Quest Journals
Journal of Research in Agriculture and Animal Science
Volume 8 ~ Issue 7 (2021) pp: 01-03
ISSN(Online) : 2321-9459
www.questjournals.org

Research Paper

Evaluation of Low Nitrogen Rates on Two Varieties of Soybean in Southern Guinea Savanna of Oyo State, Nigeria.

*[1]Oyatokun, Olukayode Stephen and [2]Adeoye, Gideon Olajire.
[1]*Ajayi Crowther University, Oyo, Nigeria*
[2]*University of Ibadan, Ibadan, Nigeria*
**Corresponding author: os.oyatokun@acu.edu.ng*

ABSTRACT
Application of fertilizer nitrogen to soybean by researchers had produced varying positive and negative results over time. This work sought to evaluate the effects of low N rates on two soybean varieties in the southern Guinea savanna of Oyo State, Nigeria.
A 2-year field experiment was established in the rainy seasons of 2009 and 2010. The experiment was located at Ipapo (Latitude 8^o 08' N; Longitude 03^o 30' E; 353m asl). The experiment was a 5 x 2 factorial in a-split-plot plot design, where N rate was at the main plot and variety was the sub-plot factor with three replications. Two soybean varieties TGx1485-1D and TGx1448-2E were obtained from IITA, Ibadan. Five low rates of N fertilizer treatments (0, 5, 15, 25 and 35 kg/ha) were applied one week after planting in the form of Urea (46%N). Planting was done on June 28, 2009 and June 11, 2010 for the two year-study at a spacing of 75cm x 5cm. Plot size was 22.5 m^2 (4.5m x 5 m). Data was collected on yield and yield parameters. Shoot samples were oven-dried at 72° C for 24 hours and analyzed for N content. Data analysis was carried out using GENSTAT statistical package and means of observations were separated using Duncan Multiple Range test at 5% level of probability.
Application of 15 and 25 kg/ha gave grain yield that was significantly greater than the control (zero application). TGx1448-2E produced a grain yield of I.54t/ha while TGx1485-1D produced 1.35t/ha. There was no difference in the effects of low N rates on soybean in terms of dry shoot weight and shoot N-content, however varietal differences occurred where TGx1448-2E produced heavier dry shoot weight (2.96t/ha) than TGx1485-1D (2.32t/ha); TGx1485-1D accumulated a greater shoot N-content (3.29%) than variety TGx1448-2E (2.59%). The uptake of N at 15 and 35 kg/ha rate was significantly higher than the control and other rates.
Application of 15 kg/ha enhanced the yield and N-uptake of soybean in the study area, however, there was a marked distinction in the responses of the two varieties under investigation. While TGx1448-2E had a heavier biomass weight, TGx1485-1D had greater shoot N content.
***Keywords**: Low N-rate, soybean, N-content, grain yield, N-uptake*

Received 20 June, 2021; Revised: 03 July, 2021; Accepted 05 July, 2021 © The author(s) 2021.
Published with open access at www.questjournals.org

I. INTRODUCTION

Nitrogen is a major nutrient element of crop and perhaps the most critical in plant nutrition (10). Nitrogen status of soils of sub-Saharan Africa is very low as a result of the prevalence of low activity clay with 1:1 lattice structure coupled with the climatic factors of characteristically heavy and torrential rainfall and high temperatures, which affect the availability of nitrogen to crops.

It is widely believed that soybean does not need any application of fertilizer nitrogen for the attainment of good growth and development. This is because, soybean as a legume is believed to enrich its environment with naturally fixed nitrogen from the atmosphere through the activities of symbiotic-bacteria that live on its roots. However, there were mixed feelings as reports from several studies either lend support for, or go against N application in soybean production (12). Such studies were reported to have led to an increased yield or a reduced yield or no effect on soybean yield consequent upon application. Randall and Schmitt (11) in studies on the effects of fertilizer-N application to soybean concluded that soybean yield could be increased by addition of soil applied fertilizer, however responses were inconsistent and varied with season, variety, rate, fertilizer source, application timing, and other yield- limiting factors. Similarly, Oplinger and Bundy (7) in a review of

soybean N fertilization research over many years summarized that in a few cases, yields were increased but in the majority of cases there was no response to applied N.

Requirement for N by soybean is typically provided through native nitrogen in the soil and through the process of atmospheric fixation by the activities of root nodule bacteria known as rhizobia. Hence relative nitrogen supply can vary, as either a function of the native soil nitrogen or as a function conditions for the development of root nodules (3).

Nigeria is ranked first among the producers of soybean in Africa, with the bulk production coming from southern Guinea savanna agro-ecology; although production has extended to other agro-ecologies (1, 6). Ipapo is a town which lies in the northern part of Oyo state, which is regarded as the food basket of the state and falls within the southern Guinea savanna agro-ecological zone of Nigeria. The soils of Ipapo (the study site) are characterized as luvisols using the FAO guidelines of 2006 (2, 9).The soils are highly weathered with low fertility levels.

This work therefore examined the effect of low rates of nitrogen application on the yield of two soybean varieties in the southern Guinea savanna agro-ecology of Oyo State, Nigeria.

II. MATERIALS AND METHOD

A 2-year field experiment was conducted during the rainy seasons of 2009 and 2010. The experiment was located at Ipapo (Latitude 8^o 08' N; Longitude 03^o 30' E; 353m asl). The soil of the study site was a loamy sand. The experiment was a 5 x 2 factorial in a-split-plot plot design, where N rate was at the main plot and variety was the sub-plot factor with three replications. Two soybean varieties TGx1485-1D and TGx1448-2E were obtained from IITA, Ibadan. Five low rates of N fertilizer treatments (0, 5, 15, 25 and 35 kg/ha) in the form of Urea (46%N) were applied one week after planting through banding. Planting was done in June 28, 2009 and June 11, 2010 for the two year-study at a spacing of 75cm x 5cm to give a population of 266,667plants/ha. Plot size was 22.5 m^2 (4.5m x 5 m). Data was collected at a designated harvest area for each treatment on yield and yield parameters. Shoot samples were oven-dried at 72° C for 24 hours and analyzed for N accumulation. Data analysis was carried out using GENSTAT statistical package (4) and means of observations were separated using Duncan Multiple Range test at 5% level of probability.

III. RESULT AND DISCUSSION

3.1 Grain yield

The two varieties responded differently to low rates of nitrogen in terms of grain yield. Variety TGx1448-2E produced a grain yield (I.54t/ha) that was significantly higher than that of variety TGx1485-1D (1.35t/ha). This might be due to the genetic composition of the varieties. This is in agreement with earlier works by Okpara and Ibiam (6) as well as Yusuf and Idowu (16) who observed significant differences among soybean cultivars. With respect to N application rates, 15 and 25 kg/ha rates produced grain yields which were significantly higher than the control (0 kg/ha); although, not significantly different from all other rates of nitrogen (Table 1). Similar positive results were reported in some field investigations (8, 13, 14) but contrary to the works of Ying *et al*. (15).

3.2 Dry shoot weight (biomass)

There was no difference in the effects of low N rates on soybean in terms of dry shoot weight, although, biomass increases with increasing N rate. Similar report was given by Manral and Saxena (5), who posited that soybean dry matter accumulation increased with nitrogen rates. However, the two varieties responded differently where variety TGx1448-2E produced heavier shoot dry weight (2.96t/ha) than TGx1485-1D (2.32t/ha). This could be ascribed to the genetic make-up of the varieties.

3.3 Shoot Nitrogen Content

Response of soybean to low nitrogen rates in terms of shoot N accumulation was similar as there was no differential effects of low nitrogen rates. However, the two varieties under investigation responded differently, where variety TGx1485-1D accumulated a greater shoot N-content than variety TGx1448-2E (Table 1). This could be due to genetic make-up of the varieties.

3.4 Nitrogen uptake

There were significant differences occasioned by the application of low nitrogen rates to soybean. Nitrogen application rates of 15 and 35 kg/ha produced crop N uptake which are significantly higher than crop N-uptake produced by 25, control (0) and 5 kg/ha application rates. However, the two varieties responded similarly in terms of N-uptake (Table 1).

IV. CONCLUSION

Application of 15 kg/ha enhanced the yield and N-uptake of soybean in the study area, however, there was a marked distinction in the responses of the two varieties under investigation in the study site. While variety TGx1448-2E produced a higher biomass weight, TGx1485-1D accumulated greater shoot N content.

REFERENCES

[1]. Chiezey, U.F., J.I. Wanyam and O.O. Olufajo, 2001.Yield and nutrient uptake of soybean as influenced by liming, nitrogen and phosphorus fertilizer levels. *Journal of Agricultural Environment*, 2: 45-54.

[2]. FAO. 2006. World Reference Base for Soil Resources. A Framework for International Classification, Correlation and Communication. *Bulletin Report* No. 103. Food and Agricultural Organization (FAO), Rome. 130pp.

[3]. Gan, Y., Stulen, I., Van Keulen, H. and Kuiper P. J. C. 2003. Effect of fertilizer top-dressing at various reproductive stages on growth N2 fixation and yield of three soybean (*Glycine max* L.) genotypes. *Field Crop Research* 80. 2: 147 - 155.

[4]. GENSTAT. 1995. Genstat 5 Release 3.2 for Windows 95. Lawes Agricultural Trust, Rothamstead Experimental Station, U.K. 147pp.

[5]. Manral, H. S. and Saxena, S. C. 2003. Plant growth, yield attributes and grain yield of soybean as affected by the application of inorganic and organic sources of nutrients. *Bioresource Technology* 92: 110 - 118.

[6]. Okpara, D.A. and B. Ibiam, 2000. Evaluation of soybean varieties for adaptability to a humid tropical environment in south east Nigeria. *Journal of Sustainable Agriculture and Environment*, 2: 26-31.

[7]. .Oplinger, E. S. and Bundy, L. G. 1998. Nitrogen fertilization of soybean: Wisconsin results. In *Proceeding of 1998 Wisconsin Fertilizer, Aglime and Pest Management Conference,* Madison, WI. 19–21 Jan. 1998. Univ. of Wisconsin, Madison. 120–129.

[8]. Osborne, S., & Riedell, W. E. (2006). Soybean growth response to low rates of nitrogen applied at planting in the Northern Great Plains. *Journal of Plant Nutrition, 29*, 985-1002. http://dx.doi.org/10.1080/01904160600686007

[9]. O.S. Oyatokun, B.N. Okafor, K. O. Oluwasemire and G.O. Adeoye 2017. Properties of Some Soils Developed from Basement Complex Parent Material in a Savanna Zone of Nigeria and Their Effect on Soybean (Glycine max) Production. *American-Eurasian J. Agric. & Environ. Sci.*, 17 (4): 280-283. DOI: 10.5829/idosi.aejaes.2017.280.283

[10]. Penas, E. J. and Wiese, R. A. 1987. Fertilizer suggestions for soybean. *NebGuide* G87-859-A, University of Nebraska, Cooperative Extension, Lincoln, NE. 1 – 4

[11]. Randall, G. W. and Schmitt, M. A. 1998. Fertilizer or manure for soybeans. In *Proceeding of 1998 Wisconsin Fertilizer, Aglime, and Pest Management Conference*, Madison, WI. 110–119.

[12]. Salvagiotti, F., Cassman, K., Specht, J. Walters, D, Weiss, A. and Dobermann, A. 2008. Nitrogen uptake, fixation and response to fertilizer N in soybeans: A review. *Field Crops Research* 108: 1 – 13.

[13]. Starling, M., Weaver D. and Wood W. 1998. Nitrogen improves yield of late planted soybeans. *Highlights of Agricultural Research* 45: 18 - 19.

[14]. Taylor, J., Whelan, B., Thylén, L., Gilbertsson, M. and Hassall, J. 2005. Monitoring wheat protein content on-harvester-Australian experiences. In J Stafford *et al.* (Eds.) *Proceeding of 5th European Conference on Precision Agriculture*, Uppsala, Sweden 9 –12 June, 2005. Wageningen Academic Publisher, Wageningen. 369–376.

[15]. Ying J. F., Herridge, D. F., Peoples, M. B. and Rerkasem, B. 1992. Effects of N fertilization on N2 fixation and N balances of soybean grown after lowland rice. *Plant Soil* 147: 235-242.

[16]. Yusuf, L. A. and Idowu A. A. 2000. Evaluation of four soybeans varieties for performance under different lime regimes on the acid soil of Uyo. *Tropical Oilseed Journal* 6: 65 - 70.

Table 1: Effects of N Rate and Variety on Yield and N-uptake (2009-2010).

Treatment	% Shoot N	Dry shoot weight (t/ha)	Grain yield (t/ha)	N-uptake (kg/ha)
N rate (kg/ha)				
0	3.05	2.10	1.24	64.14
5	2.77	2.15	1.29	59.42
15	3.17	2.37	1.38	75.19
25	2.75	2.40	1.37	65.95
35	2.90	2.53	1.34	73.37
LSD (0.05)	0.480 ns	0.44 ns	0.12	2.11
Variety				
TGx1485-1D	3.29	2.32	1.35	76.39
TGx1448-2E	2.56	2.96	1.54	75.80
LSD (0.05)	0.42	0.52	0.15	2.79 ns