research farm. The site is located between the Latitude of 7.8533N and longitude 10.9685 and longitude of 07.25E and 0727E. The study area is 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. The objectives of the study were to study the effects phosphorous fertilizer on growth and yield of soya-bean. The variety used was soya-bean (ZAMFARA). The field experiments consisted of four treatments with three replications. A randomize complete block design (RCBD) was used in testing the full experiments. The treatment used in this experiment consisted of four rates of phosphorous fertilizer 0, 150 and 300kg/ha. The results showed that the application of phosphorous fertilizer had significant effect on growth and yield of soya-bean. The application of 300kg/ha rate of phosphorous fertilizer gave the highest value of growth and yield parameters while in both growth and yield parameters control treatments 0kg/ha produced the lowest mean values.

Conclusion

The present investigation has shown that the application of 60kg/ha rate of phosphorous fertilizer gave the highest mean value in all the two growth and three yield parameters. Based on the results obtained from this experiments, it could be concluded that the application of 300kg/ha rates of phosphorous fertilizer has appeared to be optimum level for increasing yield of soya-bean production in the study area.

Recommendation

Based on the results obtained from this study, it has appeared that 300kg/ha of phosphorous fertilizer is the optimum rate for maximum yield of soya-bean in the research area. Therefore, farmers of Bali Local Government could use 60kg/ha of phosphorous fertilizer level in order to increase yield of soya-bean. Further research need to be carried out to ascertain the above.

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