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CORRELATION AND PATH ANALYSIS FOR GROWTH, YIELD AND QUALITY CHARACTERISTICS OF ORANGE-FLESHED SWEET POTATO (*Ipomoea batatas* L.) GENOTYPES

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ABSTRACT

The present research work, correlation and path coefficient studies among fourteen orange-fleshed sweet potato (OFSP) genotypes under agroclimatic conditions of Jorhat, Assam, in the *Rabi* season of 2022-23 have been investigated. This research work has been carried out with the objective to know the association between yield and quality characters, and also to find out their direct and indirect influence towards marketable tuber yield. The experimentation has been carried out in a Randomized Block Design with two replications. Various growth, yield, and quality characters were observed.

From the result of correlation analysis, the marketable tuber yield per plant was found to be significantly positively associated with the fresh weight of tuber, fresh weight of whole plant, dry weight of whole plant, vine weight per plant, dry weight of tuber, and tuber diameter at both phenotypic and genotypic level. In contrast, plant dry matter content and tuber dry matter content had negative associations with yield. Path analysis results showed that fresh weight of whole plant, dry weight of tuber, and fresh weight of tuber have the greatest positive direct influence on the marketable tuber yield, while vine weight per plant and number of tubers per plant have negative direct influences. Moreover, indirect influence from the biomass related traits played a significant role in determining yield. The study concludes that selection involving the use of fresh weight of whole plant, tuber weight, and tuber diameter is effective in improving the yield in OFSP. These results will provide important information for breeders interested in increasing the yield potential and nutritional value of OFSP.

***Key words*:** Orange-fleshed sweet potato, correlation, path analysis, marketable yield, carotenoids

Introduction

The sweet potato (*Ipomoea batatas* L.) is a nutritious starchy root and tuber vegetable belonging to the family Convolvulaceae. It is grown across the globe under tropical, subtropical, and warm temperate agro-ecologies. Being a perennial herbaceous vine crop, it is grown as an annual plant and is consumed by humans because of its storage roots, which provide high-energy foods. The crop originated in Central America but soon spread across the globe because of its easy adaptability, short cropping period, and low cost of cultivation.

Globally, the sweet potato crop comes seventh in the

ranking of food crops grown across the world, and it plays a critical role in ensuring food security. In India one of the important crop is sweet potato, occupying over 1.1 lakh hectares of cultivated land and yielding over 1.2 million tonnes annually (Anonymous, 2022). Important producing states of India include Odisha, Bihar, Uttar Pradesh, and Madhya Pradesh. In Assam, it is popularly known as Meeta Aloo or Sakarkand and is grown in small farmers' fields (Edison *et al.*, 2009).

Orange-fleshed sweet potato (OFSP) has become a nutritionally valuable biofortified variety due to its â-carotene content, a precursor of vitamin A (Kolawole *et al.*, 2020). It is considered a "food security" crop since it can provide much-needed vitamin A for people suffering from a vitamin A deficiency. Besides being a source of carbohydrates, OFSP is also rich in fiber, antioxidants, vitamins such as vitamin A, C, E, B-complex, and minerals (Oloniyo *et al.*, 2021).

Productivity and quality traits of sweet potato are quantitative in nature and are affected by many genes and the environment. Yield is a polygenic trait and comprises different biochemical and physiological elements, which makes conventional selection techniques less reliable. Therefore, it becomes necessary to study the variation in the genetic makeup and inter-relationships of different traits to improve sweet potatoes (Silungwe 2017).

Correlation analysis can provide insights into the association between traits in terms of degree and direction, whereas path analysis divides these associations into indirect and direct effects, enabling breeders to know which trait plays a more prominent role in the selection process, (Bassey *et al.*, 2022). This makes both of these techniques indispensable in breeding for increased yield and improved quality, (Bilate *et al.*, 2022).

Even though sweet potato (OFSP in particular) contributes meaningfully to food and nutritional security, very few studies on genetic relationship between yield and quality characteristics have been done under the agro-climatic condition of North-Eastern part of India. Most of the existing literature either deals with the yield or quality characteristics individually; there are very few studies that have combined the effect of both the characters together (Gurmu *et al.*, 2018). Furthermore, a variable association of beta carotene, starch content, and tuber yield was noticed among genotypes of OFSP in different locations, which necessitates the necessity of carrying out genotype-wise study of such association (Gehan 2019). Information about the level of genotypic and phenotypic correlations, together with path analysis used to partition the yield components in OFSP under Assam's climate conditions, remains limited (Choudhary and Mishra, 2011). Also, not much literature is available regarding the identification of direct and indirect effects of factors responsible for producing marketable yield in OFSP.

Considering the above limitations, there is a pressing requirement for the study of correlation and path analysis in orange-fleshed sweet potato genotypes for evaluating these aspects under local agro-climatic conditions. This will enable the identification of useful selection criteria that may be employed for concurrent improvement of both yield and quality traits (El Sharkawy, 2019).

The present study was therefore undertaken to determine the genetic association between yield and quality characters, and to quantify how various traits contribute directly and indirectly to marketable tuber yield in orange-fleshed sweet potato grown under the conditions prevailing in Jorhat, Assam.

Materials and Methods

The present experiment was carried out in the Rabi season of 2022–23 in the Experimental Farm, Department of Horticulture, Assam Agricultural University (AAU), Jorhat, Assam to investigate the behavior of fourteen orange-fleshed sweet potato genotypes for productivity and quality characters. The location is at 26°47' N latitude, 94°12' E longitude, and an elevation of 86.80 m above mean sea level, which comes under the Humid Subtropical Climate of Upper Brahmaputra Valley Zone. Rainfall in this area is around 2040 mm and characterized by high relative humidity (>80%) and temperature varying between 5 to 37°C. Fourteen genotypes i.e., were procured from AICRP on Tuber Crops (Peddapuram), AAU Jorhat, and ICAR–CTCRI, Thiruvananthapuram. The study was conducted using a Randomized Block Design (RBD) with two replications. The plots measured 3.5 m × 2.1 m with spacing of 70 cm × 20 cm and were planted with 52 plants per plot. Planting was done on 20th October 2022 using healthy vine cuttings of 20–30 cm in length.

Soil of the experimental site consisted of sandy loam having pH 5.50, EC 0.05 dS m^{-1}, organic carbon 0.46%, available nitrogen 314 kg ha^{-1}, phosphorus 24.6 kg ha^{-1}, and potassium 119 kg ha^{-1}. Completely decomposed FYM @ 10 t ha^{-1} along with recommended doses of NPK (75:50:75 kg ha^{-1}) were added. Weeding, earthing up (30-35 DAP), irrigation, and vine turning (55-60 DAP) practices were followed. Tubers were harvested at 120 DAP. Observations were recorded for five random plants in each plot. Traits considered included vine length,

internodal length, vine weight, fresh weight and dry weight of whole plant and tubers, tuber length, tuber diameter, number of tubers per plant, and marketable yield. Parameters relating to quality traits were TSS, total carotenoids, starch content, sugars, and shelf life. Statistical analysis involved use of ANOVA under RBD, (Panse, and Sukhatme, 1985). Correlation coefficients were computed phenotypically and genotypically by following the method of Falconer (1989). Significance of correlation coefficient was determined using t-test (Fisher and Yates, 1963).

To study the direct and indirect effects of various characters, path coefficient analysis was carried out according to the method of Wright (1921) and Dewey and Lu (1959), range from e" 1.00 = Very high, 0.30 – 0.99 = High, 0.20 – 0.29 = Moderate, 0.10 – 0.19 = Low, < 0.10 = Negligible, (Lenka and Mishra (1973).

Result and Discussion

Correlation analysis

Phenotypic (rp) and genotypic (rg) correlation coefficients have been estimated for thirteen quantitative traits viz., vine length (cm), internodal length (cm), vine weight/plant (g), fresh weight of whole plant (g), dry weight of whole plant (g), plant dry matter content (%), fresh weight of tuber (g), dry weight of tuber (g), tuber dry matter content (%), length of tuber (cm), diameter of tuber (cm), number of tubers/plant and marketable tuber yield/plant (g), along with two qualitative traits viz., total carotenoids (mg/100 g) and starch content (%). There was found to be sufficient variability among all the traits studied, Table 1.

Vine length exhibited a significant positive correlation with internodal length (0.753r_p, 0.762r_g) at both 5% and 1% LOS (Level of Significance) and with total carotenoids (0.426 r_p, 0.430 r_g) at 5% LOS and also recorded significant negative correlation with starch content (-0.510 r_p, -0.518 r_g) at both 5% and 1% LOS, (Mekonnen *et al*., 2020). Internodal length was significantly and negatively correlated with starch content (-0.693 r_p, -0.694 r_g) at both 5% and 1% LOS and with plant dry matter (-0.385 r_p, -0.394 r_g) and tuber dry matter (-0.375 r_p, -0.388 r_g) at 5% LOS only. Vine weight per plant exhibited a significant positive correlation with the fresh weight of whole plant (0.868 r_p, 0.902 r_g), dry weight of whole plant (0.764 r_p, 0.795 r_g), fresh weight of tuber (0.651 r_p, 0.729 r_g), dry weight of tuber (0.700 r_p, 0.730 r_g) and marketable tuber yield per plant (0.682 r_p, 0.785 r_g) at both 5% and 1% LOS (Rao, *et al*., 2017). The fresh weight of whole plant exhibited a significant positive correlation with the dry weight of whole plant (0.796 r_p, 0.799 r_g), fresh weight of tuber (0.940 r_p, 0.954 r_g), marketable tuber yield per plant (0.944 r_p, 0.967 r_g), dry weight of tuber (0.849 r_p, 0.853 r_g) at both 5% and 1% LOS. This character also recorded a significant negative correlation with plant dry matter content (-0.452 r_p, -0.445 r_g) at 5% LOS only, (Padma *et al*., 2009 and Dewi *et al*., 2019).

This trait exhibited a significant positive correlation with the dry weight of tuber (0.942 r_p, 0.942 r_g), diameter of tuber (0.593 r_p, 0.600 r_g), fresh weight of tuber (0.704 r_p, 0.717 r_g) and marketable tuber yield per plant (0.771 r_p, 0.792 r_g) at both 5% and 1% LOS. Plant dry matter content exhibited a significant positive correlation with tuber dry matter content (0.812 r_p, 0.840 r_g) and total carotenoids (0.476 r_p, 0.486 r_g) at both 5% and 1% LOS and with at 5% LOS, respectively (Koulagi 2015 and Gehan 2019).

This character also recorded a significant negative correlation with fresh weight of tuber (-0.472 r_p, -0.475 r_g) at 5% LOS, number of tubers per plant (-0.486 r_p, -0.498 r_g) at both 5% and 1% LOS and with marketable tuber yield per plant (-0.406 r_p, -0.407 r_g) at 5% LOS only. Fresh weight of tuber exhibited a significant positive correlation with dry weight of tuber (0.827r_p, 0.843r_g) and marketable tuber yield per plant (0.980 r_p, 0.985 r_g) at both 5% and 1% LOS and with a diameter of tuber (0.374 r_p, 0.389 r_g) and number of tubers per plant (0.374 r_p, 0.386 r_g) at 5% LOS (Verma, and Singh, 2015). This character also recorded a significant negative correlation with tuber dry matter content (-0.464 r_p, -0.441 r_g) at 5% LOS only. The dry weight of tuber exhibited a significant positive correlation with the diameter of tuber (0.678 r_p, 0.687 r_g) and marketable tuber yield per plant (0.868 r_p, 0.892 r_g) at both 5% and 1% LOS, (Badu *et al*., 2018 and Fidrianny *et al*., 2018).

Tuber dry matter content exhibited a significant positive correlation with the diameter of tuber (0.431 r_p, 0.444 r_g) and total carotenoids (0.387 r_p, 0.402 r_g) at 5% LOS. This character also recorded a significant negative correlation with the number of tubers per plant (-0.496 r_p, -0.527 r_g) at both 5% and 1% LOS. Length of the tuber recorded significant negative correlation with starch content (-0.422 r_p, -0.433 r_g) respectively at 5% LOS, (Gebreselassie and Ajema, 2022). The diameter of tuber exhibited a positive significant correlation with starch content (0.440 r_p, 0.445 r_g) at 5% LOS and marketable tuber yield per plant (0.486 r_p, 0.490 r_g) at both 5% and 1% LOS. This trait also recorded a significant negative correlation with the number of tubers per plant (-0.406 r_p, -0.419 r_g) at 5% LOS. The number of tubers per plant

Table 1: Phenotypic and genotypic correlation coefficients for Morphological characters of orange fleshed sweet potato genotypes.

Character		VN	INL	VWP	FWP	DWP	PMC	FWT	DWT	TDC	LT	DT	NTP	TC	Starch
Vine length	rp	**1.000**													
	rg	**1.000**													
Inter nodal length	rp	0.753**	**1.000**												
	rg	0.762**	**1.000**												
Vine weight per plant	rp	0.178	-0.050	**1.000**											
	rg	0.173	-0.050	**1.000**											
Fresh weight of whole plant	rp	0.243	-0.015	0.868**	**1.000**										
	rg	0.238	-0.016	0.902**	**1.000**										
Dry weight of whole plant	rp	0.240	-0.171	0.764**	0.796**	**1.000**									
	rg	0.239	-0.171	0.795**	0.799**	**1.000**									
Plant dry matter content	rp	-0.159	-0.385*	-0.315	-0.452*	0.133	**1.000**								
	rg	-0.157	-0.394*	-0.325	-0.445*	0.138	**1.000**								
Fresh weight of tuber	rp	0.255	0.007	0.651**	0.940**	0.704**	-0.472**	**1.000**							
	rg	0.260	0.006	0.729**	0.954**	0.717**	-0.475**	**1.000**							
Dry weight of tuber	rp	0.280	-0.145	0.700**	0.849**	0.942**	0.001	0.827**	**1.000**						
	rg	0.277	-0.146	0.730**	0.853**	0.942**	0.003	0.843**	**1.000**						
Tuber dry matter content	rp	-0.125	-0.375*	-0.119	-0.351	0.120	0.812**	-0.464*	0.064	**1.000**					
	rg	-0.143	-0.388*	-0.186	-0.360	0.122	0.840**	-0.441*	0.063	**1.000**					
Length of the tuber	rp	-0.151	0.073	0.365	0.196	0.088	-0.353	0.050	-0.006	-0.189	**1.000**				
	rg	-0.171	0.075	0.360	0.184	0.085	-0.350	0.050	-0.013	-0.221	**1.000**				
Diameter of tuber	rp	0.229	-0.166	0.237	0.354	0.593**	0.364	0.374*	0.678**	0.431*	-0.264	**1.000**			
	rg	0.233	-0.168	0.238	0.358	0.600**	0.373*	0.389*	0.687**	0.444*	-0.288	**1.000**			
Number of tubers per plant	rp	0.275	0.184	0.247	0.337	0.007	-0.486**	0.374*	0.088	-0.496**	-0.041	-0.406*	**1.000**		
	rg	0.275	0.189	0.246	0.340	0.010	-0.498**	0.386*	0.092	-0.527**	-0.052	-0.419*	**1.000**		
Total carotenoids	rp	0.426*	0.278	-0.048	-0.089	0.244	0.476*	-0.109	0.168	0.387*	-0.158	0.225	-0.092	**1.000**	
	rg	0.430*	0.278	-0.051	-0.089	0.244	0.486**	-0.111	0.169	0.402*	-0.160	0.227	-0.093	**1.000**	
Starch	rp	-0.510**	-0.693**	0.004	0.116	0.275	0.367	0.175	0.292	0.219	-0.422*	0.440*	-0.373*	-0.363	**1.000**
	rg	-0.518**	-0.694**	-0.010	0.117	0.276	0.375*	0.182	0.294	0.224	-0.433*	0.445*	-0.379*	-0.365	**1.000**
Marketable Tuber yield per plant	rp	0.301	0.067	0.682**	0.944**	0.771**	-0.406**	0.980**	0.868**	-0.394*	0.088	0.486**	0.276	0.008	0.134
	rg	0.311	0.067	0.785**	0.967**	0.792**	-0.407**	0.985**	0.892**	-0.364	0.097	0.490**	0.297	0.009	0.142

Note-*5% level of significance, **1% level of significance.

VN: Vine length; INL: Inter nodal length; VWP: Vine weight per plant; FWP: Fresh weight of whole plant ; DWP: Dry weight of whole plant; PMC: Plant dry matter content; FWT: Fresh weight of tuber; DWT: Dry weight of tuber; TDC: Tuber dry matter content; LT: Length of the tuber; DT: Diameter of tuber; NTP: Number of tubers per plant; TC: Total carotenoids

Table 1: Phenotypic and genotypic correlation coefficients for Morphological characters of orange fleshed sweet potato genotypes.

Character		VN	INL	VWP	FWP	DWP	PMC	FWT	DWT	TDC	LT	DT	NTP	TC	Starch
Vine	**rp**	**-0.111**	-0.083	-0.020	-0.027	-0.027	0.018	-0.028	-0.031	0.014	0.017	-0.050	-0.030	-0.047	0.057
length	**rg**	**0.038**	0.029	0.007	0.009	0.009	-0.006	0.010	0.011	-0.006	-0.007	0.014	0.011	0.017	-0.020
Inter nodal	**rp**	0.079	**0.105**	-0.005	-0.002	-0.018	-0.041	0.001	-0.015	-0.039	0.008	0.001	0.019	0.029	-0.073
length	**rg**	0.020	**0.026**	-0.001	0.000	-0.004	-0.010	0.000	-0.004	-0.010	0.002	0.002	0.005	0.007	-0.018
Vine weight	**rp**	-0.078	0.022	**-0.439**	-0.381	-0.335	0.138	-0.286	-0.307	0.052	-0.160	-0.138	-0.108	0.021	0.002
per plant	**rg**	-0.109	0.031	**-0.627**	-0.566	-0.499	0.204	-0.458	-0.458	0.117	-0.226	-0.195	-0.154	0.032	0.006
Fresh weight	**rp**	0.327	-0.021	1.167	**1.345**	1.070	-0.608	1.264	1.141	-0.472	0.264	0.335	0.454	-0.120	0.156
of whole plant	**rg**	0.768	-0.050	2.905	**3.220**	2.574	-1.434	3.070	2.745	-1.158	0.592	0.548	1.094	-0.288	0.376
Dry weight of	**rp**	-0.066	0.047	-0.209	-0.218	**-0.274**	-0.037	-0.193	-0.258	-0.033	-0.024	-0.195	-0.002	-0.067	-0.075
whole plant	**rg**	-0.491	0.352	-1.636	-1.645	**-2.058**	-0.283	-1.475	-1.938	-0.251	-0.175	-0.211	-0.020	-0.502	-0.568
Plant dry matter	**rp**	-0.054	-0.131	-0.108	-0.154	0.045	**0.341**	-0.161	0.000	0.277	-0.120	0.078	-0.166	0.162	0.125
content	**rg**	-0.144	-0.363	-0.299	-0.410	0.127	**0.920**	-0.437	0.003	0.773	-0.322	0.024	-0.458	0.447	0.345
Fresh weight	**rp**	0.021	0.001	0.054	0.078	0.058	-0.039	**0.083**	0.068	-0.038	0.004	0.165	0.031	-0.009	0.015
of tuber	**rg**	-0.529	-0.011	-1.481	-1.937	-1.456	0.965	**-2.031**	-1.713	0.897	-0.102	-0.194	-0.784	0.225	-0.370
Dry weight	**rp**	0.132	-0.068	0.330	0.400	0.444	0.001	0.390	**0.472**	0.030	-0.003	0.115	0.041	0.079	0.138
of tuber	**rg**	0.737	-0.387	1.940	2.266	2.503	0.008	2.241	**2.657**	0.168	-0.036	0.283	0.245	0.448	0.781
Tuber dry	**rp**	0.020	0.060	0.019	0.056	-0.019	-0.130	0.074	-0.010	**-0.160**	0.030	-0.100	0.079	-0.062	-0.035
matter content	**rg**	0.119	0.323	0.155	0.299	-0.102	-0.699	0.367	-0.053	**-0.832**	0.184	-0.090	0.439	-0.334	-0.186
Length of the	**rp**	0.014	-0.007	-0.033	-0.018	-0.008	0.032	-0.005	0.001	0.017	**-0.091**	0.010	0.004	0.014	0.039
tuber	**rg**	-0.005	-0.002	-0.011	-0.006	-0.003	0.011	-0.002	0.000	0.007	**-0.031**	-0.096	0.002	0.005	0.014
Diameter of	**rp**	-0.029	0.021	-0.030	-0.045	-0.075	-0.046	-0.047	-0.085	-0.054	0.033	**0.310**	0.051	-0.028	-0.055
tuber	**rg**	-0.089	0.064	-0.091	-0.137	-0.230	-0.143	-0.149	-0.263	-0.170	0.110	**0.325**	0.160	-0.087	-0.170
Number of tubers	**rp**	-0.055	-0.037	-0.050	-0.068	-0.001	0.098	-0.075	-0.018	0.100	0.008	0.052	**-0.201**	0.018	0.075
per plant	**rg**	-0.088	-0.060	-0.079	-0.109	-0.003	0.159	-0.123	-0.029	0.169	0.017	-0.03	**-0.320**	0.030	0.121
Total	**rp**	-0.034	-0.022	0.004	0.007	-0.019	-0.037	0.009	-0.013	-0.030	0.012	-0.040	0.007	**-0.079**	0.029
carotenoids	**rg**	-0.025	-0.016	0.003	0.005	-0.014	-0.029	0.007	-0.010	-0.024	0.009	0.023	0.005	**-0.059**	0.021
Starch	**rp**	0.133	0.181	0.001	-0.030	-0.072	-0.096	-0.046	-0.076	-0.057	0.110	-0.080	0.098	0.095	**-0.261**
	rg	0.098	0.132	0.002	-0.022	-0.052	-0.071	-0.035	-0.056	-0.042	0.082	0.071	0.072	0.069	**-0.190**
Marketable Tuber	**rp**	0.301	0.067	0.682	0.944	0.771	-0.406	0.980	0.868	-0.394	0.088	0.486	0.276	0.009	**0.134**
yield per plant	**rg**	0.311	0.067	0.785	0.967	0.792	-0.407	0.985	0.892	-0.364	0.097	0.490	0.297	0.009	**0.142**

Phenotypic Residual effect = **0.0667**; Genotypic Residual effect= **0.0230**; Diagonal (under lined) values indicate direct effects.

VN: Vine length; INL: Inter nodal length; VWP: Vine weight per plant; FWP: Fresh weight of whole plant ; DWP: Dry weight of whole plant; PMC: Plant dry matter content; FWT: Fresh weight of tuber; DWT: Dry weight of tuber; TDC: Tuber dry matter content; LT: Length of the tuber; DT: Diameter of tuber; NTP: Number of tubers per plant; TC: Total carotenoids

showed non-significant association with starch content at both genotypic and phenotypic levels (-0.373 r_p, -0.379 r_g) at 5% LOS only, (Gurmu *et al*., 2018 and Magaji and Sodangi 2020).

Total carotenoids showed non-significant association with starch content and marketable tuber yield per plant at both phenotypic and genotypic levels. Starch content showed no correlation with marketable tuber yield per plant at both genotypic and phenotypic levels (Kundy *et al*., 2016). Marketable tuber yield per plant exhibited a positive significant correlation with vine weight per plant (0.682 r_p, 0.785 r_g), fresh weight of plant (0.944 r_p, 0.967 r_g), dry weight of plant (0.771 r_p, 0.792 r_g), fresh weight of tuber (0.980 r_p, 0.985 r_g), dry weight of tuber (0.868 r_p, 0.892 r_g) and diameter of tuber (0.486 r_p, 0.490 r_g) at both 5% and 1% LOS. This trait also showed a significant negative correlation with plant dry matter content (-0.406 r_p, -0.407r_g) and tuber dry matter content (-0.394 r_p) at 5% LOS, (Mohanty *et al*., 2016 and Dash *et al*., 2015).

Path coefficient analysis

Direct Effect Path Coefficient Analysis:

The path coefficient analysis indicated that growth, yield and quality traits have differential direct effects on marketable tuber yield per plant both in phenotypic and genotypic perspectives (Table 2). The trait of vine length had a low negative direct effect on the yield in phenotypic perspective (-0.111 P), but in genotypic perspective it had a low positive direct effect (0.038 G). On the other hand, internodal length had a low positive direct effect on the marketable yield both in phenotypic and genotypic perspectives (0.105 P, 0.026 G). For vine weight per plant, there was a high negative direct effect in phenotypic and genotypic perspectives (-0.439 P, -0.627 G). In fresh weight of whole plant there is a very high positive direct effect on the yield both in phenotypic and genotypic perspectives (1.345 P, 3.220 G). On the other hand, for the trait of dry weight of whole plant there was low negative direct effect in phenotypic perspective (-0.274 P) and very high negative effect in genotypic perspective (-2.058 G), (Tirkey *et al*., 2011 and Magaji and Sodangi, 2020).

Out of all the yield-related characteristics, tuber fresh weight had a low positive direct effect (0.083 P) and a very high negative direct effect (-2.031 G) on the phenotypic and genotypic level, respectively. Tuber dry weight had a very high positive direct effect (0.472 P) and an even higher positive direct effect (2.657 G) on the phenotypic and genotypic level, respectively. This characteristic was thus considered to be a primary contributor towards yield in potatoes. Tuber dry matter content had a low negative direct effect (-0.160 P) and high negative direct effect (-0.832 G) on the phenotypic and genotypic level, respectively. Tuber length had negligible negative direct effects at both levels (-0.091 P, -0.031 G), while tuber diameter had high positive direct effects at both phenotypic and genotypic levels (0.310 P, 0.325 G). The number of tubers per plant was found to have moderate negative direct effect on the phenotypic level and a high negative direct effect on the genotypic level (-0.201 P, -0.320 G), Similar as reported by (APON 2016 and Dash *et al*., 2015).

Conclusion

Correlation analysis was observed in fourteen orange-fleshed sweet potato genotypes for the traits related to yield as well as quality parameters under the agro-climatic condition of Jorhat, Assam. From the correlation analysis of the data collected during the experiments, it was found that the yield or marketable tuber yield mainly depends upon biomass related traits such as fresh weight of tuber, fresh weight of whole plant, dry weight of tuber, vine weight per plant, and tuber diameter as these traits were positively associated with the yield. Further analysis using path coefficient method helped in understanding that the traits namely fresh weight of whole plant, dry weight of tuber, and fresh weight of tuber have shown the maximum positive direct effect on marketable yield. In contrast, some of the traits like vine weight per plant and number of tubers per plant have been seen to have negative direct effect. But these traits make contributions to marketable yield in indirect way through other yield traits. The quality traits including total carotenoids and starch content showed their complex relationship with yield. Hence, balanced selection is required for increasing productivity and nutritional quality of OFSP cultivars. Therefore, it could be said that fresh weight of the entire plant, dry weight of the tuber, and fresh weight of the tuber constitute the most accurate means of selection for increasing marketable tuber production in orange-fleshed sweet potato.

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