Ethiop. J. Agric. Sci. 34(4) 100-111 (2024)

Evaluating the Performance of Elite Sweetpotato Genotypes under Stressed and Non-Stressed Conditions Using Drought Tolerance Indices

Fekadu Gurmu[1], Bililign Mekonnen[2*] and Ayisha Here[3]
[1]Ethiopian Institute of Agricultural Research (EIAR), P.O.Box 2003, Addis Ababa, Ethiopia; [2]Sidama Region Agricultural Research Institute (SIRARI), Hawassa Agricultural Research Centre, Hawassa, Ethiopia; [3]Ethiopian Institute of Agricultural Research (EIAR), Werer Research Center, Werer, Ethiopia
[*]Corresponding author: bililign.m@gmail.com

Abstract

The performance of sweetpotato genotypes under stress conditions due to erratic rainfall patterns can be affected and can result in decreased productivity. About 24 elite sweetpotato genotypes, including one released variety, Alamura, were tested under stress and non-stress conditions in 2022, with the objective of identifying drought-tolerant genotypes for further evaluation and variety development. The trial was established in stress and non-stress blocks using a lattice design arrangement at Werer, Afar Regional State of Ethiopia. Six drought tolerance indices, namely the mean productivity index (MPI), geometric mean productivity (GMP), tolerance (TOL), stress susceptibility index (SSI), stress tolerance index (STI), and stress intensity (SI), were rigorously assessed to select consistently high-yielding genotypes under both conditions. Data were collected specifically for root yield and its components and then subjected to analysis of variance. The result revealed that over eight genotypes performed well under stress conditions for the traits considered. Based on the drought indices, the SI level was 0.23, indicating a 23% yield reduction due to drought stress, which falls within the mild intensity range. In the evaluation of sweetpotato genotypes, if the stress is not severe, correlations of yields under both conditions and drought indices can be assessed. Accordingly, yield in non-stress (YP) and yield in stressful conditions (YS) are positively and significantly associated with stress indices such as MP, GMP, and STI, implying that these indices are appropriate for selecting stress-tolerant and high-yielding genotypes under both stress and non-stress conditions. The correlations were also confirmed with principal component and biplot analyses. Based on these three indices, eight genotypes, namely G4, G6, G9, G10, G13, G17, G19, and G24 were selected as drought-tolerant for further evaluations in multi-location trials.

Keywords: Correlations; Drought indices; Erratic rainfall; Non-stress; Root yield; Stress

Introduction

Sweetpotato is a rich source of micronutrients, minerals, and vitamins that boost the immune system, promote proper growth and development, and consequently reduce micronutrient deficiency and malnutrition. Currently, sweetpotato is designated as one of the strategic crops for food and nutrition security in Ethiopia (MoA-FDRE, 2024). Nowadays, low soil moisture content, along with other climate-induced changes, is causing an impact on the sustainable production of sweetpotatoes in areas receiving irregular rainfall, preventing the crop from reaching its maximum yield potential (Belesova *et al.,* 2019; Laurie *et al.,* 2022). Sweetpotato is typically considered a drought tolerant crop; however, the crop is sensitive to drought stress during the establishment and storage root initiation stages, thus selecting suitable genotypes for drought conditions remains a priority. Low soil moisture stress affects sweetpotato yields and causes a 25% annual crop loss when the crop is most vulnerable to shortage of moisture during its establishment period, including vine formation and root initiation stages (Sapakhova *et al.,* 2023). Furthermore, some earlier studies on sweetpotato found that drought stress reduced sweetpotato yields by 15-60% (Van Heerden and Laurie, 2008).

Although sweetpotato technologies have been developed and disseminated to end users in major sweetpotato-growing areas in Ethiopia, there is currently inadequate information on the performance of existing genotypes under low moisture stress conditions, which is still a bottleneck. In addition, the performance of existing genotypes under low moisture stress is unknown. In this context, evaluating and identifying drought-tolerant sweetpotato genotypes is critical for ensuring food and nutrition security while also boosting profits for resource-poor farmers in areas where seasonal drought and erratic-rainfall are rampant. Drought tolerance indices are widely known parameters that provide a measure of drought tolerance based on yield loss under stress and non-stress conditions that have been reported as being used to screen drought-tolerant genotypes in various crop plants, including sweetpotato (Gong & Wang, 1990; Mitra, 2001; Mickky *et al.,* 2019). There are numerous drought tolerance indices available; we have used only about six that have previously been used to evaluate sweetpotato genotypes, which include the stress susceptibility index (SSI), mean product (MP), geometric mean product (GMP), stress tolerance index (STI), and tolerance (TOL), which were used to compare yield loss under stress and non-stress conditions (Golabadi *et al.,* 2006; Agili *et al.,* 2012). In general, drought resistance is defined as a genotype's relative yield compared to other genotypes treated to the same drought stress (Hall, 1993), while drought susceptibility of a genotype is frequently assessed as a function of yield reduction under drought stress (Blum, 1988). Therefore, the present study was designed to identify drought-tolerant sweetpotato genotypes with desirable traits (high yield, resistance/tolerance to sweetpotato virus disease, dry matter content, and related traits) for further evaluations.

Materials and Methods

The field experiment was conducted on-station at Werer in the Afar Regional State of Ethiopia, from mid-October to mid-January in the main cropping season in 2022. The study area is located at 9°12'8" to 9°27'46" N latitude and 40°5'41" to 40°15’21" E longitude, with an elevation of 740 meters above sea level (masl), and has a semi-arid to arid climatic characteristics. The mean annual rainfall, maximum, and minimum temperatures recorded are 571.3 mm, 34.3 °C, and 19.1 °C, respectively (Ashenafi and Bobe, 2016). The soil type in the study area is predominantly eutric fluvents, with fluvisols, followed by vertisols, occupying about 30% of the entire area (Halcrow and Partners, 1982). The field trial was set up as a stressed block (irrigation stopped at the time of root formation) and non-stressed (with full irrigation) block, each with a simple lattice design consisting of 25 genotypes (24 elite genotypes, and one dominantly growing variety used as a check). The trial was systematically arranged into two big blocks. i.e., the first block (simple lattice, consisted of all 25 genotypes, replicated twice) was non-stressed block, and the second block was a repeat of the first block, consisted of all 25 genotypes, replicated twice but stressed. A single plot for a single genotype was 6.3 m^2, with five rows of 3 m width and 2.1 m length, which allowed for 7 plants per row and 35 plants per plot. The spacing between replications was 1.5 m, whereas the spacing between plants and rows was 0.3 and 0.6 meters, respectively. The spacing between the gangways that separate the stressed and non-stressed blocks was two meters.

Furrow irrigation was applied to both blocks (stressed and non-stressed) at three-days intervals for the first two weeks following planting, and at seven-days intervals for the next 30 days until all of the plants were established. Irrigation was then stopped for the stressed block, while the non-stressed block received irrigation water for four and a half months until the trial was harvested (Agili *et al.* 2012). Other cultural practices, such as weeding, hoeing, and earthening up, were carried out after the fourth week after planting, and all plots were manually weeded to ensure weed-free condition. The experiment was conducted without the use of external inputs such as fertilizers and other agro-chemicals. All plots underwent uniform cultural practices according to the recommended sweetpotato production guideline in Ethiopia (Hawassa ARC, 2015).

Data collection and measurement

Data on root yield and root-yield related traits were collected from the two middle rows excluding the two plants planted at each end of the rows and the two border rows. Data such as marketable root yield (t ha^{-1}), unmarketable root yield, (t ha^{-1}), total root yield (t ha^{-1}), number of roots per plant (count), above-ground fresh weight yield (t ha^{-1}) were recorded at harvest.

Analysis of variance

All agronomic data collected from each genotype was evaluated in stress and non-stress conditions and analyzed using SAS software version 9.3 (SAS Institute Inc., 2003). A least significant difference (LSD) technique was employed to compare genotypes at 5% and 1% probability levels, following the guidelines developed by Cox et al. (1985). The following statistical model was used: $X_{ij} = \mu + T_i + B_j + E_{ij}$. Where, X_{ij} = the ith treatment effect in jth block, μ = the overall mean, T_i = ith treatment effect (μ_i-μ), Bj is jth block effect (μ_j-μ) and E_{ij} = the effect of ith treatment in jth block. j=1…r, i=1…t.

Determination of stress tolerance indices

Six stress tolerance indices were computed for each genotype based on yield and yield-related traits under stressed vs. non-stressed conditions as follows:

- Stress Susceptibility Index (SSI)= (1- Ys/Yp)/SI, (Fischer and Maurer, 1978)
- SI is Stress Intensity and calculated as: SI= (1-Ȳs/ Ȳp), (Fischer and Maurer, 1978)
- Mean Productivity (MP) = (Yp+ Ys) / 2, (Rosielle and Hamble,1981)
- Tolerance (TOL) = (Yp- Ys), (Rosielle and Hamble,1981)
- Stress Tolerance Index (STI) = (Yp*(Ys)/(Ȳp)2, (Fernandez, 1992)
- Geometric Mean Productivity (GMP) = (Yp* Ys), (Fernandez, 1992)
- Yp = Yield of a genotype in non-stressed condition
- Ys = Yield of a genotype in stressed condition

Furthermore, a biplot display of principal component analysis (Gabriel 1971) was used to identify stress-tolerant and high yielding genotypes and to study the interrelationship between the stress-tolerant attributes.

Results and Discussion

Performance of 25 sweetpotato genotypes for various traits evaluated under stressed and non-stressed conditions

The tested genotypes performed differently under both stressed and non-stressed conditions for various traits considered in the study (Table 1). Under non-stressed conditions, marketable root yield (MRYLD) ranged from 12.14 t ha^{-1} for Genotype G15 to 42.80 t ha^{-1} for Genotype G9, unmarketable root yield (UMYLD) from 0.1 t ha^{-1} for G15 to 5.70 t ha^{-1}for G1, and total root yield (TRYLD) from 12.24 t ha^{-1} for G15 to 45.36 t ha^{-1} for G3. In terms of above-ground fresh weight yield (AGFW), the highest 59.28 t ha^{-1} and the lowest 11.51 t ha^{-1} yields were recorded for G2 and G15. The maximum and minimum numbers of roots per plant (NRPP) were recorded for G4 and G14, with values of 10 and 1.60, respectively. Under stressed conditions, G6 gave the highest MRYLD of 37.16 t ha^{-1}, whereas G1 gave the lowest MRYLD of 13.04 t ha^{-1}. The highest and lowest UMRYLD recorded for G6 (2.70 t ha$^{-1)}$ and G23 (0.26 t ha^{-1}), respectively. TRYLD ranged from 13.17 t ha^{-1} to 40.0 t ha^{-1} for G12 and G6, in that order. AGFW varied from 78.57 t ha^{-1} for G25 to 14.60 t ha^{-1} for G1. The highest number of roots per plant, with a mean of 5.85, was obtained from G15, whereas the lowest mean of 1.34 of roots per plant was obtained from G8. Number of roots per plant (NRPP) was ranged from 1.60 to 10.00 for G14 and G4, respectively, under non-stress condition. The

maximum NRPP of 5.85 and minimum NRPP of 1.35 G4 and G12, respectively, under stressed condition.
Based on their consistent performance under both conditions, nine genotypes designated as G4, G6, G9, G10, G11, G17, G18, G19, and G24 showed good performances over the rest of the genotypes, specifically for total root yields that ranged from 22.10 t ha^{-1} to 44.90 t ha^{-1} under the non-stress condition and 21.63 t ha^{-1} to 40.00 t ha^{-1} under the stressed condition (Table 1). Thus, the genotypes that performed well under the stressed condition can further be used to evaluate their performance across areas receiving insufficient rainfall or irregular rain for research and production.

According to Fernandez (1992), genotypes can be categorized into four groups based on their performance in stress and non-stress environments: genotypes express uniform superiority in both stress and non-stress environments (Group A), genotypes perform favorably only in non-stress environments (Group B), genotypes gave relatively higher yields only in stress environments (Group C), and genotypes perform poorly in both stress and non-stress environments (Group D). Thus, Group A genotypes that perform consistently are preferable for selection and further investigation.

Table 1. Performance of sweetpotato genotypes under stressed and non-stressed moisture regime at Werer site in 2022

Code	Genotypes	under non-stress condition					under stress condition				
		MRYD (t/ha)	UMRYD (t/ha)	TRYD (t/ha)	AGFW (t/ha)	NRPP (no)	MRYD (t/ha)	UMRYD (t/ha)	TRYD (t/ha)	AGFW (t/ha)	NRPP (no)
G1	MUSG014001-3-2-12	31.20	5.70	36.86	50.16	3.90	13.04	0.62	14.60	14.03	2.95
G2	MUSG014001-3-2-70	12.60	0.13	12.60	59.28	2.84	14.17	0.45	14.62	72.14	1.91
G3	India-1-79	42.42	3.00	45.36	32.49	7.48	17.00	0.70	17.53	42.66	4.00
G4	India-1-37	34.62	4.10	38.74	25.92	10.00	34.54	1.73	36.27	27.33	5.20
G5	India-1-70	16.24	1.83	18.10	12.48	4.60	21.18	1.32	22.50	19.04	2.10
G6	MUSG014001-3-2-40	27.47	4.30	31.70	26.21	5.40	37.16	2.70	40.00	48.51	3.60
G7	India-1-81	19.00	1.92	20.86	20.10	6.80	18.92	1.65	20.60	23.49	3.55
G8	MUSG014001-3-2-53	15.60	0.51	16.10	21.04	2.40	15.20	0.60	15.80	15.57	1.40
G9	MUSG014012-76-3-16	42.80	2.10	44.90	29.30	6.90	32.18	2.33	35.50	15.57	3.39
G10	MUSG014012-26-4-16	24.70	1.71	26.40	39.95	2.80	29.00	1.51	30.46	55.97	2.77
G11	MUSG014046-20-5-47	23.60	0.80	24.36	41.00	3.77	23.00	0.32	23.32	49.54	2.82
G12	MUSG014001-3-2-24	12.60	0.32	15.86	11.63	6.50	13.04	0.15	13.17	16.93	1.35
G13	India-1-27	32.45	2.73	35.17	14.62	7.15	25.70	0.70	27.00	17.23	3.70
G14	MUSG014046-20-5-39	12.54	0.30	12.80	16.99	1.60	18.43	0.27	18.70	22.22	3.10
G15	MUSG014001-3-2-65	12.14	0.10	12.24	11.51	2.40	14.18	1.70	14.37	34.30	5.85
G16	MUSG014012-26-4-47	16.35	0.90	17.27	18.04	2.50	21.10	1.70	22.80	52.77	2.55
G17	MUSG014012-26-4-6	38.20	1.25	39.43	16.44	1.65	20.33	1.30	21.63	68.00	4.10
G18	MUSG014012-26-4-23	23.30	2.16	25.50	42.76	5.10	22.81	2.11	25.00	44.91	3.60
G19	MUSG014012-76-3-12	20.11	2.00	22.10	29.40	4.75	31.40	2.16	33.60	25.79	5.00
G20	MUSG014046-20-5-56	28.70	1.45	30.20	35.90	5.20	15.01	1.13	16.15	54.31	2.40
G21	MUSG014046-20-5-65	31.53	4.14	35.70	29.09	2.75	19.20	1.00	20.14	20.67	3.20
G22	India-1-46	17.08	2.40	19.45	22.38	3.05	17.10	0.33	17.43	49.67	1.65
G23	India-1-34	17.75	0.85	18.60	45.64	3.90	14.06	0.26	14.32	62.10	3.93
G24	India-1-21	26.16	1.07	27.40	33.35	5.10	28.00	1.18	29.07	48.05	3.70
G25	Alamura (Check)	20.70	2.00	20.60	21.79	5.30	20.17	0.61	20.80	78.56	4.38
Mean		24.71	1.91	26.73	28.30	4.55	21.68	1.14	22.83	39.17	3.29
LSD (5%)		6.11	1.40	7.21	8.12	0.90	6.34	0.76	8.00	9.23	0.86
CV (%)		17.14	21.40	18.21	30.12	14.60	21.22	27.60	24.47	19.23	13.00

Where, MRYLD=Marketable root yield, UMRYLD=Unmarketable root yield, TRYLD=Total root yield, AGFW=Above-ground root yield, NRPP=Number of roots per plant

Evaluation of genotypes based on stress tolerance attributes

Table 2 presents data for six stress tolerance indices. Drought-tolerant genotypes were assessed using stress tolerance indices including SSI, MP, GMP, STI, SI and TOL. A high STI score indicates good drought tolerance, while a low value indicates poor drought tolerance. Table 2 demonstrates that eight genotypes (G3, G4, G6, G9, G10, G13, G17, G21, G24, and G25) have high STI (>1) values, indicating good stress tolerance, while the remaining genotypes exhibit low tolerance (<1). On the other hand, genotypes with a low SSI value (SSI < 1) are more drought-tolerant. For this attribute, 60% of the tested genotypes had lower values of SSI, which implies that these genotypes are drought tolerant. For MPI, under stress conditions, genotypes with a high value of MPI index are thought to be more desirable. Considering TOL index, genotypes having low-value are more stable under two different environments and are suitable for drought tolerance screening of breeding materials. Genotypes such as G4, G6, G10, G19 and G24 were obtained low values for this index, indicating that these genotypes can be good fit for drought stress tolerance. In terms of GMP index, genotypes with high GMP index value can be considered drought tolerant. The highest GMP was achieved by G4, G6, and G9, reflecting their high drought tolerance levels, whereas, G2, and G15 had the lowest GMP values, implying their susceptibility to drought conditions. Under stressful situations, genotypes with a high value of GMP index are regarded to be preferable. Genotypes with high MPI values are considered as drought tolerant. Accordingly, nine genotypes with high MPI values, namely G3, G4, G6, G9, G10, G13, G17, G19, and G24, can be regarded as drought tolerant. On the other hand, G2 and G15 which had low MPI values are considered susceptible to drought stress.

The stress intensity (SI) is classed as mild, moderate, or severe based on the severity of the stress in causing yield reductions. Accordingly, a stress severity is regarded as mild when yield reduction ranges from 0 to 25%, moderate between 25 and 50%, and severe between 50 and 100% (Cyil *et al.,* 2015). Overall, in this study, the SI level was 0.23, indicating a 23% yield reduction due to drought stress, which falls within the mild intensity range (Table 2). SSI is an appropriate index for sweetpotato when stress is severe, but MP, GMP, STI, and TOL will be employed to select better yielding genotypes under both conditions using root yield performance of genotypes (Agili *et al.,* 2012; Cyil *et al.,* 2015).

Table 2. Estimation of drought tolerance indices based on storage root yield of 25 sweetpotato genotypes under non-stress and stress conditions in Werer
(SI=0.23)

Code	Name of genotype	YP	Ys	SSI	MPI	TOT	STI	GMP
G1	MUSG014001-3-2-12	31.20	13.04	2.98	22.12	18.16	0.74	20.17
G2	MUSG014001-3-2-70	12.60	14.17	-0.64	13.39	-1.57	0.33	13.36
G3	India-1-79	42.42	17.00	3.07	29.71	25.42	1.32	26.85
G4	india-1-37	34.62	34.54	0.17	31.08	1.08	1.76	31.08
G5	India-1-70	16.24	21.18	-1.56	18.71	-4.94	0.63	18.55
G6	MUSG014001-3-2-40	27.47	37.16	-0.50	28.82	-2.69	1.51	28.78
G7	India-1-81	19.00	18.92	0.28	19.46	1.08	0.69	19.45
G8	MUSG014001-3-2-53	15.60	15.20	1.34	17.90	5.40	0.57	17.70
G9	MUSG014012-76-3-16	42.80	32.18	2.47	32.49	20.62	1.73	30.81
G10	MUSG014012-26-4-16	24.70	29.00	-0.82	27.00	-4.00	1.32	26.93
G11	MUSG014046-20-5-47	23.60	23.00	1.21	20.80	5.60	0.78	20.61
G12	MUSG014001-3-2-24	12.60	13.04	-0.58	13.32	-1.44	0.32	13.30
G13	India-1-27	32.45	25.70	1.38	28.08	8.75	1.40	27.73
G14	MUSG014046-20-5-39	12.54	18.43	-2.40	15.49	-5.89	0.42	15.20
G15	MUSG014001-3-2-65	12.14	14.18	-0.86	13.16	-2.04	0.31	13.12
G16	MUSG014012-26-4-47	16.35	21.10	1.15	18.73	4.75	0.63	18.57
G17	MUSG014012-26-4-6	38.20	20.33	2.39	29.27	17.87	1.42	27.87
G18	MUSG014012-26-4-23	23.30	22.81	0.99	21.06	4.49	0.80	20.93
G19	MUSG014012-76-3-12	20.11	31.40	-1.60	23.26	-6.29	0.97	23.04
G20	MUSG014046-20-5-56	28.70	15.01	2.24	20.86	11.69	0.73	20.02
G21	MUSG014046-20-5-65	31.53	19.20	2.00	25.37	12.33	1.11	24.60
G22	India-1-46	17.08	17.10	0.29	16.59	0.98	0.50	16.58
G23	India-1-34	17.75	14.06	1.06	15.91	3.69	0.46	15.80
G24	India-1-21	26.16	28.00	-0.16	26.58	-0.84	1.29	26.58
G25	Alamura (Check)	20.70	20.17	1.39	23.94	7.53	1.02	23.64

Where, Yp = Yield of a genotype in non-stressed condition, Ys = Yield of a genotype in stressed condition, SSI= Stress Susceptibility Index, MPI= Mean Productivity index, TOL= Tolerance, STI= Stress Tolerance Index, GMP= Geometric Mean Productivity

Assessment of correlations among yield and stress tolerance indices under stressed and non-stressed conditions

The correlation between yields under non-stress (Yp) and stress (Ys), as well as other stress tolerance indices, was used to determine the most desirable selection criterion, which can assist in determining the most suitable genotypes and selection indices. Table 3 shows the coefficients of correlation between root yield and stress tolerance indices. Root yield under a non-stress (YP) had a significant correlation (r = 0.64) with root yield under a stress condition (YS) at a stress level of 0.23. The presence of a positive correlation between YP and Ys suggests that genotypes for drought-stress conditions can be selected indirectly based on their performance in non-stressed conditions. YP and YS were also positively and significantly associated with stress indices such as MP, GMP, and STI, implying that these indices are appropriate for selecting stress-tolerant and high-yielding genotypes under both stress and non-stress conditions. Similar findings were reported by Mitra (2001), Agili *et al.* (2012), and Sio Se-Marden *et al*. (2006). The stress tolerance indicators MP, TOL, SSI, and STI showed a strong positive correlation with one another. This implies that indices exhibiting strong correlations may be used interchangeably. This result is consistent with the research by Bennani *et al*. (2017), who found that drought indices were effective for selecting bread wheat at various levels of severity. Therefore, in both stressful and non-stressful situations, drought-stress-tolerant and high-yielding sweetpotato genotypes can be selected based on stress tolerance indices namely MP, GMP, and STI. The present findings are consistent with previous research reported by Cyil *et al.* (2015) and Agili *et al.* (2012).

Table 3. Pearson correlation coefficients within stress tolerance indices and root yield under stress and non-stress conditions

	YP	YS	MP	GMP	TOL	SSI	STI
YP		0.64**	0.90***	0.85***	0.82***	0.74***	0.84***
YS			0.70***	0.77***	-0.70**	-0.78***	0.77***
MP				0.99***	0.50**	0.43**	0.98***
GMP					0.4**	0.36	0.99***
TOL						0.94***	0.38
SSI							0.32
STI							

Where, Yp = Yield of a genotype in non-stressed condition, Ys = Yield of a genotype in stressed condition, MPI= Mean Productivity index, GMP= Geometric Mean Productivity, TOL= Tolerance, SSI= Stress Susceptibility Index, STI= Stress Tolerance Index

Principal component analysis and biplot based analysis

Table 4 presents principal component analysis **(**PCA) results of the study. PCA was used to evaluate the associations between all attributes simultaneously. Biplot analysis was also carried out and the results obtained corroborated the results of correlation analyses. The principal component analysis indicated that principal component1 (PC1) accounted for 68.5%, the majority of the variation with YP, YS MP, GMP, TOL, SSI and STI. Based on the positive values of PC1 on biplot, the selected genotypes were found to be good yielding under stress and non-stress conditions. The second principal component (PC2) explained 30.30 % of the total variation and showed a positive connection with YP, TOL and SSI. Hence, identifying genotypes that have low PC2 and high PC1 are suitable for stress and non-stress conditions. When genotypes were plotted over PC1 and PC2 with quantitative indices of stress tolerance and stressed and non-stressed yield, they were scattered across the coordinate space, demonstrating varying drought adaptation and yielding ability. This approach confirms the performance of genotypes with which selection indices they have been correlated. The current finding is in line with earlier reports by Agili *et al.* (2012), Fernandez (1992), Farshadfar (2000), and Golabadi *et al.* (2006).

Table 4. The principal component analysis for drought tolerance indices

Component	Eigen Value	Cumulative (%)	YP	YS	MP	GMP	TOL	SSI	STI
1	4.79	68.50	0.44	0.26	0.45	0.43	0.29	0.26	0.43
2	2.12	30.30	0.17	-0.56	-0.12	-0.18	0.52	0.53	-0.20

Where, Yp = Yield of a genotype in non-stressed condition, Ys = Yield of a genotype in stressed condition, MPI= Mean Productivity index, GMP= Geometric Mean Productivity, TOL= Tolerance, SSI= Stress Susceptibility Index, STI= Stress Tolerance Index

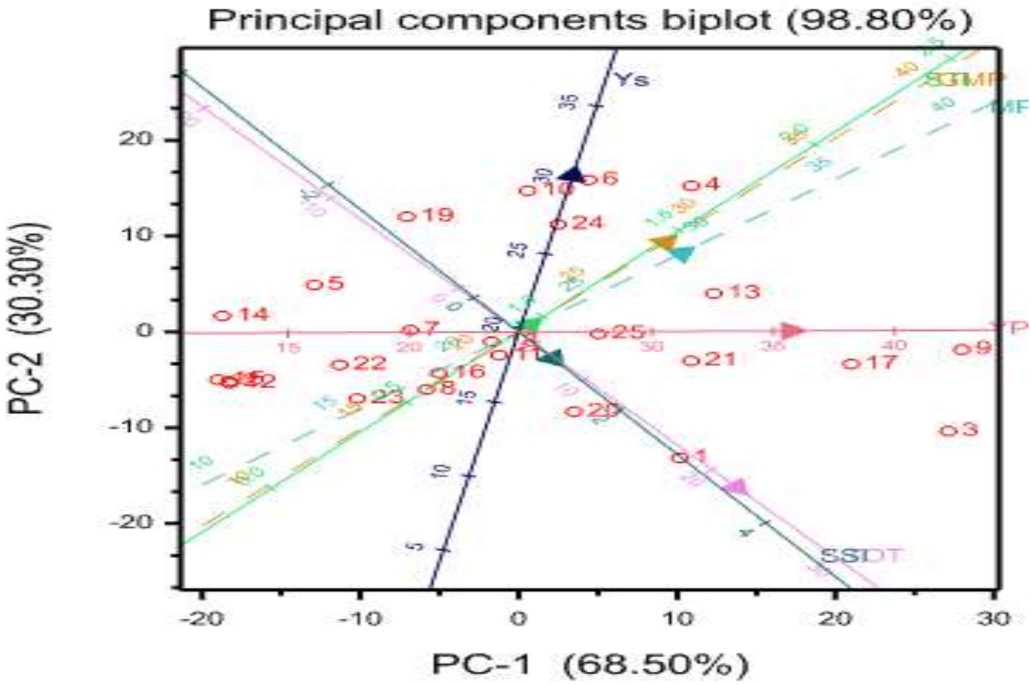

Figure 1: Biplot display of 25 sweetpotato genotypes tested in non-stressed condition (YP), stressed condition (YS) in relation to drought tolerance indices (MPI, GMP, TOL, SSI and STI)

Conclusion

Nowadays, environmental changes owing to climate dynamics necessitate the selection of suitable sweetpotato genotypes for stressful conditions in order to boost production and productivity. In this study, 25 sweetpotato genotypes were evaluated using six drought tolerance indices for selecting drought tolerant genotypes for further evaluations. Accordingly, the results showed the presence of promising genotypes that can be selected for multi-location evaluations and ultimate release for drought-prone areas. The emphasis on such genotypes is noteworthy since they are aligning with the need for crops that can be harvested earlier, potentially enhancing overall agricultural productivity. Moreover, this study indicates the possibility of obtaining moisture stress tolerant sweetpotatoes to ensure food and nutrition demands in areas where irregular rainfall hinders crop production in the context of Ethiopia. The current study identified eight genotypes that performed well under both conditions. These identified genotypes will be evaluated in multi-location trials in order to obtain promising genotypes for release.

Acknowledgements

The authors extend their gratitude to the Ethiopian Institute of Agricultural Research (EIAR) for its financial support to conduct field experiments.

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