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AGRONOMIC PERFORMANCE OF SOYBEANS AS IMPACTED BY SOIL- AND FOLIAR- APPLIED ORGANIC FERTILIZERS IN THE TROPICS

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Abstract: Organically produced soybean is <0.1% of total world production despite its increasing demand in the world market. Therefore, field trails were carried out in southwestern Nigeria during the late cropping seasons (July – Nov.) of 2017 and 2018 to evaluate the agronomic performance of three improved soybean varieties: TGx 1448-2E, TGx 1835-10E and TGx 1989-19F as affected by foliar: Arati Baja (1.01% N), Arati Nawoz (2.01% N), D I Grow (3.19% N and 1.49% N) and soil applied organic fertilizers: (Aleshinloye Grade B, O.56% N and 1.48% N), and control (no fertilizer). The experimental design was Randomized Complete Block Design in a 3 × 5 factorial arrangement in three replicates. Fertilizer application and varietal effects were significant (p<0.05) on nodulation at 10 weeks after sowing, weight of pods and seeds per plant, and grain yield in both years. It was concluded that the soil organic fertilizer or any of the foliar fertilizers can enhance soybean cultivation in the tropics.

Introduction: Soybean (*Glycine max* (L.) Merrill) is the most widely produced oilseed crop in the world. However, the volume of organically produced soybean is <0.1% of total world production. Its global market demand is being driven by growth of organic food and feed industries coupled with consumption and awareness of health benefits of organic products (Anon 2019). However, the lull in organic soybean production in the tropics could be attributed partly to inappropriate fertilizer regime, bulkiness of organic fertilizers and low fertility status of tropical soils. There is a dearth of scientific information on organic foliar nutrition in soybean in the tropics. Recent efforts included foliar use of synthetic nutrient sources, and soil and foliar manures (Nagar et al. 2016) Therefore, this study evaluated the effect of three foliar and one soil applied organic fertilizers on growth and yield of soybean in the tropics.

Material and methods: The two field trials were carried out on the organic research plots of the Institute of Food Security, Environmental Resources and Agricultural Research, Nigeria located between latitudes 7°13'51.17" N & 7°13'53.16" N and longitudes 3°23'49.12" E and 3°23'51.86" E on altitude 139 m above sea level during the late cropping seasons of 2017 and 2018. During the period of experimentation, a total rainfall of 330.5 and 902.5 mm was recorded in 2017 and 2018, respectively. The soils of the experimental sites were loamy sand in texture and low in nitrogen (0.16 and 0.15 % N), moderate in organic carbon (1.67 and 1.40 %) low in available phosphorus (3.33 and 5.40 mg/kg), very low in

exchangeable potassium (0.09 and 0.06 cmol/kg) with moderately neutral to slightly acidic pH (6.7 and 6.2) in 2017 and 2018, respectively. The experimental design was Randomized Complete Block Design in a 3 × 5 factorial arrangement in three replicates. The three foliar organic fertilizers were applied at 3, 6 and 9 Weeks After Sowing (WAS) and Aleshinlove organic fertilizer at 3WAS at the rate equivalent to 25kg N/ha. The two factors were namely variety: TGx 1448-2E (late maturing), TGx 1835-10E (early maturing) and TGx 1989-19F (early maturing) and fertilizer application: foliar organic fertilizers: Arati Baja (1.01% N), Arati Nawoz (2.01% N), D I Grow (3.19% N and 1.49% N) and soil applied organic fertilizer (Aleshinloye Grade B, 0.56 and 1.48% N), and control (no fertilizer). Weeds were controlled manually at 3 and 6 weeks after owing (WAS). After the first weeding at 3WAS, five randomly selected plants were tagged in the middle rows for plant height and yield attributes measurement at maturity on plot basis. Data were collected on phenology, nodulation, growth, grain yield and yield attributes of soybeans. The growth stages were determined according to Fehr and Caviness (1977). All data collected on plot basis were analysed using MSTATC package and the means of significant treatments were separated using the least significant difference method (LSD) at 5% probability level (Freed et al. 1989). **Results:** Data on nodule number, pod and seed weight per plant, and seed yield of the three soybean varieties in 2017 and 2018 as affected by foliar and soil applied organic fertilizers are presented in Table 1. Application of the organic fertilizers and varietal effect significantly (P<0.05; F-Test) affected all the parameters in both years. Soil applied organic fertilizer significantly (P<0.05) enhanced nodule number per plant relative to the three foliar fertilizers and the control in both years. Variety TGx 1035-10E (early maturing) produced the highest number of nodules per plant and was significantly (P<0.05) higher than the number of nodules produced by the two other varieties in 2018 and only TGx 1448-2E (late maturing) in 2017. The soil applied organic fertilizer significantly (P<0.05) increased pod and seed weight per plant compared to foliar application and control in both years. However, this trend did not translate to significantly higher seed yield in 2017 which was 36.6% dryer than 2018. On average, application of organic fertilizers resulted in seed yield above 1 ton/ha in both years. The two early maturing varieties (TGx 1035-10E and TGx 1989-19F) recorded significantly (P<0.05) higher pod and seed weight per plant, and seed yield than the late maturing TGx11448-2E in both years. The F × V effect was significant (P<0.05; F-test) for pod and seed weight per plant and seed yield in both years, except seed weight in 2018.

Treatment		2017				2018			
	Nodul	PWT	SWT	SY	Nodul	PWT	SWT	SY	
	е	g/pla	g/pla	D	е	g/pla	(g)/plant	D	
	numb	nt	nt	ton/	count	nt		ton/	
	er			ha				ha	
Fertilizer (F)									
Arati Baja	29.0	13.58	9.47	1.79	34.0	20.56	12.76	1.91	
Arati Nawoz	28.0	12.50	8.90	1.30	37.0	19.61	12.56	2.03	
DI Grow	32.0	14.07	8.74	2.11	39.0	19.70	13.30	1.99	
Aleshinloye	71.0	18.87	11.83	1.72	66.0	22.29	15.19	2.28	
Control	10.00	6.54	3.58	0.71	16.0	16.39	10.36	1.55	
LSD 5%	31.50	1.670	1.61	0.80	22.0	1.73	1.94	0.17	
Variety (V)									

Table 1: Effect of organic fertilizer application on nodule number, pod and seed weight per plant, andseed yield ofthree soybean varieties in 2017 and 2018.

TGx 1448-2E	24.4	5.79	3.92	0.79	11.0	18.03	11.01	1.74
TGx 1035-10E	48.0	16.61	10.93	1.72	69.0	19.80	13.93	2.09
TGx 1989-19F	39.0	16.94	10.65	2.07	36.0	21.30	13.55	2.03
LSD 5%	15.0	1.29	1.25	0.62	17.0	1.340	1.50	0.13
								0
F×V	ns	*	*	*	ns	*	ns	*

*- significant at P < 0.05 ns – not significant; PWT pod weight, g; SWT Seed weight, g; SYD seed yield, ton/ha **Discussion:** Soil applied organic fertilizer impacted more than the foliar fertilizers on the agronomic traits of the three soybean varieties. This could be attributed to increase in microbial population in the soil after the application of the organic fertilizer and subsequent increase in biological nitrogen fixation (BNF), release of phosphorus and other growth promoting hormones. Number and weight of pods and seeds per plant were significantly enhanced with the application of both foliar and soil organic fertilizers irrespective of the prevailing growth conditions. Mean seed yield recorded across organic fertilizer treatments (1.30 - 2.11 ton/ha in 2017 and 1.55 - 2.28 ton/ha in 2018) compared favorably with Nigerian (0.97ton/ha) and African (1.37 ton/ha) but slightly lower than the world's 2.85 ton/ha (FAOSTAT 2018). It is recommended that soil applied organic fertilizer or any of the evaluated foliar fertilizers can be used to enhance soybean productivity in the tropics.

References: Anonymous (2019): Organic Soybean market: Global Industry Trend Analysis 2012 to 2017 and Forecast 2017-2025. Available at https://www.persistencemarketreaserch.com/market-research/orga.... Accessed on 6/4/2019.

FAOSTAT (2018): Soybeans, yield (hectogram per hectare) for all countries. www.fao.org/faostat/en/#search/Soybeans

Fehr WR & Caviness CE (1977): Stages of soybean development. Special Report 80. Iowa Agriculture and Home Economics Experimental Station, Iowa State University, Ames, USA 672

Freed R, Einmensmith SP, Guetz S, Reicosky D, Smail VW & Wolberg P (1989): User's guide to MSTATC, An analysis of agronomic research experiments. Michigan State University, East Lansing, MI.

Nagar G, Abraham T & Sharma DK (2016): Effect of different solid and liquid forms of organic manure on growth and yield of soybean (*Glycine max* (L.) Merrill) Advance Research Journal of Crop Improvement 7:56-59.

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