Evaluation of some advanced soybean (*Glycine max* (L.) Merr.) genotypes using cultivar performance index.

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***Abstract*: In discriminating means that are statistically significant, agriculturist mostly use LSD, DMRT, t-test, z-test, stability analysis etc in selecting the best genotype from trial. The presence of gxe interaction necessitates the need for multilocational trials in order to select stable/adapted and superior genotypes for release. Fifteen soybean genotypes were examined across five locations in 2018 cropping season using performance index approach. The genotypes NCRI SOYAC79 and NCRI SOYAC5 were the most outstanding across the five locations. Whereas NCRISOY AC41 and NCRISOY AC47 recorded relatively low performance index and zero P value.**

***Key words*: Soybean, genotypes, performance index, genotypes by environment interactions, stability and adaptation**

I. INTRODUCTION

Plant breeders enhance the value of food crops, by improving their yield and the nutritional quality of their products, for healthy living of humans Acquaach (2012). They use various technologies, methodologies and statistical analysis to achieve target and directional changes in the nature of plants.

Whether conventional or unconventional breeding method, the main objective is to register and release out standing/superior genotypes, also to ensure that credible and best cultivars are introduced to the public for general cultivation. The DUS and VCU tests must be ascertain before registration and release.

Planned and unplanned pair comparison is the simplest and most commonly used in agricultural research Gomez and Gomez (1984). The LSD test is most appropriate for making planned pair comparisons but strictly speaking, is not valid for comparing all possible pairs of means, especially when the number of treatment is large. The usual way of data presentation to identify superior genotypes, is to arrange the genotype means in order of descending magnitude. Any two means not differing statistically significant are either underscored by the same line or signed by the same letter. Likewise, any two means statistically not significant are not underscored by the same line or signed by different small letter. This data arrangement although universally established, lacks simplicity and as the number of means increases, discrimination by the eye becomes problematic Fasoulas (1983). The objective of this work is to evaluate the performance of soybean genotypes using an alternative and simple approach called performance index.

II. MATERIALS AND METHODS

The experimental materials consist of fifteen soybean genotypes evaluated at five locations in 2018 cropping season in Nigeria. (1) Teaching, Research and Experimental Farm of University of Agriculture Makurdi; (2) NCRI outstation Yandev (3) NCRI outstation Amakama (4) NCRI outstation Ibadan and (5) NCRI Badeggi all in Nigeria. The trials were laid out in randomized complete block design (RCBD) with three replications in all cases. The experimental plot size was 3mx1.5m. with inter row spacing of 50cm and intra roe spacing of 5cm to obtained 20plants/m and 400,000plants/ha. The experimental field were all ploughed and double harrowed after three weeks to obtain a good tilt. The planting dates were between 1st and 20th of July, 2018. The seeds were drilled and later thinned to one stand per hill, two to three after planting. A post and pre-emergence herbicide at the rate of 2litr/ha were applied within 48 hours after planting. Fertilizer was applied at the rate of NPK 30:60: 30 at four weeks after planting. Yield data was taken at harvest.

For the computation of cultivar performance index (PI), the number of means "m", from which a particular genotype differs statistically significant, is used to arrange genotypes in order of descending superiority. If the total number of genotypes is n, then n – 1 is the maximum "m" for the best genotype, n -2 for the second and so on. Because "m" represents an objective and relable statistical measure of genotype performance, it has been used to calculate performance index, P= 100m/(n-1), giving the percentage of which a particular genotype exceeds statistically significant.

Where: m = the number of significantly inferior varieties, and n = number of varieties tested.

III. RESULT

Performance of fifteen soybean genotypes according to mean and performance index (P), grown in 2018.

The performance of the fifteen elite soybean genotypes in five locations is shown in table 1.

Badeggi Location: The genotype TGx1904-6F (a check), NCRI SOYAC84 and NCRI SOYAC5 with cultivar performance indices of 100%, 85.71% and 85.71% respectively were the most outstanding in Yield performance in the trials at Badeggi. The elite soybean genotypes NCRI SOYAC58, and NCRI SOYAC41 have zero cultivar performance indices.

Makurdi Location: At Makurdi the genotypes NCRI SOYAC79, TGx1835-10E (a check), NCRI SOYAC38 and TGx1448-2E (also a check) with cultivar performance indices of 100%, 78.57%, 78.57%, and &78.57% respectively were the most outstanding in yield performance. Whereas the soybean genotypes NCRI SOYAC47 recorded zero per cent as cultivar performance index.

Yandev Location: The genotypes NCRI SOYAC84 and NCRI SOYAC79 out yielded other genotypes with cultivar performance index of 92.86%, followed by TGx1835-10E (acheck) with cultivar performance index of 85.71% and NCRI SOYAC5 with performance index of 71.43%. The genotypes NCRI SOYAC32, NCRI SOYAC41, NCRI SOYAC36, NCRI SOYAC49 and TGx1448-2E (a check) all recorded cultivar performance index of 7.14%. Zero cultivar performance index was observed in NCRI SOYAC58.

Amakama Location: The soybean genotypes TGx1835-10E (a check) cultivar performance index was 100%, followed by TGx1987-10F (a check) and NCRI SOYAC32 with both cultivar performance indices of 85.71% and NCRI SOYAC49 with 71.43%. However the genotypes NCRI SOYAC84, TGx1987-62F (a check) and NCRI SOYAC58 were seen with zero cultivar performance indices.

Ibadan Location: The soybean genotypes with the highest performance index was NCRI SOYAC79 (100%), followed by NCRI SOYAC5 (92.86%) and three checks, TGx1904-6F, TGx1835-10E and TGx1448-2E with same performance indices of 78.57%. Performance index of 14.29% were seen in the following genotypes NCRI SOYAC41, NCRI SOYAC47, NCRI SOYAC36, and NCRI SOYAC49. However, the genotype NCRI SOYAC84 and NCRI SOYAC32 were seen with performance index of zero.

IV. DISCUSSION

Cultivar performance index

The differential performance of the fifteen soybean genotypes in five locations used for these trials brings out very clearly the existence of genotype by environmental interactions. Screening of genotypes for stability/adaptation in multi-location trials is an essential step in any crop improvement programme, because of the effects of genotype by environment. The rating of genotypes across environments for yield stability/adaptation has been done using several methods (Eberhart and Russel 1966, Finley and Wilkinson 1983, Lin 1982, Miller 1984, Wricke 1962, and Wricke 1964). An alternative method is the cultivar performance index (P). A rating of the fifteen soybean genotypes tested across five locations using this method.

The results revealed that the performance index (P) gives information that are normally not given by LSD. While it is true that the indicated LSD values in each case would detect statistical differences between entries, entry ranking given by both M and P gives value is not indicated by the LSD. In this study, the entry with the highest value of P in each location is considered best suitable for that location in terms of seed yield, while entry with a zero value is adjudged unsuitable.

The rating of fifteen soybean genotypes across the five location in 2018, genotype G10 (NCRI SOYAC79) recorded the highest P value in Ibadan, Makurdi and Yandev. The genotype G8 (NCRI SOYAC5) was seen with high P values in Ibadan, Yandev and Amakama.

The rating of fifteen soybean genotypes across five locations in 2018, consistent high P values were seen in G10, and G8. It will be observed that apart from small shift in position the performance index brings out the two soybean genotypes G10 and G8 as the most outstanding in these trials. This approach has been used by Bodunde 2002 in "performance index efficacy for cultivar rating in tomatoes evaluated for heat tolerance in a dry hot Eco-zone. Echekwu and Showemimo 2001 in "An appraisal of line performance in upland cotton breeding trials in Northern Nigeria using the performance index approach. Fasoulas 1983 in " rating cultivar and trials in applied plant breeding. Yisa et al., 2018 in "application of cultivar performance index analysis on some selected rice varieties. Shaahu et al., 2014 in "Assessment of yield and yield components of some improved soybean genotypes using performance index.

Table 1: Performance of fifteen elite soybean genotypes according to mean and performance index (P) grown in 2018

CODE	Genotype	ENTRY	SYBAD	M	P	SYMKD	M	P	SYYAND	M	P	SYAMAKA	M	P	SYIBD	M	P
1	TGX 1904-6F	14	3.00	14	100.00	1.71	5	35.71	1.35	7	50.00	0.67	3	21.43	2.03	11	78.57
2	NCRISOYAC84	9	2.42	12	85.71	1.02	1	7.14	2.01	13	92.86	0.45	0	0.00	0.35	0	0.00
3	NCRISOYAC5	8	2.47	12	85.71	1.72	5	35.71	1.56	10	71.43	1.40	9	64.29	2.72	13	92.86
4	NCRISOYAC79	10	2.02	8	57.14	3.00	14	100.00	2.02	13	92.86	0.73	3	21.43	3.00	14	100.00

5	TGX 1987-62F	12	2.00	8	57.14	1.89	5	35.71	1.26	7	50.00	0.45	0	0.00	1.23	9	64.29
6	TGX 1835-10E	13	1.97	8	57.14	2.45	11	78.57	1.75	12	85.71	2.69	14	100.00	1.67	11	78.57
7	NCRISOYAC38	3	1.67	5	35.71	2.49	11	78.57	1.52	9	64.29	0.89	7	50.00	0.68	3	21.43
8	TGX 1448-2E	15	1.88	8	57.14	2.47	11	78.57	0.97	1	7.14	0.92	7	50.00	1.97	11	78.57
9	NCRISOYAC49	6	1.53	5	35.71	1.99	7	50.00	0.92	1	7.14	1.48	10	71.43	0.64	2	14.29
10	NCRISOYAC36	2	1.50	5	35.71	2.00	7	50.00	0.88	1	7.14	0.71	3	21.43	0.57	2	14.29
11	TGX 1987-10F	11	1.31	4	28.57	2.23	10	71.43	1.43	8	57.14	2.07	12	85.71	0.70	3	21.43
12	NCRISOYAC32	1	1.02	2	14.29	1.34	2	14.29	0.87	1	7.14	2.00	12	85.71	0.41	0	0.00
13	**NCRISOYAC47**	5	1.01	2	14.29	0.72	0	0.00	1.05	5	35.71	0.75	3	21.43	0.67	2	14.29
14	NCRISOYAC58	7	0.75	0	0.00	1.23	2	14.29	0.58	0	0.00	0.48	0	0.00	0.76	4	28.57
15	NCRISOYAC41	4	0.71	0	0.00	1.32	2	14.29	0.92	1	7.14	1.36	9	64.29	0.66	2	14.29

Where: SYBAD= seed yield at Badeggi; SYMKD= seed yield at Makurdi, SYYAND= seed yield at Yandev; SYAMAKA= seed yield at Amakama; SYIBD= seed yield at Ibadan

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