International Journal of Plant & Soil Science

Volume 37, Issue 12, Page 454-473, 2025; Article no.IJPSS.150020
ISSN: 2320-7035

Development of Quantitative Trait-based Yield Assessment and Forecasting Models for Eggplant (*Solanum melongena spp*) Genotypes Selection

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SS and MJ developed the concept and designed. Authors SS, GAM, EA carried out the experiment and data collection. Authors SS, MM, and MJ implement the software and formal analysis. Authors SS, GAM, EA, MM and AF, wrote the draft of the manuscript. Authors MS, AJM, SVA, MM and SAK supervised the manuscript. Authors SS, AF, MJ, AJM, MS, SVA and SAK authenticate the manuscript. Authors AF, MJ, AJM, MS, MM, EA, GAM, SVA and SAK reviewed the manuscript. All authors read and approved the final manuscript.

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Cite as: *SENESIE SWARAY, GELEJIMAH ALFRED MOKUWA, EMMANUEL ALPHA, MOHAMED MUSA, MOHAMED SESAY, ANSUMANA JOSEPH MUSA, SHEKU ALHAJI KOROMA, ALFRED FATORMA, SENESIE VICTOR ANSU, and MOMODU JALLOH. 2025. "Development of Quantitative Trait-Based Yield Assessment and Forecasting Models for Eggplant (Solanum Melongena Spp) Genotypes Selection". International Journal of Plant & Soil Science 37 (12):454–473. https://doi.org/10.9734/ijpss/2025/v37i125907.*

Article Information

DOI: https://doi.org/10.9734/ijpss/2025/v37i125907

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://pr.sdiarticle5.com/review-history/150020

Original Research Article

Received: 14/10/2025
Published: 29/12/2025

ABSTRACT

Eggplant is an economically significant vegetable that is extensively cultivated in Sierra Leone. To identify the best performing eggplant variety that could meet producers' and consumers' needs, a field experiment was conducted to evaluate the vegetative growth and yield performance of three diversities of eggplant. The study utilized the Randomized Complete Block Design (RCBD) with four replications. A systematic randomized selection and tagging on seven experimental eggplants as sample eggplants per plot summing up to a total of 21 sample eggplants per replication was done one week after transplanting. The analysis showed that yield traits were affected by the environment. The analysis further demonstrated that genotype Solanum robustum – *efloraofindia* had the highest fresh fruit yield mean of 4.14 kg/harvested/genotype. The performance of *Solanum robustum – efloraofindia* was better than the other two genotypes for growth and yield traits. All the eggplant characters had a high phenotypic coefficient of variation. This implied that traits of eggplant were influenced by the environment and genotypic coefficient of variation estimation result showed that fresh fruit yield (FFY) of 40.67% and eggplant stem girth (ESG) of 41.97% had the highest genotypic coefficient of variation (GCV). The genetic advance had an outstanding percentage of FFY at 78.51% and ESG of 200.54%. The broad-sense heritability also recorded the highest percentage mean of 62.51% (FFY) and 149.44% for ESG. Additionally, most of the traits recorded a weak positive correlation estimation in this study which may have occurred due to the environmental effect.

Model two stands as the best model, followed by model four for eggplant yield improvement. Therefore, genotype *Solanum robustum – efloraofindia* had been identified as the best performing yielding of economic importance, and *Solanum robustum – efloraofindia* agro-morphological characterization is recommended for commercial cultivation and breeding purposes.

Keywords: Solanum melongena; forecasting models; quantitative attributes; agronomic practices; general linear model; statistical analysis system.

ABBREVIATIONS

GMP : *General Mean Procedure,*
MAX : *Maximum,*
MIN : *Minimum,*
ITM : *Individual Trait Means,*
O̕2G : *Genetic Variance,*
O̕2E : *Error Variance,*
O̕2P : *Phenotypic Variance Total,*
PCV : *Phenotypic Coefficient of Variation,*
GCV : *Genotypic Coefficient of Variation,*
H2B : *Broad Sense Heritability,*
GA : *Genetic Advance,*
% : *Percentage,*
DF : *Degree of Freedom,*
DM : *Dependent Mean,*
PE : *Parameter estimates,*
SE : *Standard Error,*
SS : *Sum of Square,*
MS : *Sum of Means,*
CT : *Corrected Total,*
ADJ R-SQ : *Adjusted r. Square,*
COV : *Coefficient of Variation,*
FFY : *Fresh Fruit Yield,*
NHF : *Number of Harvested Fruit,*
FWT : *Fruit Weight,*
FFL : *Fresh Fruit Length,*
FSL : *Fruit Stock Length,*
ESG : *Eggplant Stem Girth,*
EPH : *Eggplant Plant Height,*

ENB : Eggplant Number of Branch,
ENL : Eggplant Number of Leaf,
ELL : Eggplant Leaf Length,
ELW : Eggplant Leaf Width,
ELA : Eggplant Leaf Area,
ELPL : Eggplant Leaf Petiole Length

1. INTRODUCTION

The eggplant (*solanum melongena* l.) is an important vegetable crop, sometimes referred to as brinjal or aubergine, grows well in warm temperate, tropical, and sub-tropical climates (Musa et al., 2023), and Sierra Leone is no exception. It is a member of the globally dispersed solanaceae family, which also includes a number of domesticated species, such as tobacco, tomato, pepper, and potato (Mat Sulaiman et al., 2020; Musa et al., 2021). according to AMRC (2024), eggplant belongs to the same plant family as peppers and tomatoes (solanaceae), and the cultural methods used to produce them are comparable to those used for those crops. warm-season plants that are more susceptible to cold temperatures than tomatoes, eggplant is a native of the tropics.

The sizes, colours, and yield of eggplant fruit vary widely. a wide range of variations allows eggplants to be found in a variety of colours, including variegated, white, red, purplish black, and others, as well as shapes, including round, elongated, and egg-shaped (AMRC, 2024). Similar to Indonesia, Sierra Leone boasts a wide variety of eggplants, including native kinds grown by farmers and superior cultivars created by seed producers. the most popular types are these regional and traditional cultivars. Local cultivars perform worse agronomically than improved kinds. even if the improved eggplant variety performs better agronomically, it still has special needs in terms of technology and organoleptic quality that satisfy users. Because of the additional effort and expenses required, as well as their resilience to biotic and abiotic stresses, this scenario persists (Sihachakr et al., 1993; Yurlisa et al., 2019). In the solanaceae family of nightshades, eggplant is a significant non-tuberous species (Yurlisa et al., 2019). In Asia, Africa, Europe, and the near east, eggplant has been grown for generations (Weese and Bohs, 2010; Yurlisa et al., 2019). Its fruit size, shape, and color vary. purple cultivars are the most often grown variety (Mat Sulaiman et al., 2020; Musa et al., 2020). According to Musa et al. (2023), eggplant is thought to have originated in Indo-Burma, with China serving as a secondary site of origin. For selection and yield improvement, a complex attribute like yield depends on a number of plant traits. Before starting a successful selection process, it is crucial to comprehend the importance of each component and how it connects to yield and to other components (Rahman et al., 2015). High-yielding, agronomically adaptable, and economically valuable, eggplant is a crop (Hanson et al., 2006; Yurlisa et al., 2019). Due to its high content of antioxidants (anthocyanins and phenolic acids), which are favourable for human health, interest in this plant is booming (Gajewski et al., 2009; da Costa, et al., 2015; Yurlisa et al., 2019). It is well known that eggplant fruit is low in calories and has a mineral content that is good for human health. iron, calcium, magnesium, and potassium are also abundant in it (Michalojc et al., 2008; Yurlisa et al., 2019). Additionally, eggplant has been found to have seventy-seven therapeutic qualities, demonstrating the plant's significance in traditional medicine as well as its potential as a functional food and in the natural product sector (Meyer et al., 2014; Lusher et al., 2017). However, it is thought that previous researchers, including Ukkund et al. (2007), Simon et al. (2013), Malek et al. (2014), Bende et al. (2019), Musa et al. (2020; 2023), and many others, could have carried out field research on yield attributes on species in the solanaceae family for selection either for cultivation or breeding programs. it is thought that a straightforward measure of forecasting models and character correlation cannot quantify the relative contribution of causal factors to the final yield.

Research on the relationships between genotypic and phenotypic features in crop plants, however, is valuable for planning, assessing, and defining selection criteria in breeding programs, according to Tulu et al. (2014) and Onyia et al. (2020). The efficacy of selection indices based on correlation coefficients is limited since interdependence and component traits sometimes change their direct relationship with yield, according to a recent publication by Musa et al. (2023). In field trials, genetic linkages help create a directional model focused on yield and its constituent parts and offer straightforward selection criteria (Swaray et al., 2021). It is preferable to carry out yield evaluation and forecasting models on eggplant research in order to create suitable breeding strategies targeted at increasing yield through selection. These investigations help to clarify the connection between yield and yield characteristics (Mondal et al., 2011; Malek et al., 2014). The component attributes that can be depended upon for progress are identified through correlation studies, which look at the correlations between different traits. it is crucial in identifying efficient breeding procedures (Tulu, 2014). The selection and determination of plant species' yields, such as eggplant, are aided by mathematical models. According to Chakrabarty et al. (2017), it helps create trustworthy selection criteria and lowers the risks of component compensation in yield enhancement. therefore, this study assessed the performance of quantitative attributes and forecasting models on eggplant genotypes for component traits selection.

2. MATERIAL AND METHODS

This study aimed to assess the yield and forecasting models on eggplant (*Solanum melongena spp*) diversity of morphological quantitative characters for traits selection. The materials of the present research consisted of two local diversities (Solanum virginianum and *Solanum melongena*) and one imported hybrid (Solanum robustum – efloraofindia) of eggplant. Fig. 1 represents the three diversities of eggplant used in this field research.

2.1 Planting Materials of Eggplant Diversities

The materials of the present research consisted of two local diversities (*Solanum virginianum* and *Solanum melongena*) and one imported hybrid (*Solanum robustum – efloraofindia*) of eggplant. These three diversities were used in this field research.

2.2 Experimental Design

The total experimental land area used was 161.28m^2(28.8 m length and 5.6 m width). The study utilized the Randomized Complete Block Design (RCBD) with four replications. For each replication, three plots were constructed with a ground total of 12 plots.

2.3 Location and Procedure for Data Collection

The concluded field experiment was carried out at Kpai-Bandama layout Small Bo Chiefdom, Kenema District, Eastern Region. The location is along the Bo Kenema highway, 1.5 km to Kenema City and 40.5 km to Bo City. The soil in the study area comprised of sandy loamy. The rainfall estimation in the study location was 1500 mm to 2500 mm/year. The location manifested a temperature requirement of approximately 28 °C minimum to 33 °C maximum, and a relative humidity of 75% to 85%.

The field research was carried out during the start of the planting season (second week in May) and lasted for six months in 2023 at Kpai-Bandama layout Small Bo Chiefdom. The seeds of the three genotypes were transferred to the field after having grown into seedlings. The planting distance used was 90 cm x 90 cm. Each accession eggplant was planted four plants per row and was planted in three rows with a total of 12 seedlings per plot per diversity plot and 36 per replication. A total experimental eggplant population was 144 eggplants. Transplanting was done during the evening hours, an hour after sufficient watering.

Fig. 1. Eggplant diversities (a). Solanum virginianum (Morkarbie), (b). *Solanum melongena* (Manplassas) and (c). Solanum robustum-efloraofindia (Black beauty) used in this field trial

A systematic randomized selection and tagging on seven experimental egg plants as sample egg plants per plot summing up to a total of 21 sample egg plants per replication was done one week after transplanting. The total experimental sample egg plants considered in this field trial was 84 sample egg plants.

Data collection was instituted on the tagged eggplants on two phases which comprises of growth attributes on eggplant morphology and characters of eggplant reproductive phase. Data collected two weeks after transplanting (vegetative phase) included eggplant height (E PH cm), eggplant stem girth (E SG cm), eggplant leaf number (E LN no.), eggplant leaf length (E LL cm), eggplant leaf width (E LW cm), eggplant leaf area (E LA cm^2), eggplant leaf petiole length (ELPL cm), eggplant leaf spines (ELS), and eggplant leaf hair (ELH).

The second segment of the data collection commenced at the reproductive phase of 45-60 days after transplanting. The following reproductive traits were considered: Number of eggplant fruits harvested per plant (NHF no.), eggplant fresh fruit weight (EFFW kg), eggplant fresh fruit yield (EFFY kg/ha), eggplant genotype fruit color (EGFC), eggplant fresh fruit length (EFFL cm), eggplant fresh fruit diameter (EFF D cm), eggplant fruit sector (EFS no.), eggplant fresh fruit shape (EFFS), and eggplant fresh fruit colour (EFFC).

2.4 Recommended Agronomic Practices

The recommended agronomic practices for eggplant were considered during the trial phase. However, weeds growing around plants were weeded, and controlling pests and diseases were carried out culturally. Observations were made on all individual plants in each population. The characters observed were morphological characters and crop production. Observations were based on descriptors (Yurlisa et al., 2019; Datta et al., 2021).

Additionally, we must know that insects are one of the most significant pests of eggplants. Cucumber beetle, Colorado potato beetle and flea beetle were particularly problematic during the initial phase of this trial (Jalloh et al., 2018). Immediately after transplanting, scout plants for insect damage were instituted. Most significant damage on yield and quality of eggplant occurs from early-season damage especially on the Solanum robustum – efloraofindia (black beauty). Flea beetles chew small holes in the leaves of eggplants but do not feed on the fruit (Fig. 2). Cucumber beetles and Colorado potato beetles chew the leaves and can also damage the fruits of eggplants. These Beetles or Creepy-crawlies insects were culturally controlled during the experimental period.

2.5 Data Analysis

Quantitative traits on both vegetative and yield traits were used in the analysis and data collected on the qualitative attributes were also considered for presentation in this study.

The collected quantitative characters data were analysed using the application of General Linear Model (PROC GLM) of the Statistical Analysis System (SAS 9.4, Institute, Cary, NC, USA) software. In the case of missing data, the General Linear Model (PROC GLM) of SAS will be use to carry out analyses of variance (ANOVA) amid eggplant genotypes. Simple Descriptive statistics such as Mean, coefficient of variation (CV), standard deviation (SD), standard error (SE), maximum (Max) and minimum (Min) were determined among eggplant genotypes. The Least Significance Difference (LSD) Test was used for mean separation. The phenotypic correlation of eggplant genotypes was also determined to validate the mean separation results obtained. The determination of correlation coefficient was estimated following Schober et al. (2018) based on the 95 percent confident interval, where ‘r’ was estimated as follows: poor correlation ($r < 0.5$), moderate ($0.5 \leq r \leq 0.75$), good ($0.75 \leq r \leq 0.9$) and perfect relationship ($0.9 < r = 1$).

The phenotypic coefficients of variation (PCV), genotypic coefficient of variation (GCV) and Genetic advance percentage (GA%) value were estimated following Oladosu et al. (2014) and Swaray et al. (2020) as high (> 20%), moderate (10% – 20%), and low (>10%). Also, Heritability was estimated following the categorization of Swaray et al. (2020) as high (> 60%), moderate (30 - 60%), and low (< 30%). For the qualitative characters of eggplant growth and yield assessment, it was compared directly per trait among accessions/varieties of eggplant.

Fig. 2. Insect damage and management during experimental phase

2.6 Useful Model Equation Relationship of Direct Contributing Traits and Yield

Regression analysis was used to acquire models for a functional relationship between independent variables [EPH cm, ESG cm, ELN no.), NHF no.) and EFFW kg)] and dependent variables (EFFY kg/ha). The R-Square procedure model-one of the regression models was utilized, since both of the variables (response and explanatory) were measurable and were subjected to error. The simple linear regression with a linear model form of $Y = \beta_0 + \beta_1 X_1 + \mathcal{E}$ was used as delineated by (Ngo *et al*., 2012), where Y = response variable, β_0 = intercept (value of Y, when X is 0), $\beta_1 x_1$ = slope (change in Y, for each unit change in X) known as the explanatory variable and Ɛ = random error. The equations of interest are as follows;

1. $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{EPH}) + \mathcal{E}$
2. $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{ESG}) + \mathcal{E}$
3. $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{ENL}) + \mathcal{E}$
4. $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{NHF}) + \mathcal{E}$
5. $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{EFFW}) + \mathcal{E}$

Where: The variable, eggplant high (EPH) in the 1st equation, eggplant stem girth (ESG) in the 2nd equation, Eggplant leaf number (ENL) in the 3rd equation, number of eggplant fruits harvested per plant (NHF) in the 4th equation and eggplant fresh fruit weight (EFFW) in the 5th equation are the slopes at a time, respectively, while β0 is the intercept and β1 eggplant fresh fruit yield (EFFY) is response variable and Ɛ is the random error.

3. RESULTS AND DISCUSSION

3.1 Analysis of Variance (ANOVA) and Variance Component on Yield Attributes

The results showed that the number of harvested fruit (NHF no.), fruit weight (FWT kg) and fruit stock length (FSL cm) among replications had a significant difference at $p < 0.05$ and non-significance variation was found among replications for fresh fruit yield (FFY kg/ha) and fresh fruit length (FFL cm) at $p > 0.05$. However, FFY recorded a highly significance variation among genotypes at $p < 0.01$. Whereas, a significance difference at $p < 0.05$ was observed amid the genotypes for NHF, FWT and FSL, but FFL had a non-significance difference among the eggplant genotypes at $p > 0.05$. This ANOVA results for both replication and genotype indicated no variation for fresh fruit length.

Moreover, the variance component is a key determining factor that comprises genetic variance (σ^2_g), error variance (σ^2_e) and phenotypic variance total ($\sigma^2_{(ph)}$).The variance component always indicates the contributions of the genetics of the crop and the environment in which the crop is been evaluated. Therefore, the variance component revealed that the highest and lowest σ^2_g were recorded in FFY at 31.25% and FFL at <0.01, respectively (Table 1). However, the results presented in Table 1, showed that the yield traits (FFY, NHF, FWT, FFL and FSL) with percentage error variance of 68.75%, 96.21%, 96.66%, 99.99% and 97.40%, respectively, were influenced by the environment. The σ^2_g of the eggplant genotypes in this study implies that its contributions in all of the yield morphological characters were low. A single trait, cannot lead to high production of any crop, but a contribution from various traits which can either be direct or indirect or a combination of the traits. Therefore, the yield recorded in this trial would have occurred as a result of the environment in which this trial was evaluated. This finding was supported by Musa *et al*. (2020) in terms of yield, that there were highly significant differences (p ≤ 0.01) between the genotypes.

Table 1. Analysis of variance for eggplant genotypes yield traits

SV	DF	FFY	NHF	FWT	FFL	FSL
REP	3	2.87ns	8.86*	0.15*	8.14ns	4.40*
GTP	2	107.33**	13.80*	0.21*	4.86ns	4.66*
ERROR	234	2.87	3.33	0.06	13.15	1.49
Variance Component						
		1.31	0.13	<0.01	<0.01	0.04
σ^2_g		(31.25)+	(3.79)	(3.34)	(<0.01)	(2.60)
σ^2_e		2.87	3.33	0.06	13.01	1.49
		(68.75)+	(96.21)	(96.66)	(99.99)	(97.40)
$\sigma^2_{(ph)}$		4.18	3.46	0.06	13.01	1.53
Mean		2.81	5.23	0.26	16.28	4.39
Std Error		0.12	0.12	0.02	0.23	0.08
Std Dev		1.94	1.87	0.24	3.61	1.25
Max		9.87	12.00	0.96	32.00	8.00
Min.		0.76	2.00	0.00	11.01	2.00

Note: SV = source of variation, DF = degree of freedom, REP =replication, GTP =genotype, FFY =fresh fruit yield (kg/ha.), NHF = number of harvested fruit (no.), FWT =fruit weight (kg), FFL =fresh fruit length (cm), FSL =fruit stock length (cm), σ^2_g = genetic variance, σ^2_e = error variance, $\sigma^2_{(ph)}$ = phenotypic variance total, Std = standard, Dev = deviation, Max = maximum, Min = minimum

3.2 Eggplant Genotypes Performance on Yield Characters

In determining the performance of the three eggplant genotypes [*Solanum melongena* (SM), *Solanum virginianum* (SV) and *Solanum robustum – efloraofindia* (SRE)], the Least Significance Difference (LSD) was used to determine variations among eggplant genotypes traits. The LSD revealed that genotype SRE had a significant variation with SM and SV. Which implied that SRE had the highest fresh fruit yield of 4.14 kg/harvested/genotype. A non-significance difference was not noticed between SM and SV, even though, genotype SM recorded the second-highest yield at 2.31 kg/harvest/genotype. Whereas, genotype SV recorded the lowest fresh fruit yield (Fig. 3).

Similarly, a non-significant variation was observed between genotypes SM (5.01 no./harvested/genotype) and SV 4.98 (no./harvested/genotype). Whereas, genotype SER recorded the highest number of harvested fruits (5.72 no./harvested/genotype), which varied significantly in the number of harvested fruits per harvested per genotype. Also, it was observed that genotype SM produced the highest weight of 0.32 kg/harvested/genotype with a significant variation from SV and SRE (Fig. 3). However, a significant difference was not recorded between genotypes SRE and SV, as resented in Fig. 3.

The fresh fruit length (FFL) was similarly evaluated and the result revealed a non-significance difference among the three genotypes with mean values of 16.47 cm, 16.01 cm and 16.37 cm, respectively.

In addition, the fruit stock length was also investigated among the three genotypes. The analysis carried out examined that a significant variation was not recorded in genotype SM (4.56 cm) and SV (4.34 cm), but SM had a significant variation with SRE at 4.34 cm, respectively. Therefore, based on the genotypes' performance for yield traits, genotype SRE could be recommended for commercial cultivation and future breeding programs, due to its outstanding performance in yield traits

3.3 Analysis of Variance and Variance Component on Vegetative Characters of Eggplant Genotypes

The combined ANOVA and variance component for eggplant genotypes on vegetative characters is presented in Table 2. Among the replications, eggplant stem girth (ESG cm), eggplant number of leaf (ENF no.), eggplant leaf width (ELW cm) and eggplant leaf petiole length cm) recorded the highly significant variation at $p \leq 0.01$ and eggplant height (EPH cm), eggplant number of branches (ENB no.), eggplant leaf length (ELL cm) and eggplant leaf area (ELA cm) were observed to hard recorded non-significance difference in replications.

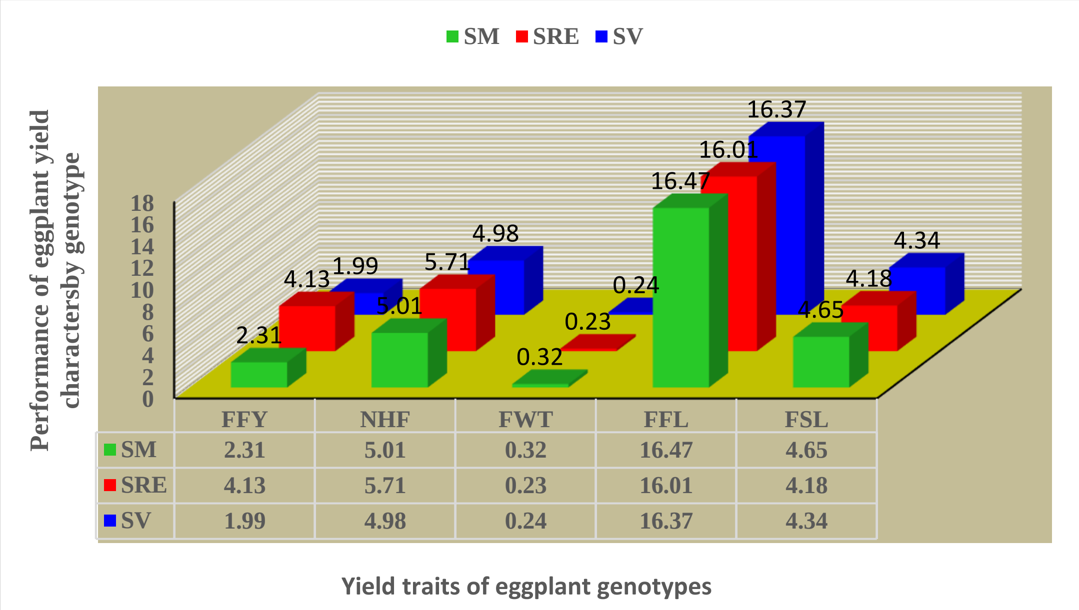

Fig. 3. Performance mean of yield traits per eggplant genotypes

Note: SM = FFY =fresh fruit yield (kg/ha.), NHF = number of harvested fruit (no.), FWT =fruit weight (kg), FFL =fresh fruit length (cm), FSL =fruit stock length (cm), Solanum melongena, SV = Solanum virginianum. SRE = Solanum robustum – efloraofindia

Table 2. Analysis of variance for eggplant vegetative characters

S/V	DF	ESG	EPH	ENB	ENL	ELL	ELW	ELA	ELPL
REP	3	23.89**	37.76ns	11.06ns	95.45**	0.55ns	16.37**	36.91ns	6.50**
GTP	2	762.32**	0.18ns	3.87ns	10.21ns	2.34*	0.81ns	182.54ns	0.58ns
ERROR	234	3.21	21.66	5.03	12.18	0.62	3.89	66.73	1.64
Variance component									
		9.49	<0.01	<0.01	<0.01	0.02	<0.01	1.45	<0.01
σ^2_g		(74.72)+	(<0.01)	(<0.01)	(<0.01)	(3.34)	(<0.01)	(2.14)	(<0.01)
σ^2_e		3.21	21.48	5.02	12.17	0.62	3.86	66.35	1.63
		(25.28)+	(99.99)	(99.99)	(99.99)	(96.66)	(99.99)	(97.86)	(99.99)
$\sigma^2_{(ph)}$		12.70	21.48	5.02	12.17	0.64	3.86	67.80	1.63
Mean		7.48	11.90	8.63	9.34	2.84	6.32	18.15	4.53
Std Error		0.20	0.30	0.15	0.23	0.05	0.13	0.53	0.08
Std Dev		3.13	4.66	2.26	3.63	0.80	2.00	8.21	1.30
Maxi.		23.00	33.00	19.00	24.00	5.74	9.00	43.47	8.00
Min.		2.00	1.00	4.00	4.00	1.00	2.43	2.54	1.40

S/V = surce of variation, DF = degree of freedom, GTP = genotype, REP = replication , σ^2_g = genetic variance, σ^2_e = error variance, $\sigma^2_{(ph)}$ = phenotypic variance total, Std = standard, Dev = deviation, Max = maximum, Min = minimum ESG = eggplant stem girth, EPH = eggplant plant height, ENB = eggplant number of branch , ENL = eggplant number of leaf, ELL = eggplant leaf length , ELW = eggplant leaf width, ELA = eggplant leaf area, ELPL = eggplant leaf petiole length

Similarly, genotypes had a high significance in ESG and a significance in ELL and the rest of the remaining characters (EPH, ENB, ELL and ELA) had non-significance differences in eggplant genotype.

The variance component revealed that σ^2_g recorded a range of <0.01% to 74.72%. Traits EPH, ENB, ENL, ELW and ELPL recorded the least σ^2_g with a value of <0.01. The highest σ^2_g of 74.72% was recorded by ESG with a 25.28% contribution from σ^2_e (Table 2). This means that the eggplant stem girth low performance was influenced by the genetic makeup of the eggplant genotypes. Whereas, the remaining vegetative traits of EPH, ENB, ENL, ELL, ELW, ELA and ELPL with percentage means which are presented in Table

2. This result implied that with the exception of ESG, all the vegetative characters examined in this study, were influenced by the environment which may have resulted in their low performance.

3.4 Morphological Characters and Mean Performance of Eggplant Genotypes

In the evaluation of vegetative characters of eggplant genotypes, the eggplant leaf spines (ELS) and eggplant leaf hair (ELH) were assessed. Through observation, *Solanum virginianum* commonly known in Sierra Leone as Morkarbie, had spines on the leaves and sector caps that attached the fruit stock and the fruit. The *Solanum robustum-efloraofindia* known as Black Beauty had hairy leaves and genotype *Solanum melongena* known as Manplassas had smooth leaves.

However, the mean assessment of vegetative characters is presented in Fig. 4. The general mean performance for eggplant stem girth (ESG) was 7.48 cm and 0.20 0f standard error. Significance difference was observed among the eggplant genotypes. The lowest ESG of 3.94 cm was recorded by SV genotype. The largest stem girth of 9.59 cm was obtained by SRE genotype and its performance in ESG was significantly varied from SM and SV, but SM which recorded the second largest ESG of 8.92 cm had a significance difference with SV genotype. The normal mean difference between the largest ESG and smallest ESG was 5. 65 cm. Stem girth is considered as a directive quantitative trait which contributes towards the yield of crops, i.e. the larger the stem girth of a crop, the better the yield. Also, the eggplant height (EPH) in this study showed non-significant variation among the eggplant genotypes. Similarly, the general mean performance of 11.90 cm was not different from the individual genotype height of SM (11.95 cm), SRE (11.89 cm) and SV (1186 cm). This indicated that the mean height of the genotypes was the same. Also, non-significance variation was noticed among the genotypes for eggplant number of branches (ENB). However, SM, SRE and SV had a general mean of 8.63 (no.) and a standard error of 0.15, whereas, 8.88 (no.), 8.45 (no.) and 8.56 (no.), respectively, were produced by the eggplant genotypes in this study. Their performance in eggplant number of leaf (ENL) production was not significantly varied from each other and in their general mean performance of 9.34 (no.). Genotype SM, SRE and SV leaf production means were presented in Fig. 4 and 9.75 (no.), 9.14 (no.) and 9.14 (no.), respectively, were recorded as their individual means for ENL production.

Moreover, the analysis revealed that a significance difference was recorded in eggplant leaf length (ELL). Genotype SV recorded the longest leaf length of 3.03 cm which was significantly different from SM and SRE with mean values of 2.70 cm and 2.77 cm, respectively, with a general mean leaf length of 2.84 cm. The general mean for ENL was longer than SM and SRE leaf lengths Fig. 4. Among the eggplant genotypes for eggplant leaf width (ELW), recorded non-significance difference and they recorded a general mean of 6.32 cm wide. It was also noticed that the general mean was not different from the individual mean performance in ELW.

Nonetheless, a significance difference was observed among genotype SV and the remaining two genotypes (SM and SRE). The largest leaf area of 19.90 cm^2 was significantly varied from SM (17.28 cm^2) and SRE (17.28 cm^2). Interestingly, SM and SRE had non-significance difference their leaf area production. It was further noticed that the general mean performance for leaf area was18.15 cm^2, which higher than the individual genotypes leaf area, except for SV which produced more leaf area. According to Usman *et al*. (2017), Oladosu *et al*. (2018) supported by Musa *et al*. (2020), reported that physiological processes such as photosynthesis rely on the external environmental conditions to function at the best impact in plant growth and development. Leaf area has been demonstrated to be a successful derivative trait for supporting the growth and raising yield in crop production of which eggplant is no exception.

In addition, eggplant leaf petiole length (ELPL) was measured, but the results obtained indicated non-significance difference in their ELPL. However, a general mean of 4.53 cm was recorded for ELPL. The individual genotypes mean performance for ELPL revealed non-significance difference among them. Yet, SM, SRE and SV recorded the following means of 4.59 cm, 4.43 cm and 4.56 cm, respectively (Fig. 4).

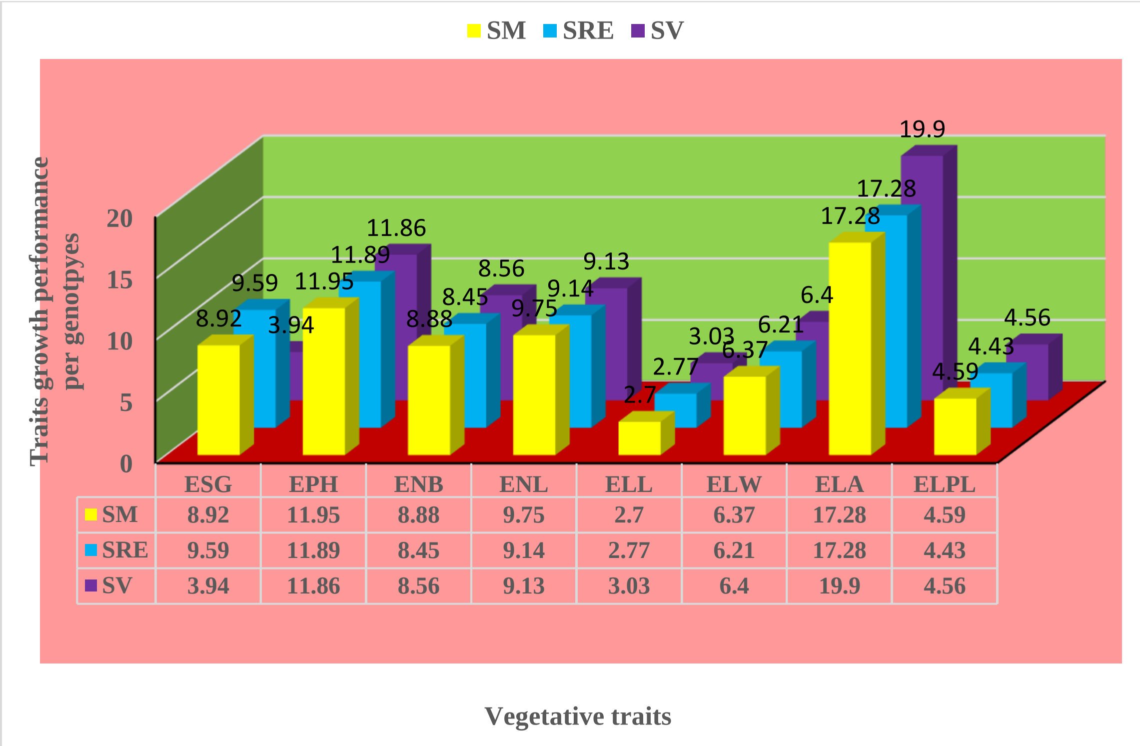

Fig. 4. Performance mean of growth parameters per eggplant genotypes

Note: ESG = eggplant stem girth, EPH = eggplant plant height, ENB = eggplant number of branches, ENL = eggplant number of leafs, ELL = eggplant leaf length, ELW = eggplant leaf width, ELA = eggplant leaf area, ELPL = eggplant leaf petiole length, SM = Solanum melongena, SV = Solanum virginianum. SRE = Solanum robustum – efloraofindia

3.5 Variance Parameter Estimation for ten Characteristics in Eggplant Genotypes

The general mean procedure (GMP) in this study showed that ELA had the largest area of 18.15 cm^2 followed by FFL at 16.28 cm, whereas FWT recorded the least value of 0.25 kg. Similarly, the maximum (Max) mean of 43.47 cm was recorded by ELA, followed by EPH at 33.00 cm and the least maximum value of 0.96 kg was recorded by FWT. Whereas, EFL of 11.02 cm was the minimum (Min) highest value recorded in this study and the least minimum mean was noticed in EWT (0.00 cm).

The genetic component which includes phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV) and genetic advance as well as heritability (h^2_B) were estimated due to their importance in selecting traits. However, the PCV in this study revealed that all the eggplant characters had a high PCV (Table 3). This implied that traits of eggplant were influenced by the error variance known as environment. Equally, GCV of 13 traits was also estimated and the estimated result showed that FFY of 40.67% and ESG of 41.97% had the highest GCV and a moderate of FWT (16.88%) was recorded. Whereas, the remaining traits had a low GCV. This indicated that only genotype with FFY and ESG should be selected for commercial cultivation and for future breeding. Furthermore, traits FFY and ESG had an outstanding percentage of 78.51% and 200.54%, respectively in genetic advance (GA). The remaining 11 traits had low GA% (Table 3). Therefore, genotype with high FFY and ESG traits in GA%, should be cultivated and selected for hybridisation.

Moreover, these same traits (FFY and ESG) in broad sense heritability (h^2_B) also recorded the highest percentage mean of 62.51% and 149.44%, respectively. With the exception of FFY and ESG, the remaining 11 traits had low heritability (Table .3). This further revealed that only genotypes with high FFY and ESG in this investigation should be selected for cultivation and crossing purposes.

Table 3 Estimation of variance and genetic parameters, and heritability for 13 characters in eggplant

Traits	GMP	Max	Min	$σ^2_g$	$σ^2_e$	$σ^2_P$	PCV%	GCV%	h^2_B%	GA%
FFY	2.81	9.87	0.76	31.25	68.75	4.18	72.75	40.67	62.51	78.51
NHF	5.23	12.00	2.00	3.79	96.21	3.46	35.54	6.91	7.57	6.34
FWT	0.26	0.96	0.00	3.34	96.66	0.06	92.33	16.88	6.69	3.25
FFL	16.28	32.00	11.01	0.00	100.00	13.01	22.15	0.00	0.00	0.00
FSL	4.39	8.00	2.00	2.60	97.40	1.53	28.18	4.54	5.19	3.16
ESG	7.48	23.00	2.00	74.72	25.28	12.70	47.63	41.17	149.44	200.54
EPH	11.90	33.00	1.00	0.00	100.00	21.48	38.95	0.00	0.00	0.00
ENB	8.63	19.00	4.00	0.00	100.00	5.02	25.97	0.00	0.00	0.00
ENL	9.34	24.00	4.00	0.00	100.00	12.17	37.36	0.00	0.00	0.00
ELL	2.84	5.74	1.00	3.34	96.66	0.64	28.30	5.17	6.68	3.28
ELW	6.32	9.00	2.43	0.00	100.00	3.86	31.08	0.00	0.00	0.00
ELA	18.15	43.47	2.54	2.14	97.86	67.80	45.36	6.64	4.28	8.53
ELPL	4.53	8.00	1.40	0.00	100.00	1.63	28.23	0.00	0.00	0.00

Note: GMP = general mean procedure, Max = maximum, Min = minimum, ITM = individual trait means, $σ^2_g$ = genetic variance, $σ^2_e$ = error variance, $σ^2_P$ = phenotypic variance total, PCV = phenotypic coefficient of variation, GCV = genotypic coefficient of variation, h^2_B = broad sense heritability, GA = genetic advance, % = percentage

3.6 Correlation Coefficient Estimation of Eggplant Traits

Moreover, to validate the findings of the study (Table 4), the correlation coefficient analysis was carried out on 13 quantitative traits. The result revealed that FFY had a weak positive correlation with NHF (r = 0.16; df = 3, 2; p =0.0154). The FFY eggplant trait also had a positive weak relationship with ESG at r = 036; df = 3, 2; p = 0.0001 and a weak positive association with FWT (r = .13; df = 3, 2; p = 0.0488). It was recorded that FSL had a weak positive relationship with ENL (r = 0.17; df = 3, 2; p = 0.0071). The FSL further recorded a weak negative correlation with ELL (r = -0.13; df = 3, 2; p = 0.0493). It was observed that ESG with ELA recorded a weak negative relationship of r = -0.15; df = 3, 2; p = 0.0201. Whereas, EPH with ENL and ENB with ENL recorded a weak positive relationship with each other with correlation values (r = 0.25; df = 3, 2; p = 0.0001) and (r = 0.16; df = 3, 2; df = 3, 2; p =0.0112), respectively.

Similarly, the correlation was observed that ENL with ELL had a negative weak relationship at r = -0.24; df = 3, 2; 0.0002, whereas, ELL had a moderate positive relationship with ELW (r = 0.72; df = 3, 2; 0.0001). The ELL with ELPL similarly recorded a weak positive correlation of r = 0.13, df = 3, 2; p = 0.0371. A weak positive correlation value of r = 0.21; df = 3, 2; p = 0.001 was obtained between ELL and ELPL. Whereas, ELW had a strong positive relationship with ELA (r = 0.76; df = 3, 2; p = 0.0001). It was further noticed that ELA recorded a weak positive correlation with ELPL at r = 0.15; df = 3, 2; p =0.0194. This implied that, the longer and wilder the leaf is the larger the leaf area.

3.7 Estimation of Model Formation for Yield Improvement in Eggplant Cultivation

Table 5 displays the results of the regression analysis for the response variable (EFFY) against each independent variables that was regressed with EFFY were determined. The Adj (Adjusted) R-Square and R-Square are two statistics that are used to assume the fit of the regression model values which is close to one indicate a better fit (Ngo et al., 2012).

To determine whether each parameter is significantly different from zero, the parameter estimations included the intercept (β0), slope (β1), and F-statistics together with the accompanying *p*-values for each independent traits (EPH, ESG, ELN, ENHF and EFFW) with regression (EFFY) (Table 5). The *p*-values for the regression at each independent traits, however, showed that the intercepts for each independent variables (ESG, ENHF and EFFW) and the dependent variable (EFFY) were significant and a statistically significant difference with ELN. Whereas, an exception of EPH was determined to be insignificant (Table 5).

The F-value for the first model for Equation one $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{EPH}) + \mathcal{E}$, was not significant (F=0.03, *P*>0.8631), meaning that the model explained the non-significant size of the variation. Equation one's R-Square was <0.0001 with an Adj R-Sq of -0.041, indicating that less than 1% of EFFY could be explained by EPH (Table 5).

Table 4. Eggplant traits relationship determination

	FFY	NHF	FWT	FFL	FSL	SG	PH	NB	NL	LL	LW	LA	LPL
FFY	1	0.16*	0.13*	-0.04ns	-0.06ns	0.36**	0.01ns	0.03ns	-0.12*	0.10ns	-0.06ns	0.00ns	0.02ns
NHF		1	-0.07ns	-0.09ns	-0.09ns	0.03ns	-0.02ns	-0.08ns	0.00ns	0.00ns	-0.03ns	-0.02ns	-0.01ns
FWT			1	-0.06ns	-0.15*	0.05ns	0.04ns	-0.04ns	-0.26**	0.00ns	-0.01ns	-0.02ns	-0.04ns
FFL				1	-0.05ns	-0.01ns	-0.03ns	-0.05ns	-0.12*	0.11ns	0.01ns	0.09ns	0.05ns
FSL					1	-0.01ns	0.02ns	0.11ns	0.17**	-0.13*	0.07ns	-0.03ns	0.00ns
SG						1	-0.06ns	0.03ns	-0.03ns	-0.07ns	-0.09ns	-0.15*	0.00ns
PH							1	0.05ns	0.25**	0.01ns	0.05ns	0.03ns	0.01ns
NB								1	0.16*	-0.07ns	0.03ns	-0.06ns	-0.01ns
NL									1	-0.24**	0.07ns	-0.11ns	-0.04ns
LL										1	0.13*	0.72**	0.21**
LW											1	0.76**	0.02ns
LA												1	0.15*
LPL													1

Note: FFY =fresh fruit yield, NHF = number of harvested fruit, FWT =fruit weight, FFL =fresh fruit length, FSL =fruit stock length, ESG = eggplant stem girth, EPH = eggplant plant height, ENB = eggplant number of branch, ENL = eggplant number of leaf, ELL = eggplant leaf length, ELW = eggplant leaf width, ELA = eggplant leaf area, ELPL = eggplant leaf petiole length

Table 5. Analysis of variance and other parameters estimates of regression analysis for the relationship between eggplant fruit yield and other traits of eggplant

			Analysis of Variance			
1. EPH	**Source**	**DF**	**SS**	**MS**	**F Value**	**Pr > F**
	Model	1	0.11204	0.11204	0.03	0.8631
	Error	238	895.22063	3.76143		
	CT	239	895.33267			
		Root MSE	1.93944	R-Square	0.0001	
		DM	2.80962	Adj R-Sq	-0.0041	
		CoV	69.02846			
	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	2.7543	0.34414	8	<.0001
	EPH	1	0.00465	0.02694	0.17	0.8631
2. ESG	Source	DF	SS	MS	F Value	Pr > F
	Model	1	118.1233	118.1233	36.17	<.0001
	Error	238	777.2094	3.26559		
	CT	239	895.3327			
		Root MSE	1.80709	R-Square	0.1319	
		DM	2.80962	Adj R-Sq	0.1283	
		Coeff Var	64.31795			
	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	1.13143	0.30243	3.74	0.0002
	ESG	1	0.22432	0.0373	6.01	<.0001
3. ELN	Source	DF	SS	MS	F Value	Pr > F
	Model	1	13.63938	13.63938	3.68	0.0562
	Error	238	881.69329	3.70459		
	CT	239	895.33267			
		Root MSE	1.92473	R-Square	0.0152	
		DM	2.80962	Adj R-Sq	0.0111	
		CoV	68.50495			
	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	3.42331	0.34311	9.98	<.0001
	ENL	1	-0.06572	0.03425	-1.92	0.0562

		Analysis of Variance				
1. EPH	**Source**	**DF**	**SS**	**MS**	**F Value**	**Pr > F**
4. ENHF	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	3.42331	0.34311	9.98	<.0001
	ENL	1	-0.06572	0.03425	-1.92	0.0562
	Source	DF	SS	MS	F Value	Pr > F
	Model	1	21.8711	21.8711	5.96	0.0154
	Error	238	873.46156	3.67001		
	CT	239	895.33267			
		Root MSE	1.91573	R-Square	0.0244	
		DM	2.80962	Adj R-Sq	0.0203	
		CoV	68.18441			
	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	1.9616	0.36874	5.32	<.0001
	ENHF	1	0.16204	0.06638	2.44	0.0154
5. EFWT	Source	DF	SS	MS	F Value	Pr > F
	Model	1	14.51983	14.51983	3.92	0.0488
	Error	238	880.81284	3.70089		
	CT	239	895.33267			
		Root MSE	1.92377	R-Square	0.0162	
		DM	2.80962	Adj R-Sq	0.0121	
		CoV	68.47073			
	Variable	DF	PE	SE	t Value	Pr > |t|
	Intercept	1	2.54399	0.18277	13.92	<.0001
	EFWT	1	1.01738	0.51363	1.98	0.0488

Note: DF = degree of freedom, DM = Dependent Mean, PE= Parameter estimates, SE = Standard error, SS = sum of square, MS = sum of means, CT= corrected total, Adj R-Sq = adjusted R. square, COV = coefficient of variation

This is so because less than 1% of non-significant contribution of eggplant hight to eggplant fresh fruit yield was obtained from the regression analyses with an equation model $\mathrm{EFFY} = 2.7543\ (\beta_0) + 0.00465\ [\beta_1(\mathrm{EPH})] + 0.02694(\mathcal{E})$. The determinant relationship of r = 0.01, *p* =0.8631, implies that EFFY had non-significant contribution with EPH in this study, even though plants plant height is considered as direct trait for yield improvement. The insignificant occurrence between EFFY and EPH may have occurred due to the dwarf nature of the eggplant diversities evaluated in this field study. The regression relationship between eggplant height (EPH) and eggplant fruit weight (EFWT) has been presented in Fig. 5.

Secondly, the F-value for the second model for Equation two, $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{ESG}) + \mathcal{E}$, had a significant variation of F =6.01; *p* = 0.0001, which denoted that the model clarified the significant extent of the difference. The equation two R-Square recorded was 0.1319 with an Adj R-Sq of 0.1283, meaning that 13.19% of the variation in EFFY could be explained by ESG. The F-value in the model for Equation two was significant (F=36.17, P<0.0001), suggesting that the model explained the realistic part in terms of variation. As a result, the second equations' R-Square of 0.1319 indicated that was in charge of 13.19% of the variance in ESG in EFFY yield reduction and therefore, an equation model of $\mathrm{EFFY} = 1.13143\ (\beta_0) + 0.22432\ [\beta_1(\mathrm{ESG})] + 0.0373(\mathcal{E})$ was formed. Therefore, Fig. 6 presented the regression relationship between eggplant fruit yield and eggplant stem girth. In any crop evaluation, stem girth is considered as one of the direct quantitative traits in yield determination and therefore, it 13.19% contribution in eggplant yield in this study was defensible. In relationship determination, EFFY had positive significant relationship with ESG (r = 0.36; df = 1; p = 0.0001).

Moreover, the F-value for the third model Equation where $\mathrm{EFFY} = \beta_0 + \beta_1(\mathrm{ELN}) + \mathcal{E}$, had a statistically significant variation of F = -9.12; *p* = 0.0562, which denoted that the model elucidated a statistically significant level of EFFY with ELN, but the intercept had a high significant p- value (Table 5). Similarly, Fig. 6 exhibited the regression relationship between eggplant fruit yield and eggplant leaf number. The equation three R-Square was 0.0152 with an Adj R-Sq of 0.0111, represented 1.52% of EFFY which could be explained by ELN. This is so because 2% of statistically significant contribution of eggplant leaf number to eggplant fresh fruit yield was attained from the regression analyses with an

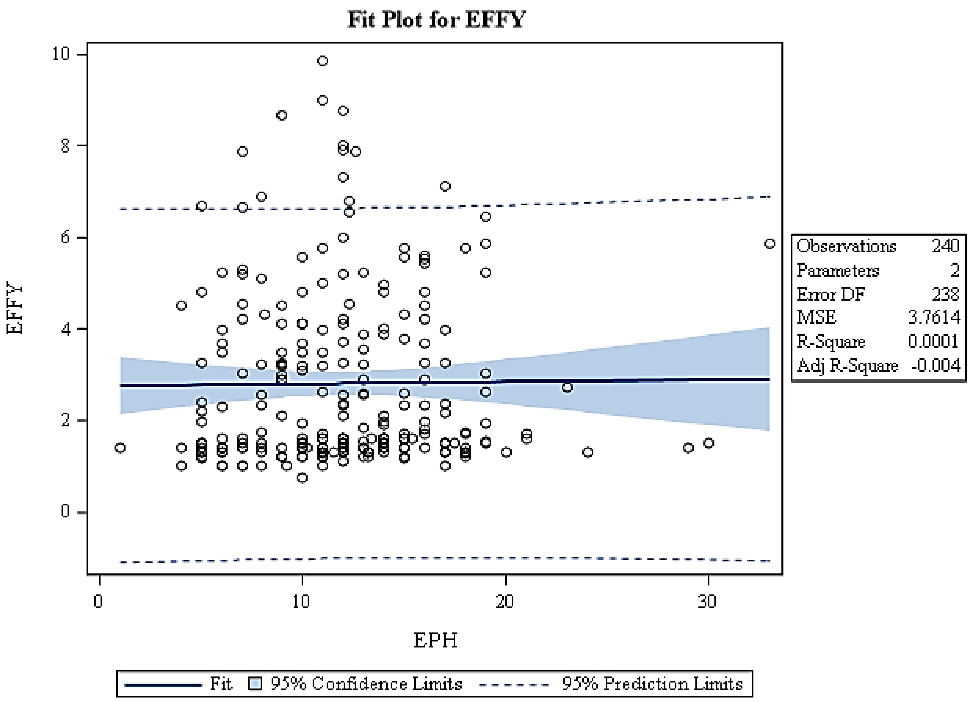

Fig. 5. Regression relationship between eggplant height (EPH) and eggplant fruit weight (EFWT)

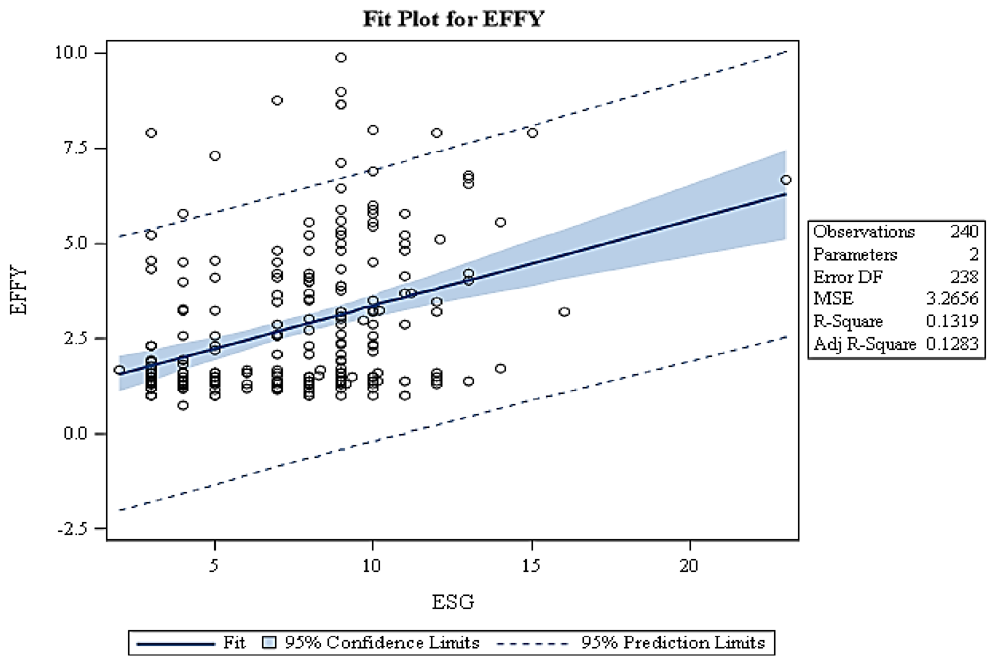

Fig. 6. Regression relationship between eggplant fruit yield (EFFY) and eggplant stem girth (ESG)

equation model $\text{EFFY} = 3.42331\ (\beta_0) + 0.06572\ [\beta_1(\text{ELN})] + 0.03425(\mathcal{E})$. The number of leaf production in plant contribute to the plant chlorophyl formation through the process of photosynthesis. In that case, leaf production in plant is also considered as one of the direct traits crop productivities. However, the statistically significant of 1.52% contribution in this study, occurred based on the damaged caused by eggplant defoliator beetles' breakout during the trial phase. A negative weak correlation relationship of r = -0.12; p = 0.0562 was established between EFFY and ELN and this may have happened due to the activities of insect defoliators and leafy ailments.

3.8 Regression Relationship between Eggplant Fruit Yield (EFFY) and Eggplant Leaf Number (ELN)

Additionally, the F-value of the fourth regression model equation, $\text{EFFY} = \beta_0 + \beta_1(\text{ENHF}) + \mathcal{E}$, had a significance difference of F= 2.44; P<0.0154, suggesting that the model also explained a large percentage of the variation. The equation four R-Square was 0.0244 with an Adj R-Sq of 0.0203, represented 2.44% of EFFY which could be explained by ENHF. Thus, the model for equation showed a substantial F-value (F = 2.44; P<0.0154), showing that the level of variation was explained by the model in the derived equation four of $\text{EFFY} = 0.16204\ (\beta_0) + 0.16204\ [\beta_1(\text{ENHF})] + 3.67001(\mathcal{E})$. Similarly, the correlation of r = 0.16; df = 1; p = 0.0154 implied a positive weak significant relationship in this study. The number of fruit initiation depends on some key environmental factors including nutrient availability, in which it has a negative impact on leaf formation which may have resulted in low fruit production.

3.9 Regression Relationship between Eggplant Fruit Yield (EFFY) and Eggplant Number of Harvested Fruit (ENHF)

Furthermore, the F-value for the fifth regression model equation of $\text{EFFY} = \beta_0 + \beta_1(\text{EFWT}) + \mathcal{E}$, recorded a significant disparity (F = 1.98; *p* = 0.0488), which signified that the model explained a statistically significant level of EFFY with EFWT and the intercept had a high significant p- value (Table 5). Whereas the equation (i-v) showed the regression relationship between eggplant fruit yield and eggplant fruit weight. The equation three R-Square was 0.0162 with an Adj R-Sq of 0.0121., This exemplified 1.62% of EFFY which could be explained by EFWT. This is so because 1.62% of statistically significant contribution of harvested eggplant fruit weight to EFFY was achieved from the regression analyses with an equation model $\text{EFFY} = 2.54399\ (\beta_0) +$

$0.01738\,[\beta_1(\text{EFWT})] + 3.70039(\mathcal{E})$. A positive correlation of r =0.13; df = 1; p = 0.0488 of which was determined by EFFY with EFWT. The weight of any harvested crop should have a positive impact on the yield, because, it is the product of harvested fruits multiply by the weight determine the crop yield.

3.10 Regression Relationship between Eggplant Fruit Yield (EFFY) and Eggplant Fruit Weight (EFWT)

The fitted model from the parameter-estimates from models one to five were as follows:

i. $\text{EFFY} = 2.7543\,(\beta_0) + 0.00465\,[\beta_1(\text{EPH})] + 0.02694(\mathcal{E})$
ii. $\text{EFFY} = 1.13143\,(\beta_0) + 0.22432\,[\beta_1(\text{ESG})] + 0.0373(\mathcal{E})$
iii. $\text{EFFY} = 3.42331\,(\beta_0) + 0.06572\,[\beta_1(\text{ELN})] + 0.03425(\mathcal{E})$
iv. $\text{EFFY} = 0.16204\,(\beta_0) + 0.16204\,[\beta_1(\text{ENHF})] + 3.67001(\mathcal{E})$
v. $\text{EFFY} = 2.54399\,(\beta_0) + 0.01738\,[\beta_1(\text{EFWT})] + 3.70039(\mathcal{E})$

The best fit for the model is indicated by the smallest MSE or the highest Adj R-Square since, as per Ngo et al. (2012), the Adj R-Square rises when the MSE falls. Thus, according to the Root MSE in Table 5 models two stands to be the best model of $\text{EFFY} = 1.13143\,(\beta_0) + 0.22432\,[\beta_1(\text{ESG})] + 0.0373(\mathcal{E})$ with the lowest mean square error (MSE) of 3.26559 followed by model four of $\text{EFFY} = 0.16204\,(\beta_0) + 0.16204\,[\beta_1(\text{ENHF})] + 3.67001(\mathcal{E})$ with MSE value of 3.67001. The MSE difference between model two and model four was 0.40442 which supported model two as the most outstanding model for eggplant yield determination and therefore, it has been recommended in eggplant production.

4. CONCLUSION

The performance of the three eggplant diversities were evaluated through field experiment. The analysis of variance on quality yield traits of the different eggplant varieties showed a wide range of differences. The results of the variance component analysis showed that the environment had a greater influence on yield and vegetative traits which concluded that traits were pretentious by the environment. Genotype *Solanum robustum – efloraofindia* had a significant variation with *Solanum melongena* and *Solanum virginianum.* These implied that *Solanum robustum-efloraofindia* had the highest fresh fruit yield of 4.14 kg/harvested/genotype. Similarly, the exception of eggplant stem girth, all the vegetative characters examined in this study, were influenced by the environment which may have resulted in their low performance. The mean separation showed that genotype *Solanum robustum – efloraofindia* had the best performance for vegetative traits in this study. All the eggplant characters had a high phenotypic coefficient of variation and his implied that traits were influenced by the environment and genotypic coefficient of variation estimation result showed that fresh fruit yield of 40.67% and eggplant stem girth of 41.97% had the highest. The genetic advance had an outstanding percentage of fresh fruit yield at 78.51% and eggplant stem girth of 200.54%. The broad sense heritability also recorded the highest percentage mean of 62.51% of fresh fruit yield and 149.44% for eggplant stem girth. Also, most of the treats recorded a weak positive correlation estimation in this study which may have occurred as a result of the environmental effect. Model two stands as the best model, followed by model four for eggplant yield improvement. Therefore, due to its outstanding performance in yield traits, genotype *Solanum robustum – efloraofindia* has been recommended for profitable cultivation and for future diversities development. The findings of this study and be concluded that the cultivation of high yielding variety of eggplant like *Solanum robustum – efloraofindia* is vital for eggplant farmers in Sierra Leone for better productivity and increase in their economy.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

ACKNOWLEDGEMENTS

The authors are thankful to the management and field worker of the Eastern Technical university of Sierra Leone (ETU-SL), as one the technical and research institution in Sierra Leone for providing the conducive learning environment for us to be able to carry out this research. We are also delighted for the various financial and moral support from individual contributions from all the authors. All relevant contributors, including anonymous reviewers are acknowledged for their contribution to this manuscript quality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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