

Full Length Research Paper

Field evaluation of soybean varieties at Ilorin in the southern guinea savanna ecology of Nigeria

Akande, S. R., Owolade, O.F. and Ayanwole J.A.

Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P.M.B. 5029 Ibadan, Nigeria.

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Twenty six newly developed soybean varieties were evaluated for two years at Ilorin in a southern guinea savanna environment of Nigeria. The reaction of the varieties to rust infection was also assessed. Effects due to year, variety and year x variety interaction were significant for all the characters evaluated except for plant height where year x variety interaction had no significant effect. Number of days to 50% flowering ranged from 42 to 47.33. Early flowering varieties included TGX 1903-8F, TGX 1903-7F and TGX 1904-2F, while late flowering ones were TGX 1924-1F and TGX 1925-1F. Plant height varied between 25.00 and 44.17 cm. Grain yield ranged from 1017.24 to 2133.01 kg/ha. The best yielding varieties were TGX 1921-23F and TGX 1922-1F. Significantly higher grain yields were obtained in 2005 with an average value of 1602.0 kg/ha compared with 1470.13 kg/ha recorded in 2006. There was no incidence of rust infection in 2005, but in 2006 however, six soybean varieties expressed mild symptoms of the disease.

Key words: Grain yield, varietal evaluation, rust infection, savanna agro-ecology, soybean.

INTRODUCTION

Soybean is one of the important sources of oil and protein in the world and it is commonly used in both human and animal diets (Onwueme and Sinha, 1991; Ariyo 1995). Soybean (*Glycine max* (L.) Merrill.) is not an indigenous crop in Nigeria, it is however, gaining popularity in the country because of its numerous potentials that rank it even better than cowpea in the supply of high quality protein. North America is the largest producer of soybean in the world. Countries producing soybean in Africa are Kenya, Nigeria, Zimbabwe, Egypt, South Africa, Zambia, Malawi and Uganda (Nassiuma and Wasike, 2002). Most of the soybeans produced in Nigeria come from the southern guinea savanna, although production has also extended to the northern guinea savanna and the forest environments (Okpara and Ibiam, 2000; Chiezey et al., 2001). As new varieties of soybeans are continuously being developed to meet demand, it is im-

portant to evaluate these new varieties in the southern guinea, savanna agro-ecology where the bulk of it is produced commercially.

Rust disease of soybean was recently discovered at Oniyo Village in Oyo State derived savannah of south west Nigeria (Shokalu et al., 2000). It has however been reported to be endemic to southern guinea savanna agro-ecology (IITA, 1999) where the bulk of soybean is produced in Nigeria. The disease is caused by the fungus *Phakorpora pachyrhizi* H and P Sydow. It has since spread to other parts of the country. It is a destructive soybean disease in humid tropical and sub-tropical regions (Tichagwa, 1999). It can cause pre-mature leaf fall and reduce oil percentage recovery from grains from 42.7 to 14.94% and yield loss between 10 - 100% (Yujun et al., 1999). It is therefore, important to evaluate newly developed soybean varieties for their susceptibility to this important disease in this agro-ecology.

The objectives of this work therefore were to evaluate the performance of a set of newly developed soybean varieties at Ilorin in southern guinea savanna environment for grain yield and their reactions to rust infection

*Corresponding author. E-mail: remiajibade2002@yahoo.com

Table 1. Mean square values of some agronomic characters and severity of rust infection of soybean evaluated for two years.

Varieties	Days to 50% Flowering	Plant Height (cm)	Yield (kg/ha.)	Rust (1-5)
Year	54.26**	1241.03**	678274.67**	3.39**
Variety	12.50**	152.41**	351705.09**	0.47**
Year x Variety	3.63**	28.52	495112.63**	0.47**
Error	1.80	26.85	36710.69	0.05

** , significant at 0.01 probability level

under natural environment for appropriate recommendation to farmers.

MATERIALS AND METHODS

Twenty six newly developed soybean varieties were planted at Ilorin for two years (2005 and 2006). Ilorin falls within the southern guinea savanna agro-ecology of Nigeria with Latitude 8°30'N and Longitude 4°33'E. Total annual rainfalls during the period of crop growth were 1327.0 mm for 2005 and 1208.8 mm for 2006. Seeds of the soybean varieties were supplied by the International Institute of Tropical Agriculture (IITA).

The plantings were done in mid July of each year using a randomized complete block design with three replicates. Each plot consisted of four rows of 5 m long, with 50 cm between and 5 cm within row spacing. Two seeds were initially planted per hole but later thinned to one, three weeks after seedling emergence. No fertilizer was applied and manual weeding was done as at when due.

At flowering (between 7 and 8 weeks after planting) the soybean varieties were observed for natural development of symptoms of rust infection using a five-point scale disease severity ratings. Where 1 = no obvious spot on leaves, 2 = slight infection, less than 20% of leaves showing symptoms, 3 = moderate infection, 20 - 40% of leaves showing symptoms, 4 = severe infection, 40 - 70% of leaves showing symptoms and 5 = leaf abscission, over 90% of the leaves losing most of their photosynthetic areas.

At maturity, agronomic data were taken from plants in two middle rows of each plot to reduce border effect. Data recorded include number of days to 50% flowering, plant height and grain yield per plot from which grain yield per hectare was estimated at 15% moisture content. Data collected were subjected to analysis of variance using general linear model (GLM) procedure of SAS (SAS, 1997). Significant mean differences were determined with standard error of means.

RESULTS AND DISCUSSION

Effects due to year, variety and year x variety interactions were significant for the three characters evaluated except for plant height where year x variety interaction had no significant effect (Table 1). Average performances of the soybean varieties combined over years are shown in Table 2. Number of days to 50% flowering ranged from 42 to 47.17. The early flowering varieties were TGX 1903-8F, TGX 1903-7F and TGX 1904-2F, while the late flowering varieties were TGX 1924-1F and TGX 1925-1F. Mean values for plant height varied between 25.00 and

44.17 cm with varieties TGX 1921-2F and TGX 1921-1F producing the tallest plants while varieties TGX 1485-1D and TGX 1921-13F gave the shortest plants. Average grain yields ranged from 1017.24 to 2133.01 kg/ha. Varieties TGX 1921-23F and TGX 1922-1F produced the highest grain yields while TGX 1921-7F and TGX 1921-13F had the least. The two best yielding varieties could therefore, be considered for cultivation in the environment under evaluation. Higher grain yields were reported by Bello et al. (1996) for soybean varieties planted earlier in the season (early June) in a similar environment. Average grain yield ranging from 919.4 to 2006.90 kg/ha was however, reported by Bhatnager et al. (1994) for the predominant soybean growing regions of Central India. Severity of rust was low and it ranged from 1 to 1.83. Only six varieties had mild symptoms of the disease (Tables 1 and 4).

Average values of the grain yield and other characters evaluated in each year are presented in Table 3. Significantly higher grain yields were obtained in 2005 with an average value of 1602.0 kg/ha compared with 1470.13 kg/ha recorded in 2006. Although higher total annual rainfall was experienced in 2005 than 2006, rainfall distribution during the three months of soybean growth were 122.4, 162.4 and 254.4 mm for the months of July, August and September in 2005 respectively giving a total of 539.2 mm. While values of 184.6, 74.7 and 349.1 mm for the same months respectively were recorded in 2006 with a total of 608.4 mm. Rainfall was more uniformly distributed in 2005 than 2006 and less rainfall during the period of harvest in 2005 allowed for uniform and timely drying of seeds which could enhance yield. Significantly higher values were also observed for number of days to 50% flowering and plant height in 2005 (Table 3).

There was no incidence of rust infection in 2005, however, in 2006 six varieties expressed mild symptoms of the disease (Tables 3 and 4). There were no significant differences among the six soybean varieties in their reactions to the disease. The obtained data in this study revealed that rust infection is not yet a serious problem in the environment under evaluation. Shokalu et al. (2000), reported that the disease is relatively new in south west Nigeria, although it was been reported to be endemic to the southern guinea savanna agro-ecology of the country (IITA, 1999). Rust disease is however, well known in

Table 2. Mean number of days to 50% flowering, plant height, grain yield and rust infestation of 26 soybean varieties evaluated at Ilorin, southern guinea savanna of Nigeria

Variety	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Rust Severity (scale 1-5)
TGX 1903-4F	42.83	27.17	1519.16	1.00
TGX 1903-7F	42.50	29.00	1733.10	1.00
TGX 1903-8F	42.00	37.67	1623.72	1.00
TGX 1904-2F	42.67	31.50	1381.73	1.00
TGX 1904-4F	43.17	31.17	1911.54	1.00
TGX 1908-6F	43.50	29.83	1600.78	1.00
TGX 1909-2F	44.00	28.00	1536.43	1.67
TGX 1909-3F	43.17	27.33	1382.28	1.00
TGX 1919-1F	44.67	29.67	1367.32	1.00
TGX 1920-1F	45.00	37.33	1646.63	1.00
TGX 1921-1F	43.00	42.17	1734.81	1.00
TGX 1921-2F	43.67	44.17	1444.68	1.00
TGX 1921-6F	44.50	30.00	1494.50	1.67
TGX 1921-7F	44.50	32.17	1017.24	1.67
TGX 1921-13F	43.17	26.83	1190.65	1.83
TGX 1921-20F	46.33	32.33	1799.71	1.00
TGX 1921-23F	45.50	30.67	2133.01	1.50
TGX 1922-1F	44.17	33.50	1954.89	1.50
TGX 1923-3F	45.11	35.17	1271.23	1.00
TGX 1923-4F	43.00	29.00	1514.16	1.00
TGX 1924-1F	47.33	37.50	1441.37	1.00
TGX 1924-4F	45.67	31.00	1347.32	1.00
TGX 1925-1F	47.17	41.33	1395.27	1.00
TGX 1485-1D	42.83	25.00	1533.09	1.00
TGX 1830-20E	42.83	27.83	1431.63	1.00
TGX 1448-2E	45.00	34.67	1531.41	1.00
Mean	44.13	32.39	1536.06	1.15
SEM	0.11	0.41	15.67	0.02
CV (%)	3.04	16.00	12.47	18.46

Table 3. Mean number of days to 50% flowering, plant height, grain yield and rust infestation of the soybean varieties evaluated in 2005 and 2006.

Characters	2005	2006	Mean	S E M
Days to 50% flowering	44.72	43.54	44.13	0.15
Plant height (cm)	35.21	29.56	32.39	0.59
Grain yield (kg/ha)	1602.00	1470.13	1536.06	22.17
Rust severity (1-5)	1.00	1.30	1.15	0.02

China and Taiwan where different races of the pathogens have been identified (Yeah, 1983; Tan and Sun, (1989)). The two best yielding varieties TGX 1921-23F and TGX 1922-1F (Tables 2 and 4), also had mild symptoms of the disease. Resistant genes to rust disease have to be introduced into these varieties to maintain their high yield potential in the event of the serious attack by the disease.

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Table 4. Mean severity scores of six soybean varieties with mild symptoms of rust infection in 2006.

Variety	Rust severity (1-5)
TGX 1909-2F	2.33a
TGX 1921-6F	2.33a
TGX 1921-7F	2.33a
TGX 1921-13F	2.67a
TGX 1921-23F	2.00a
TGX 1922-1F	2.00a
Mean	2.22
S E M	0.14

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