PERFORMANCE OF SOME SELECTED VARIETIES OF SOYABEAN (*Glycine max* (L.) Merr) AT BIU, BORNO STATE, NIGERIA.

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ABSTRACT

Field experiments were carried out during the 2020 and 2021 cropping sessions to investigate the performance of some selected varieties of Soyabean (Glycine max (L.) Merr) *at Biu, Borno State,Nigeria. The experimental treatments consist of three soyabean varieties (TGX 1448-2E, TGX1904-6F and TGX 1830-2E) were laid out in a split plot design and replicated three times. Characters measured were establishment count, plant height, number of branches, and number of pods, 100-seed weight and yield kgha^{-1}. Data collected was subjected to analysis of variance and Means were separated using the List Significant Difference (LSD) procedure. Results showed that, there was significant difference among varieties (P< 0.05) that were recorded in establishment count, plant height at 6 weeks after sowing (WAS) (P< 0.05) and 9 weeks after sowing, (WAS) and also in the number of branches, number of pods, 100-seed weight and grain yield kgha^{-1}. The variety TGX 1448-2E produced the highest yield in the study area and is therefore recommended to farmers for cultivation particularly in the study area.*

Keywords: Varieties, Soyabean, Performance, study, farmers, significance.

INTRODUCTION

Soyabean (*Glycine Max (*L*)* Merr) belongs to the family `Fabaceae. It is native to East Asia and annual crop that has been used in China for about 5,000 years. It was introduced into Europe in the 17th century and USA in 1804, but did not receive much attention until the 20th century. Since 1920 there has been production in the USA and of the entire crop produced there since the 1960s none has increased in importance and hectare as much as soyabean (Onwueme and Sinha, 1991). Its production responds to increasing industries which substituted soyabean for groundnut oil/feed cake. The crop due to its high protein and oil content is of high nutritional value and can thus supplement the local diet especially where animal protein is expensive. The crop has a total digestible nutrient of 95% implying that is an excellent source of energy. Available records indicate that China is the center of origin of soyabean (Onwueme and Sinha, 1991), and it was introduced into several countries such as Japan, Indonesia, Vietnam, Thailand, Malaysia, Burma, Taiwan, Nepal and India. The spread was due to the establishment of sea and land trade routes. It was introduced into Nigeria probably due to trade lines with East Africa and Asia Preliminary attempt to promote the crop in Nigeria were encouraged by the missionaries who were aware of the many uses of the crop. Yield is often improved by manipulating plant population, row spacing and plant nutrition. However yield increase due to rising densities is parabolic due to interplant competition which adversely affect yield at high densities (Bluementhal *et al.*, 1998; Egli, 1998). Varying row spacing appear to some extent to have similar effect as varying plant

density by affecting interplant competition which increase as row spacing is decreased (Blum and Naveh, 1976; Taylor *et al.,* 1982,. Planting crops in rows of specific width is a farming operation designed to make several farming operations like sowing, application of agro chemicals and harvesting easy to carry out. Reducing soyabean row width, results in early canopy formation which directly affect the management programme that lead to more consistent weed control (Busari, 1996; Nelson and Renner, 1999; Young *et., al* 2001).

In Nigeria, the cultivation of soyabean is largely carried out in middle belt where it was originally grown as a cash crop but has now become part of the people diet and an important industrial raw materials (Sodangi, *et al.,* 2006). The upsurge in demand for soyabean coupled with the introduction of high yielding cultivars with a range of maturity dates and desirable agronomic characteristics has resulted in increased interest in soyabean cultivation in various parts of the country. The market for soyabean in Borno State is growing very fast Hitherto, production has been constrained by both lack of market and technical skill to produce and use soyabean. There has been an upsurge in the production of soyabean stimulated by increased household level utilization especially as a condiment (daddawa) leading to emergence of several buying agents at the Biu market and in Buni Yadi, Yobe State. The increasing importance of the crop for food and industrial uses reflect huge market potential and opportunity for improving income of farmers in the State. Soyabean production in Borno State is relatively new and in several other communities, it is completely unknown. It is believed that the need to grow soyabean will increase as more farmers become aware of the potential of the crop for soil fertility improvement and striga control in the state. To ensure that farmers do not get discouraged by poor yields, it is important that they adopt recommended practices for the crops (Onyibe *et al.,* 2006).

Soyabeans like groundnut have the ability to utilize fertilizer residues that are normality not available to other crops (Onweme and Sinha, 1991). The plant has special enzymes that break down soil fertilizer complex holding essential mineral in a form available to most plants. The ever increasing population especially in developing countries can only be satisfied by applying improved technologies which include rational use of fertilizer adequate to different soil and climatic conditions (FAO, 1994). We all depend on plants for our food and plant depend on mineral nutrients and water for their growth and development this could lead to deterioration of soil nutrients. Based on FAO (1980) rating,.In Borno State extensive research and promotion effort on soyabean production and utilization have been carried out by PROSAB (promoting sustainable agricultural in Borno State). In collaboration with other development agencies adaptable varieties have been selected along with the appropriate agronomic practices for high yield (Kamara *et al.*, 2006).

The recommended varieties of soyabean suitable to different ecological zones in Borno State are TGX 1448-2E, TGX1904-6F, TGX 1830-2E and TGX1485-ID. Soyabeans perform well in areas with about 700 mm rainfall, flat land or moderately sloping land with deep soil and moderate to good drainage are suitable. It tolerates wet soil conditions better than many other crops but water

logged areas should be avoided and also areas with heavy texture in the surface soil should be avoided because of potential problems with crusting and poor seedling emergence (Kamara *et al*., 2006) from the available information there is need to carry out more research work on soyabeans production in the study area, Biu. Using various varieties to evaluate their performances. This work aimed at evaluating the performance of some selected varieties of soyabeans in Biu, Borno State and also identify the best variety of soyabean that suited the environment.

MATERIALS AND METHODS

Experimental site

The experiment was conducted during the 2020 and 2021 cropping seasons at Biu, Borno State. Biu is located within latitude 13º 2`N and longitude 11º 2` E at altitude of 1200 m above sea level, in the northern fringes of the Guinea Savannah belt of Nigeria. Biu is characterized by moderate rainfall season with average rainfall of 700mm in a year. The soil texture is essentially clay – loam and loamy soils with a good water holding capacity (Grayer, 1983).

Source of planting materials (seeds)

Three soyabeans varieties (TGX 1448-2E; TGX 1904-6F and TGX 183O-2E) were obtained from the Borno State Agricultural Development Programme (BOSADP) Agronomy Department, International Institute for Tropical Agriculture (IITA) Sub-station, Biu.

Experimental design and treatment

The treatments consisted of three soyabeans varieties (TGX 1448-2E; TGX 1904-6F and TGX 183O-2E) which were laid out in a split plot designed (SPD) and replicated three times.

Land Preparation and Sowing

Before planting the fields were harrowed once, leveled and the plots laid out in a split plots design with plots measuring 4 x 3 m (Fig. 1). At sowing, the seeds were treated with a pre – planting fungicide, Apron plus (Metaloxyl) at the rate of 5grammes of chemical to 1kg of seed. 2 – 3 seeds per hole were sown at 1 – 2 cm depth. Seedlings were later thinned to 2 plants per stand at two weeks after sowing (WAS). Spacing was 20 cm, weeds were controlled manually using a hoe at 3, 6, and 9 weeks after sowing.

DATA COLLECTION

Stand count of net plot: This was determined by counting the number of plants in each plot at establishment and at harvest.

Plant height: Height was measured using a graduated rule from the base of the main plant to the apex of the plants. Five plants were randomly picked from three middle rows in each net plot. The mean Measurements was taken at 6 and 9 weeks after sowing and at harvest and the mean recorded.

Number of branches per plant: The number of branches per plant was taken by counting the branches of five (5) tagged plants per plot and counted at 2, 6 and 9 WAS and the mean number was recorded per net plot.

Number of pods per plants: Five randomly picked plants in each plot were harvested at maturity and the number of pods were counted and divided by five to obtain the mean number of **pods per plant.**

1000 seed weight: One thousand (1000) seeds were counted from each treatment after threshing and weighed separately.

Grain yield per plot/hectare the pods obtained from the plots were dried and threshed using mortar and pestle and winnowed. The grains obtained were weighed with a weighing scale and the values obtained were converted to kg/ha^{-1}.

STATISTICAL ANALYSIS

The data collected was subjected to analysis of variance (ANOVA) and the least significant differences (LSD) produced at 5% level of probability used to separate the means thrift are significantly different.

RESULTS

The effect of variety on establishment count of soyabean in 2020 and 2021 analysis revealed that from the varieties, there were significant effect ($P \leq 0.05$) on establishment count in 2020 , TGX 1448 – 2E (V1) recorded the highest number of plants of 30.05 number of plant per plot followed by TGX 1904 – 6F (V2) with mean value of 17.33 number of plants per plot and TGX 1830-2E (V3) recorded the least number of plants with mean value of 12.07 number of plant per plot in 2020 cropping season. In 2021 cropping season, significant effect ($P \leq 0.05$) was recorded on variety with regards to establishment count TG x 1448 – 2E (V1) recorded the highest number of plants with 22.42 followed by TG x 1904 – 6F (V_2) with 19.71 number of plants, while TG x 1830 – 2E (V3) recorded the lowest with 17.56 number of plants.

Effect of variety on plants height of soyabean in 2020 and2021. The mean squares With regards to variety, significant effect ($P \leq 0.01$) on plant height at 6 WAS in 2020 cropping season was recorded, TGX1448-2E recorded the tallest plant height 44.53 cm followed by TGX1830-2E with 25.99cm and the least was TGX1904-6F with 21.39 cm. Significant effect ($P \leq 0.01$) was recorded on plant height in 2021 cropping season TGX1448-2E recorded the tallest plant height of 48.41 cm followed by TGX1830-2E with 32.57 cm and the least TGX1904-6F with 27.36 cm There were significant effect ($P \leq 0.01$) of variety on plant height at 9 WAS in 2020 cropping season. TGX1448-2E recorded the tallest height with 49.89 cm followed by TGX1830-2E with 41.55 cm and TGX1904-6F recorded the least with 36.47 cm. In 2021 cropping season significant effect was recorded on plant height, TGX1448-2E recorded the tallest 56.72 cm followed by TGX1830-2E with 41.55 cm and TGX1904-6F recorded the least with 36.47 cm.

In 2020 cropping season significant effect ($P \leq 0.01$) of variety of plant height at harvest was recorded. TGX1448-2E recorded the tallest plants with 60.26 cm followed by TGX1904-6F with 46.74 cm and TGX1830-2E recorded lower height of 38.41 cm. There were significant effect ($P \leq 0.01$) of variety on plant height at harvest in 2021 cropping season. TGX1448-2E recorded the tallest height with 69.28 cm followed TGX1830-2E with 52.88 cm and TGX1904-6F recorded the least with 47.62 cm. Significantly from 90 × 20 cm (S3) and 50 × 20 cm (S2)

which gave 37.94 cm and 30.73 cm, respectively in 2020 cropping season. In 2021 cropping season significant effect (P≤ 0.01) of inter-row spacing was recorded on plant height which 25 × 20 cm recorded the tallest plant with 46.99 cm followed by 90 × 20 cm (S3) with 40.24cm, while 50 × 20 cm recorded the lowest plant height of 36.04

The effect of variety on number of branches of soyabean in 2020 and2021 cropping seasons. In 2020 cropping season, variety TGX1448-2E recorded the highest number of branches of 7.75 followed by TGX1830-2E with 7.67 and the least was recorded by TGX1904-6F with 6.0 branches. In 2021 cropping season, there was no significant effect (P≤0.05) of variety on number of branches. Although there was no significant effect among the varieties TGX1448-2E recorded the highest number of branches of 6.04 followed by TGX1830-2E and TGX1904-6F with 5.67 and 5.16 of branches per plant respectively.

Yield components and grain yield

The effect of variety on stand count at harvest in 2020 and2021 cropping seasons. In 2020 cropping season, there were significant effects (P≤0.05) of variety on stand count at harvest. Variety TGX1448-2E produced the highest stand count of 29.75 which differed significantly from the other varieties. TGX1904-6F followed with 16.73 and TGX1830-2E recorded lest stands with 11.79. There was no significant effect (P≤0.05) on variety on stand count at harvest in 2021 cropping season.

The effect of number of pods in 2020 and2021 cropping seasons There were significant effect (P≤0.05) of variety on number of pods per plant in 2020 cropping season. The variety TGX1448-2E produced the highest number of pods of 47.80 pods per plant followed by TGX1830-2E which had 45.25 pods per plant. Variety TGX1904-6F recorded the lowest number of pods of 43.11 which differed significantly (P≤0.05) from the other two varieties.

In 2021 cropping season, significant effect (P≤0.05) was recorded on variety on number of pods per plant. Variety TGX1904-6F produced the highest number with 59.78 pods per plant. This variety differed significantly from the rest of the varieties. TGX1904-6F and TGX1830-2E produced 47.80 and 45.25 pods per plant respectively.

The effect of variety on 1000-seed weight in 2020 and 2021 cropping seasons showed that Significant effect (P≤0.05) of variety was not recorded on 100 seed weight in 2020 cropping season. Similarly, in 2021 cropping season, there was no significant difference (P≤0.05) of variety on 100-seed weight.

The effect of variety on grain yield kg/ha in 2020 and2021 cropping seasons .In 2020 cropping season, significant effect (P≤0.05) of variety on grain yield were recorded with TGX1448-2E and TGX1830-2E produced the highest grain yield with mean values of 2633.3 and 2383.3 kg/ha respectively which differed significantly from the other variety. TGX1904-6F produced the lowest grain yield with 2041 kg/ha.

Similarly, there were significant effect (P≤0.05) effect of variety on grain yield in 2021 cropping season. TGX1448-2E and TGX1830-2E produced the highest grain yield with mean values of

2850 kg/ha and 2591.6 kg/ha respectively, and TGX1904-6F produced the lowest grain yield of 2341 kg/ha.

DISCUSSION

The effects of variety on performance of soyabeans has been observed in both the two cropping seasons on the growth characteristic measured in terms of establishment count in the years 2020 and 2021 there was no significance difference observed this is also in line with the report of Dura kin (1986) which reported that at an early stage of growth, the difference in the varieties may not show especially if all the varieties have close related characters. But later the difference can be seen, at 6 weeks after sowing (WAS), there was significant difference in the height of the varieties in both 2020 and2021 TGX 1448-2E have the highest height and this was basically attributed to it vigorous growth abilities (Onyibe *et al*., 2006) and (Sodangi and Abbas, 2007). Soyabean growth highly supported by the varieties based on characters such as root nodules formation, branching ability, height of maturity as well as time of maturity (Alabi and Ayeni, 2004).

The significant effects recorded on the number of branches during 2020 and 2021 seasons is also conforming with the work of Oyibe *et al*. (2006) which reported on the varieties of soyabeans used within the Guinea savannah and the Sudan savannah zone, TGX 1448-2E which produce the highest number of branches was reported, also Akinola, (1980) reported a similar train in northern Nigeria about soyabeans production. The number of pods produced in 2020 and 2021 reported a significant difference on the varieties, while TGX 1448-2E recorded the highest pods while the lowest was from TGX 1904-6F, this is also in agreement with the report of Busari (1996) and Anonymous (1994) that the ability to utilize the soil nutrient and also competition makes a variety stand out from the others even if the conditions of growth is the same. The one 1000 seed weight of the three varieties was not different in all the cropping season 2020 and 2021.

CONCLUSION

In conclusion the results of this study indicates that soyabean gives higher yield with the variety TGX 1448-2E and lowest yield was obtained from TGX1904-6F this results can conclusively said that soyabean yield depends on variety used as other factors like soil nutrient level, type of Soil, Climatic factors and zone of production requires.

RECOMMENDATIONS

Based on the findings from the study the following recommendations can be made.

i. The variety TGX 1448-2E produced the highest yield in the study area and should be used by farmers.

ii. Other varieties of soybean should also be studied more carefully by researchers to boost production level.

iv. Other parameters such as fertilizer application, weed control, pest and diseases of the crop or inter cropping of soybean should be investigated to provide famers with broad knowledge on soybeans production in the area.

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Table 1: Effect of variety on establishment count per plot of soyabean in 2020 and2021 cropping seasons

Treatments	2020	2021
Variety		
TG x 1448 – 2E	30.05a	22.42a
TG x 1904 – 6F	17.33b	19.71b
TG x 1830 – 2E	12.07c	17.56bc
Mean	19.42	19.89
SE	0.0001	0.099
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant.

Table 2: Effects of variety on plant height (cm) of soybeans in 2020 and2021 cropping season

Treatments	6WAS		9 WAS		at harvest	
	2020	2021	2020	2021	2020	2021
Variety						
TG x 1448 – 2E	44.53a	48.41a	49.89a	56.72a	60.26a	69.28a
TG x 1904 – 6F	21.39c	27.39c	30.48c	36.47c	40.64bc	47.62bc
TG x 1830 – 2E	25.99b	32.57b	34.84b	41.55b	41.40b	52.88b
Mean	30.10	36.11	35.15	41.32	46.93	56.59
SE+	0.0001	0.0001	0.001	0.001	0.0001	0.0001
Significance	*	*	*	*	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant

Table 3: Effect of variety on number of branches of soyabean in 2020 and2021 cropping season

Treatments	2020 cropping season	2021 cropping season
Variety		
TG x 1448 – 2E	7.75a	6.04a
TG x 1904 – 6F	6.00c	5.16c
TG x 1830 – 2E	7.67ab	5.67b
Mean	7.11	5.62
SE+	0.001	0.24
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant

Table 4: Effect of variety on stand count at harvest in 2020 and2021 cropping season

Treatments	2020 cropping season	2021 cropping season
Variety		
TG x 1448 – 2E	29.75a	37.29a
TG x 1904 – 6F	16.73b	22.22b
TG x 1830 – 2E	11.79c	17.38c
Mean	19.01	22.02
SE+	0.031	0.061
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant

Table 5: Effect of variety on number of pods per plant of soyabean in 2020 and2021 cropping season

Treatments	2020 cropping season	2021 cropping season
Variety		
TG x 1448 – 2E	47.80a	50.40c
TG x 1904 – 6F	43.11c	59.78a
TG x 1830 – 2E	45.25b	52.51b
Mean	45.29	54.23
SE+	0.077	0.0001
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant

Table 6: Effect of variety on 100-seed weight of soyabean in 2020 and2021 cropping seasons

Treatments	2020 cropping season	2021 cropping season
Variety		
TG x 1448 – 2E	10.41ab	10.81a
TG x 1904 – 6F	10.46a	10.73b
TG x 1830 – 2E	9.49c	10.82a
Mean	10.11	10.78
SE+	0.356	0.311
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant

Table 7: Effect of variety on grain yield ($kgha^{-1}$) of soyabean in 2020 and2021 cropping seasons.

Treatments	2020 cropping season	2021 cropping season
Variety		
TG x 1448 – 2E	2633.3a	2850.2a
TG x 1904 – 6F	2041c	2341c
TG x 1830 – 2E	2383.3b	2591b
Mean	2811.5	3111.4
SE+	0.0895	0.128
Significance	*	*

Means followed by the letter(s) within a column are not significantly different at 5% level of probability using Duncan's multiple range test(DMRT) NS=not significant *= significant