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THE EFFECTS OF N. P. K. LEVELS ON THE GROWTH, YIELD COMPONENTS AND GRAIN YIELD OF 2 – CULTIVARS OF SOYBEANS, ''TAMAKPO'' AND JOHN GREEN (*Glycinemax* (L.) *Merrill*), IN BALI LOCAL GOVERNMENT AREA OF TARABA–STATE, NIGERIA

Ugwuegbulam Onyekachi Cordelia
Department of Agricultural Technology
Federal Polytechnic, Bali, Taraba – State, Nigeria

ABSTRACT

Field trial was conducted at the Teaching and Research Farm of the Department of Agricultural Technology, Federal Polytechnic, Bali, Taraba – State in 2019 cropping season, to study the effects of N. P. K. levels on the Growth, Yield components and Grain yield of 2- cultivars of Soybeans ''Tamakpo'' and John Green (Glycine max(L.) Merrill), in Bali Taraba – State, in the northern – guinea savanna zone of Nigeria. The experimental design was a split – plot design with the Soybean cultivars ''TAMAKPO'' and JOHN GREEN as the main plots and five treatments T1 (Control), T2, T3, T4, and T5 as sub – plots. These treatments were replicated four times giving a total of forty (40) sub-plots. Parameters measured include; Plant height (cm) at 4, 8, and 12 weeks after planting (WAP), number of leaves per plant at 4, 8, and 12 weeks after planting (WAP), number of branches at 4, 8, and 12 weeks after planting (WAP),and number of effective and non – effective nodules per plant . For yield, the following Parameters were taken; Number of pods per plant, pod weight per plant, 100 seed weight and grain yield in kg/ha. The result shows that there was no significant difference at (P<0.05) in the effects of treatment and cultivar on number of leaves of soybean cultivars at 4, 8, and 12, after planting (WAP). The results also shows that there was no significant difference at (P<0.05) in the effects of treatments and cultivars on number of branches of soybean cultivars at 4, 8, and 12 weeks after planting (WAP). There was no significant difference at (P<0.05) in the effects of treatments and cultivars on the height of soybean cultivars at 4, 8, and 12 weeks after planting (WAP). On yield parameters, there was no significant difference at (P<0.05) in the effects of treatment and cultivar on the yield of soybean cultivars. In the yield parameter of this study, that is, number of effective and non – effective nodules, pod weight, number of pods, 100 seed weight and pod yield/ha. The results of this study indicated that there were no significant differences in the performance of the cultivars on both growth and yield parameters. This might be due to soil conditions, agronomic practices and environmental conditions in Bali Local Government Area of Taraba–State. Despite the fact, that there was no significant differences between N, P, K, levels(treatment) and cultivars, more research can be carried out using other treatments on the same cultivars, to experiment on commercial production which can be disseminated to farmers, for large scale production of soybean.

Keywords; Soybean Cultivars, Yield Performance, Effective and Non–Effective Nodules, Treatments, Leguminosae.

INTRODUCTION

Background of the study

Soybean (*Glycine max* L. *Merrill*), is an essential oil seed belonging to the family *leguminosae*, is mainly grown as a food crop (Iwe, 2003). Soybean generally requires at least 500 - 700mm of rainfall to mature (Randall, 2001).The rainfall requirements ranges between 600–1200mm uniformly distributed over a period of four – five months, For successful cultivation, soybean requires well drained fertile loamy sand or sandy soil. It also thrive well on black or clay soils provided that rainfall is not so high to cause water – logging. The pH range is 5 – 6. (Achakzai and Kayani, 2003).

Correspondence Author: Ugwuegbulam Onyekachi Cordelia: E-mail: uonyekac@gmail.com

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Soybean requires careful land preparation and the soil should be to a medium tilt, but not so finely broken down that will encourage erosion by water (Witty and Mallarino, 2004). According to Nimje (2003), one of the most critical factors that affect the yield of soybean in Africa is low plant population density of (20,000-25000 plants/ha. Recommendation for plant population vary widely from 100,000 – 350, 000 plants per hectare (Bello, 2001).

Hundreds of available cultivars have been adopted to various regions of the world (Iwe, 2003). Soybean production and utilization as food came from Ancient China not later than the 11^{th} Century, Before Christ (B.C). It is known that the seed of soybean contains protein among all cultivated legumes (FAO, 1989). Much attention has been given to soybean worldwide due to its high nutritional food value and protein content (Tiamigu and Idowu, 2001). It is the primary source of vegetable oil and protein for food and industrial applications (Endress, 2001).

Soybean production is high in the guinea savanna zones and forest belts of Nigeria (Okpala and Ibiam,2000).

There are about 316 cultivars of soybean from Brazil; some of them include;

- Embrapa 48 soybean – This is more than 15 years on the market.it possess milk with superior flavour.
- BRS 213 - has triple null for lipoxigenase enzyme. It has the taste of beany flavour.
- BRS – 216, has very long seeds and high protein value.
- BRS – 257, has similar productivity with current cultivation. Soy milk and soybean industry needs it.
- BRS – 258, originated from an old Embrapa soybean cultivar called BR 36.
- BRS – 267, has very large seeds and sweet flavour.
- BRS- 282, originated from Embrapa 48 and was launched 3 years ago (https://www.intechopen.com). (Brazilian soybean varieties for human -……).

In Nigeria, ''TAMAKPO'' and John Green cultivars are cultivated in Bali, Bali local Area of Taraba – State.

In view of the above, two cultivars of soybean were grown to determine their yield performance in Bali local Area of Taraba – State and its environs and to recommend the best yielding cultivar for cultivation to farmers for commercial production.

METHODOLOGY OF THE STUDY

Field experiment was conducted at the Teaching and Research Farm of the department of Agricultural Technology, Federal Polytechnic Bali, Taraba–State, in 2019 cropping season. The study area was located within $7^0\ 12^1$ N to $9^0\ 00^1$ N of the Equator, and longitude $10^0\ 00^1$ E to $12^0\ 00^1$E of the meridian (ANAMMCO ATLAS, 2008). Its land mass is about 10, 000^2 Km and lies within the guinea savannah ecological zone of Nigeria. It's annual rainfall ranges between 750mm to 1100mm, while temperature ranges between 22^0C – 35^0C. The land was ploughed with tractor, while harrowing was done with hoe. The experimental field was a spit –plot design with the soybean cultivars ''Tamakpo'' and John Green as the main plots and five treatments T1 (Control), T2, T3, T4, and T5 as sub – plots. These treatments were replicated four times giving a total of 40 sub–plots. The following treatments was used; T1 = 0 Kg N. P.K/ha (Control), T2 = 72 Kg N. P. K/ha, T3= 96 Kg N. P. K/ ha, T4 = 120 Kg N. P. K/ ha, and T5 = 144 Kg N. P. K/ha. Each main plot measured 20M X3M = ($60M^2$), while the sub – plot measured 4M X3M = ($12M^2$), separated by 0.75M pathway between each plot and replications. The total experimental area was 40M X 12M = ($480M^2$). The cultivars of soybean used was purchased from a local market in Bali on the 27^{th} of July, 2019. when rainfall has fully established, seeds were sown on the 2^{nd} of August, 2019, and herbicide Butachlor 50% EC was applied to suppress weeds. Planting was done by drilling two seeds and later thinned to one at an intra – row spacing of 7CM after three weeks of planting (WAP), that gave an estimated plant population of 166, 666 plants per hectare.

Seeds were planted at inter – plot spacing of 75CM, inter – row spacing of 75CM and intra – row spacing of 7CM. N. P. K. fertilizer (15: 15: 15) was applied at 4, 8, and 12 weeks after planting (WAP).

Growth and Yield Parameters Taken

Data collected included: Number of leaves at 4, 8, and 12 (WAP), Number of branches at 4, 8, and 12 (WAP), height at 4, 8 and 12 (WAP), and yield parameters which include, number of effective nodules, number of non –effective nodules, pod weight, number of pods, 100 seed weight and pod yield / ha.

Methods of Parameters Taken

Method of Growth Parameters Taken

Plant height (in cm) at 4, 8, and 12 weeks after sowing was taken by using a meter rule for measuring each plant height, for 20 plants on each sub plot, number of leaves per plant at 4, 8, and 12 after sowing was taken by physical counting of the leaves on each plant, number of branches per plant at 4, 8, and 12 weeks after sowing was taken by physical counting of the branches on each plant, number of nodules per plant at 8 weeks after sowing was taken by uprooting 20 plants in each sub - plot and counting the total number of nodules and divided by 20 to get the total number of nodules / plant. The same procedure is applied for non – effective nodules and effective nodules per plant.

Method of yield Parameters Taken;

Number of pods per plant was determined by physical counting of pods on 20 plants and divided by 20 to get the number of pods per plants, pod weight per plot was obtained by harvesting and weighing dry pods in each plot, 100 seed weight was obtained by weighing 100 grains in each sub – plot, and production in kg / ha was determined by converting production /plot to kg / ha.

Data collected was analysed using SPSS VERSION 22 and separation was done using Duncan Multiple Range Test (DMRT)

RESULTS AND DISCUSSION

Table 1: shows that there was no significant difference at ($P< 0.05$) in the effects of treatment and cultivars on number of leaves of soybeans at 4, 8, and 12 weeks after planting(WAP), using SPSS Version 22 and separation was done using Duncan Multiple Range Test (DMRT), Which showed no significant difference at $P< 0.05$. This result might be due to the fact that soybean cultivars / varieties are differently affected due to agronomic practices and environmental conditions (Akparaobi, 2009). Table 2: shows that there was no significant difference at ($P< 0.05$) in the effect of treatments and cultivar on the number of branches of soybean plants at 4, 8, and 12weeks after planting(WAP), using SPSS Version and separation was done using Duncan Multiple Range Test(DMRT), which showed no significant difference at $P<0.05$. This might be due to climatic and soil conditions, during the 2019 cropping season.

Table 3: showed that there was no significant difference at ($P<0.05$), in the effect of treatments and cultivars on plant height of soybean plants at 4, 8, and 12 weeks after planting (WAP), using SPSS Version 22 and separation was done using Duncan Multiple Range Tests (DMRT). This might be so , due to the fact that cultivars/ varieties are tested at different environmental zones and different agronomic practices where soybean is cultivated during a particular cropping season. Table 4: shows that there was no significant difference at ($P<0.05$) in the effects of treatments and cultivar on the yield of soybean plants. Yield Parameters measured include; number of effective and non – effective nodules, Pod weight, number of pods, 100 seed weight and pod yield/ha.

SPSS version 22 was used for the analysis, while Duncan Multiple Range Tests was used for the separation. This might be due to agronomic practices, climatic conditions and environmental conditions employed, during the 2019 cropping season.

CONCLUSION

Based on the result of this study, it can be concluded that the soybean cultivars ‘’TAMAKPO’’ and John Green has no significant difference at P< 0.05% in both growth and yield parameters during the field experiment. There was also no significant difference at P< 0.05% between treatment and cultivars. There was no significant difference also at P< 0.05% in separation according to Duncan Multiple Range Test. With regards to this result, the same research can be carried out in the same ecological zone using the same cultivars of soybeans with different treatments which can boost high production of soybean that can be disseminated to farmers for maximum yield.

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APPENDICES

Appendix 1 : Effect of Treatments and Cultivar on the number of leaves of Soybeans plants

Treatment (NPK/ha)	Weeks after Planting 4	8	12
0 kg	16.50	39.00	45.88
72 kg	16.75	49.25	48.25
96 kg	16.88	44.50	60.63
120 kg	17.00	44.63	56.25
144 kg	15.75	41.50	62.00
SEM	0.48	4.19	6.08
	NS	NS	NS
Cultivar			
Tamakpo	16.350	45.60	54.80
John-Green	16.800	41.95	54.40
SEM	0.31	2.65	3.85
	NS	NS	NS

Values in the column followed by the same letter(s) have no significant difference according to Duncan Multiple Range Test(DMRT).

Effect of Treatments and Cultivar on the number of leaves of Soybeans plants

The results from Table 1 shows that there was no significant difference ($p<0.05$) in the effects of treatments and cultivar on number of leaves of Soybeans plants at 4, 8 and 12 Weeks After Planting (WAP).

Appendix 11**: Effect of Treatments and Cultivar on the number of branches of Soybeans plants**

Treatment (NPK/ha)	Weeks after Planting 4	8	12
0 kg	0.38	7.63	11.50
72 kg	0.75	8.50	13.00
96 kg	0.38	9.00	14.25
120 kg	0.13	7.75	12.63
144 kg	0.38	7.38	12.25
SEM	0.25	1.08	1.52
	NS	NS	NS
Cultivar			
Tamakpo	0.50	8.90	12.55
John-Green	0.30	7.20	12.90
SEM	0.16	0.68	0.96
	NS	NS	NS

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range Test(DMRT) at $p< 0.05$.

Effect of Treatments and Cultivar on the number of branches of Soybeans plants

The results from appendix 11 - shows that there was no significant difference ($p<0.05$) in the effects of treatments and cultivar on number of branches of Soybeans plants at 4, 8 and 12 Weeks After Planting (WAP).

Appendix**111 : Effect of Treatments and Cultivar on the height of Soybeans plants (CM).**

Treatment (NPK/ha)	**Weeks after Planting (cm)**		
	4	**8**	**12**
0 kg	15.38	28.38	31.88
72 kg	16.31	36.38	40.00
96 kg	16.31	33.88	37.25
120 kg	15.88	33.25	36.88
144 kg	14.38	32.63	36.50
SEM	1.02	3.45	3.88
	NS	NS	NS
Cultivar			
Tamakpo	15.23	33.60	37.30
John-Green	16.08	32.20	35.70
SEM	0.65	2.18	2.46
	NS	NS	NS

Values in the same column followed by the same(letters) have no significant difference according to Duncan Multiple Range Test(DMRT) at $p< 0.05$.

Effect of Treatments and Cultivar on the height of Soybeans plants

The results from Table 3 shows that there was no significant difference ($p<0.05$) in the effects of treatments and cultivar on the height of Soybeans plants at 4, 8 and 12 Weeks After Planting (WAP).

Appendix iv: Effect of Treatments and Cultivar on yield parameters of Soybeans plants

Treatment (NPK/ha)	**No. of eff. Nods**	**No. of non eff. Nods**	**Pod weight**	**No. of pods**	**100 Seed weight**	**Pod yield**
0 kg	3.88	2.75	118.04	257.25	23.97	3928.26
72 kg	3.25	6.50	124.50	237.63	23.63	3803.86
96 kg	8.25	6.75	133.61	257.63	23.68	3177.90
120 kg	3.63	2.88	115.24	263.75	22.61	3952.32
144 kg	4.38	3.88	113.64	234.13	23.15	3424.68
SEM	1.86	2.33	16.11	33.11	0.99	412.64
	NS	NS	NS	NS	NS	NS
Cultivar						
Tamakpo	3.85	4.60	119.70	219.95	24.78	3336.00
John-Green	5.50	4.50	122.31	280.20	22.04	3978.80
SEM	1.17	1.48	10.19	20.94	0.63	260.97
	NS	NS	NS	NS	NS	NS

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range Test(DMRT) at $p< 0.05$

Effect of Treatments and Cultivar on yield parameters of Soybeans plants

The results from Table 4 shows that there was no significant difference ($p<0.05$) in the effects of treatments and cultivar on the yield parameters of Soybeans plants. Yield parameters measured include; number of effective and non-effective nodules, pod weight, number of pods, 100 seed weight and pod yield/ha.

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Key:-

Trt = Treatment

DMRT = Duncan Multiple Range Test.

WAP = Weeks After Planting (WAP)

CM = Centimetre

No. of eff. Nods = numbers of effective nodules

No. of Non-effective nods = Number of Non-effective nodules

P.W. = Pod weight

No. of Pods = Number of pods.

100 S.W = 100 seed weight.

Pod Y/ha = Pod yield per hectare