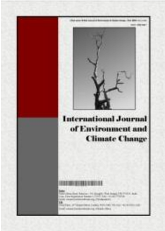

International Journal of Environment and Climate Change

12(11): 3650-3656, 2022; Article no.IJECC.92350
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Assessment of Growth and Yield of Sweet Potato Genotypes

D. S. Kar [a*], C. M. Panda [b], G. S. Sahu [c], P. Tripathy [c], A. K. Das [c], S. Sahu [d] and A. Mohanty [e]

[a] KVK, Dhenkanal, OUAT, Bhubaneswar, India.
[b] Department Fruit Science, OUAT, Bhubaneswar, India.
[c] Department of Vegetable Science, OUAT, Bhubaneswar, India.
[d] Department of Plant Breeding and Genetics, OUAT, Bhubaneswar, India.
[e] AICRP on Vegetable Crops, OUAT, Bhubaneswar, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i111414

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/92350

Original Research Article

Received 07 August 2022
Accepted 10 October 2022
Published 04 November 2022

ABSTRACT

The experiment was conducted taking Fifteen genotypes of sweet potato were evaluated in RBD with three replications during kharif season of 2019 & 2020 at in the K.V.K Dhenkanal District ,Odisha. Among the characters studied, different high PCV and GCV were observed for characters like vine length, vine internodal length, number of branches per plant, number of leaves per plant, total leaf area, number of roots per plant, root yield per plant, β-carotene content, starch content, total sugars, reducing sugars, non reducing sugars and total root yield per hectare content indicating high variability available in the germplasm for these characters for further improvement. High heritability coupled with high genetic advance as per cent of mean was observed for characters vine length, vine internodal length, number of branches per plant, length of leaf lobe, number of leaves per plant, total leaf area, root girth, root yield per plant, β-carotene content, starch content, total sugars, reducing sugars, non reducing sugars and total root yield per hectare indicated that these characters were least influenced by the environmental effects, and these characters were governed by additive genes and selection will be rewarding for improvement of such traits. The total root yield per hectare (t/ha) had significant positive correlation with traits like number of branches per plant, number of roots per plant, root girth, root yield per plant and β-carotene content suggesting the importance of these traits in selection for yield and can be

**Corresponding author: E-mail: dibyasundarkar81@gmail.com;*

identified as yield attributing characters for the genetic improvement of yield in sweet potato. The total root yield per hectare (t/ha) was result of direct effect of number of branches per plant, number of roots per plant, root length, root yield per plant, starch content and reducing sugars. The high direct effect of these traits appeared to be the main factor for their strong association with total root yield per hectare. Analysis for divergence using D^2 statistic revealed highly significant differences for different traits, grouping the 15 genotypes into 6 clusters. Cluster II had the maximum number of genotypes (8) followed by cluster I (7). Maximum inter cluster distance was observed between clusters III and VI while the intra cluster distance was maximum in cluster II and VI. Highest percent contribution to divergence came from β-carotene content, starch content, total sugar, total leaf area, root dry matter content, number of leaves per plant, root yield per plant, petiole length, root girth, vine length and reducing sugar suggested that selection of one or two elite genotypes from divergent (II & VI) and (III & VI) clusters based on the above characters and crossing would result in more heterosis and novel hybrid.

Keywords: Growth; yield; sweet potato genotypes.

1. INTRODUCTION

"Sweet potato yields high amount of energy per unit area per unit time and is expected to bridge the food shortages and malnutrition. The comparative short duration coupled with its innate power for tremendous dry matter production has enabled sweet potato to rank as the foremost tuber crop in respect of calorie value. In India, Sweet potato is being cultivated in almost all the states with an area of 1, 12, 250 ha, and production of 11, 05, 550 MT and productivity of 9.84 MT/ha" (NHB Database,2013). "In Andhra Pradesh, it is grown in an area of 280 ha with a production of 5, 530 MT and productivity of 19.75 MT/ha" (NHB Database, 2013). Odisha is the largest producer of sweet potato in India. In Asia, sweet potatoes are mostly consumed by people, used as animal feed, and only in very small amounts as a raw material for manufacturing starch alcohol.

2. MATERIALS AND METHODS

The experiment was conducted in the instructional farm of KVK, Dhenkanal. Fifteen accessions of Sweet potato was taken in a Randomized Block Design (RBD) experiment with three replications in kharif season , 2019 and 2020. The vines were planted in a Spacing : 60 cm x 30 cm. The planting material were obtained from CTCRI Regional Centre, ICAR, Bhubaneswar and local collection. They were: T 1 :Pol-19-9-3 , T2 : Pol-19-8-2 , T 3: Gouri , T4: Kaling , T5: Kanchangad ,T 6 :Sourin ,T 7: Bhu Sona ,T8 : T 9 :Sankar ,T 10: Sree Vardhini ,T11 :Sree Nandini ,T 12 :Pusa Safed ,T 13 :Goutam ,T14 :Kamala ,T 15 :Kishan . Well matured healthy and disease free vine cuttings of previous season of each genotype were used as vineing material for the experiment. Cuttings were vineed in the plots obtained from the nursery at a spacing of 60×20cm and 5-7cm depth. Standard recommended cultural practices were followed during the entire crop period.

3. RESULTS AND DISCUSSION

The estimates of genetic parameters, including phenotypic and genotypic variance, computed along with the coefficients of variation, provide a solid foundation for identifying the variability components as well as knowing the proportions of heritable and non-heritable variation for each of these characters. From the current study, it is evident that the majority of the ten quantitative features in sweet potato exhibit a wide range of phenotypic and genotypic variance. Minimum differences were evident between the values of PCV and GCV for most of the traits studied except vine length and tuber length in all the trials and analysis. The presence of minimal variation between these two parameters indicated that environment has little influence on the expression of these characters and that the phenotype accurately represents the genotype. When the phenotypic coefficient of variation and genotypic coefficient of variation values are compared, it is found that the former is greater than the latter for all ten quantitative characters under consideration. In the present study, presence of high to moderate coefficients of variation in case of number of branches per plant,number of tubers per vine,tuber weight, tuber length, tuber girth and tuber yield per vine indicated the presence of good amount of variability among the materials evaluated and therefore, selection for these characters may be

Table 1. Analysis of variance (mean squares) for various biometrical traits first year

Sl. No	Character	First Year			Second Year			Pooled		
		Mean squares			Mean squares			Mean squares		
		Replication	**Genotypes**	**Error**	**Replication**	**Genotypes**	**Error**	**Replication**	**Genotypes**	**Error**
	Df	**2**	**14**	**28**	**2**	**14**	**28**	**2**	**14**	**28**
1	Vine Length (cm)	415.784	200.321*	253.106	388.078	521.341**	223.875	36.623	237.046**	60.616
2	Number of branches per vine	0.874	1.768**	0.290	0.038	2.254**	0.503	0.159	1.864**	0.125
3	Number of leaves per vine	108.906	409.578**	40.990	204.831	835.990**	153.266	6.947	479.344**	44.916
4	Number of tubers per vine	0.051	0.632**	0.036	0.042	0.735**	0.045	0.001	0.531**	0.018
5	Tuber weight (g)	42.454	860.371**	68.604	271.977	721.423**	162.353	96.394	636.699**	36.683
6	Tuber length (cm)	13.446	8.603*	4.051	7.487	17.866**	2.537	10.192	11.988**	1.746
7	Tuber girth(cm)	3.038	5.511*	1.018	4.592	15.181**	2.293	0.601	7.602**	0.860
8	Tuber yield/ vine (g)	1237.250	11907.261*	773.399	318.567	20552.423**	576.204	685.739	14452.50**	442.733
9	Tuber yield/ plot (kg)	2.840	13.956*	0.872	1.481	18.067**	0.741	1.985	14.988**	0.358
10	Tuber yield/ hectare (t/ha)	2.671	26.987*	1.016	8.767	34.801**	3.267	4.285	28.926**	0.929

*** Indicate significance at 5% level*

Table 2. General mean, range, coefficient of variation and heritability for ten characters among varieties in sweet potato (first year)

Sl. No.	Character	First year							Second Year						
		General mean	Range	PCV	GCV	Heritability	GA	GA as % mean	General mean	Range	PCV	GCV	Heritability	GA	GA as % mean
1	Vine Length (cm)	126.43	96.40 – 155.20	14.5	6.2	32.3	0.8	6.0	121.24	92.3 – 158.5	14.8	8.2	30.69	11.3	9.3
2	Number of branches per vine	4.13	2.66 – 6.30	21.4	16.9	62.9	1.1	27.7	4.13	2.02-7.84	25.3	18.5	53.68	1.1	28.0
3	Number of leaves per vine	96.32	62.80- 113.80	13.2	11.5	74.9	19.7	20.5	96.55	51.8 – 125.0	20.2	15.6	59.75	24.0	24.8
4	Number of tubers per vine	3.01	2.06 – 3.85	16.0	14.7	84.5	0.8	28.0	3.27	2.18- 4.49	16.0	14.6	83.77	0.9	27.6
5	Tuber weight (g)	111.52	78.30 – 151.10	16.3	14.5	79.3	29.8	26.7	104.30	63.8- 159.6	17.9	13.0	53.44	20.5	19.7
6	Tuber length (cm)	13.50	8.60 – 18.40	17.4	9.1	27.2	1.3	9.8	14.5	10.66 – 21.2	19.1	15.6	66.81	3.8	26.3
7	Tuber girth(cm)	11.64	9.10 – 14.50	13.6	10.5	59.5	1.9	16.7	12.51	17.8- 19.6	20.5	16.5	65.20	3.4	27.5
8	Tuber yield/ vine (g)	329.29	179.36 – 464.16	20.5	18.6	82.7	114.1	34.9	325.19	134.9 – 4.16	26.1	25.0	92.03	161.2	49.5
9	Tuber yield/ plot (kg)	11.22	6.75 – 16.38	20.3	18.6	83.3	3.9	34.9	11.60	6.15- 15.82	22.0	20.7	88.64	4.6	40.1
10	Tuber yield/ hectare (t/ha)	15.59	10.36 – 21.85	19.9	18.8	39.4	5.7	36.7	16.10	8.04- 22.01	23.0	20.1	76.29	5.8	36.2

Table 3. General mean, range, coefficient of variation and heritability for ten characters among varieties in sweet potato (pooled over two years 2019 and 2020)

Sl. No.	Character	General mean	Range	PCV	GCV	Heritability	GA	GA as % mean
1	Vine Length (cm)	123.83	104.152 – 147.85	9.46	4.502	22.613	5.346	4.410
2	Number of branches per vine	4.12	2.8 – 6.1	20.37	18.487	82.365	1.424	34.562
3	Number of leaves per vine	96.43	69.6- 118.6	14.28	12.479	76.326	21.657	22.458
4	Number of tubers per vine	3.14	2.31 – 3.85	13.81	13.151	90.691	0.811	25.00
5	Tuber weight (g)	107.91	78.8 – 146.05	14.25	13.105	84.502	26.780	24.817
6	Tuber length (cm)	14.0	10.6 – 19.57	16.25	13.224	66.179	3.098	22.161
7	Tuber girth(cm)	12.07	8.92- 16.37	14.60	12.416	72.328	2.627	21.753
8	Tuber yield/ vine(g)	325.74	207.14 - 441.22	21.95	20.979	91.340	134.539	41.302
9	Tuber yield/ plot (kg)	11.41	6.88 – 15.53	20.043	19.344	93.146	4.390	38.459
10	Tuber yield/ hectare (t/ha)	15.85	10.39 -20.79	20.214	19.278	90.954	6.003	37.874

quite hopefully used in sweet potato for crop improvement programme. Choudhary and Mishra, [1]; Badu et al. [2] and Mekonnen et al. [3] observed similar trends which are in agreement with the present findings.

In the present experiment, heritability (bs) was morefor tubers per vine, yield per vine, tuber weight and number of branches per plant in first year and second year and yield per hectare, yield per plot, yield per vine and number of tubers per vine and tuber weight in pooled analysis. The majority of the features had high to moderate heritabilities, indicating that these characteristics may be highly heritable and less influenced by environment. Choosing genotypes based on these characteristics might be beneficial for improving sweet potatoes. The findings of Gin et al. [4], Choudhury and Mishra [1], and Sharma (2004) are all in agreement with the results attained. It was argued that knowledge of the genetic and environmental variations associated with quantitative characters' heritabilities could help to increase the effectiveness of selection. Taking into account the genotypic coefficient of variation values and heritability calculations. Based on these characters, it was determined that selection might be extremely effective. On the other hand, disparities between the present study's findings and those of earlier researchers may be the result of variations in the environment and genetic stock. Even while studies of heritability estimates are significant, their application is constrained because they are calculated broadly and are prone to change with changes in environment and the testing material. Further, the heritability estimate by itself maynot be alone a useful index of genetic potentiality of a character. According to Eswro et al. (1963), genetic advance (GA) indicates “the potentiality of selection at a particular level of selection intensity. Thus, heritability estimates along with genetic advance are more valuable than heritability alone in predicting the response ofselection High heritability does not necessarily mean that the character will show high genetic advance, but when such compatible association exists (high heritability and high GA) additive genes come into prominence because no genetic advance is due to non-additive genes. The selection based on a character showing high genetic gain (GA) may be desirable particularly incase of directional selection, when the main aim of the selection is to change the mean value of a character to have better standards. On the other hand, high heritability accompanied with low genetic advance indicates the prominence of non-additive gene effect, suggesting the adoption of heterosis breeding (hybridization) instead of direct selection”.

In the present investigation, high estimates of heritability coupled with high genetic advance for characters such as number of leaves per plant, number of tuber per vine, tuber weight, and yield per plantmay be ascribed to effect of additive genes; Sankari et al. [5], Teshome et al. [6] and Sh Liang and Walter, (1968) and may be amenable for selection [7,8].

When the three genetic parameters, genotypic coefficient of variation, heritability, and anticipated genetic gain, are considered together, the characters with higher values are attributable to additive gene action, which is responsible for the expression of these characters. As a result, direct selection based on these characteristics will be effective in sweet potato improvement.

4. CONCLUSION

From the experiment it was observed the number of branches per vine, tubers per vine, tuber weight, tuber length and tuber girth are important characters and should be taken into consideration for crop improvement programme in sweet potato varieties Gouri and BhuSona gave higher yield which may be tried in Dhenkanal district to get better yield in sweet potato. The qualitative characters pertaining to starch content, total sugar content, reducing sugar, non-reducing sugar and β-carotene content did not varied much during first and second year as these are qualitative characters. Kamala Sundari recorded the highest total sugar of 6.98% and 6.62 % in both the years whereas, β-carotene content varied significantly and was highest in BhuSona in both the years. Different quality parameters in sweet potato were already reported by Mishra et al. [1], Mekonnen et al. [3] and Narayan et al. [9]

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Choudhary AK, Mishra SB. Character association and path analysis study in sweet potato (*Ipomoea batatas* (L.) Lam.). Environ Ecol. 2011;29(1A):435-8.

2. Badu M, Ashok P, Sasikala K, Patro KTSKK. Mean performance of orange flesh sweet potato (*Ipomoea batatas* L. Lam.) Genotypes under coastal Andhra Padesh condition. J Pharm Innov. 2017.
3. Mekonnen B, Gedebo A, Gurmu F. Character association and path coefficient analysis of orange fleshed sweet potato (*Ipomeabatatas* (L.) Lam.) genotypes evaluated in Hawassa, Ethiopia. J Plant Breed Crop Sci. 2020;12(4):292-8.
4. Gin G, Devi AKB, Singh NB. Genetic variability and correlation studies in sweet potato. Orissa J Hortic. 2008;36(2):73-6.
5. Sankari A, Thamburaj S, Kannan M. Genetic variability in sweet potato. J Root Crops. 2001;27(1):71-3.
6. Teshome AD, Veeraragavathatham, Kannan M. Genetic variability and correlation studies in sweet potato (*Ipomoea batatas* L.). Madras Agriculture Journal. 2004;91 (7-12):420-4.
7. Mekonnen B, Gedebo A, Gurmu F. Genetic variability for yield and yield related traits in Orange-fleshed sweet potato Genotypes Evaluation. AFF. 2021;10(1).
8. Rangare RNR, Johnson PL, Tandekar K. Studies on genetic variability heritability and genetic advance of potato (*Solanum tuberosum* (L.) genotypes for yield and yield attributing traits. The Pharm Innov J. 2022;11(3):260-3.
9. Narayan A, Dileep K, Alam T, Singh RS, Giri GS, Prasad R et al. Genetic diversity in sweet potato (*Ipomoea botatas* (L.). J Pharm Innov. 2022;11(6): 2352-5.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/92350