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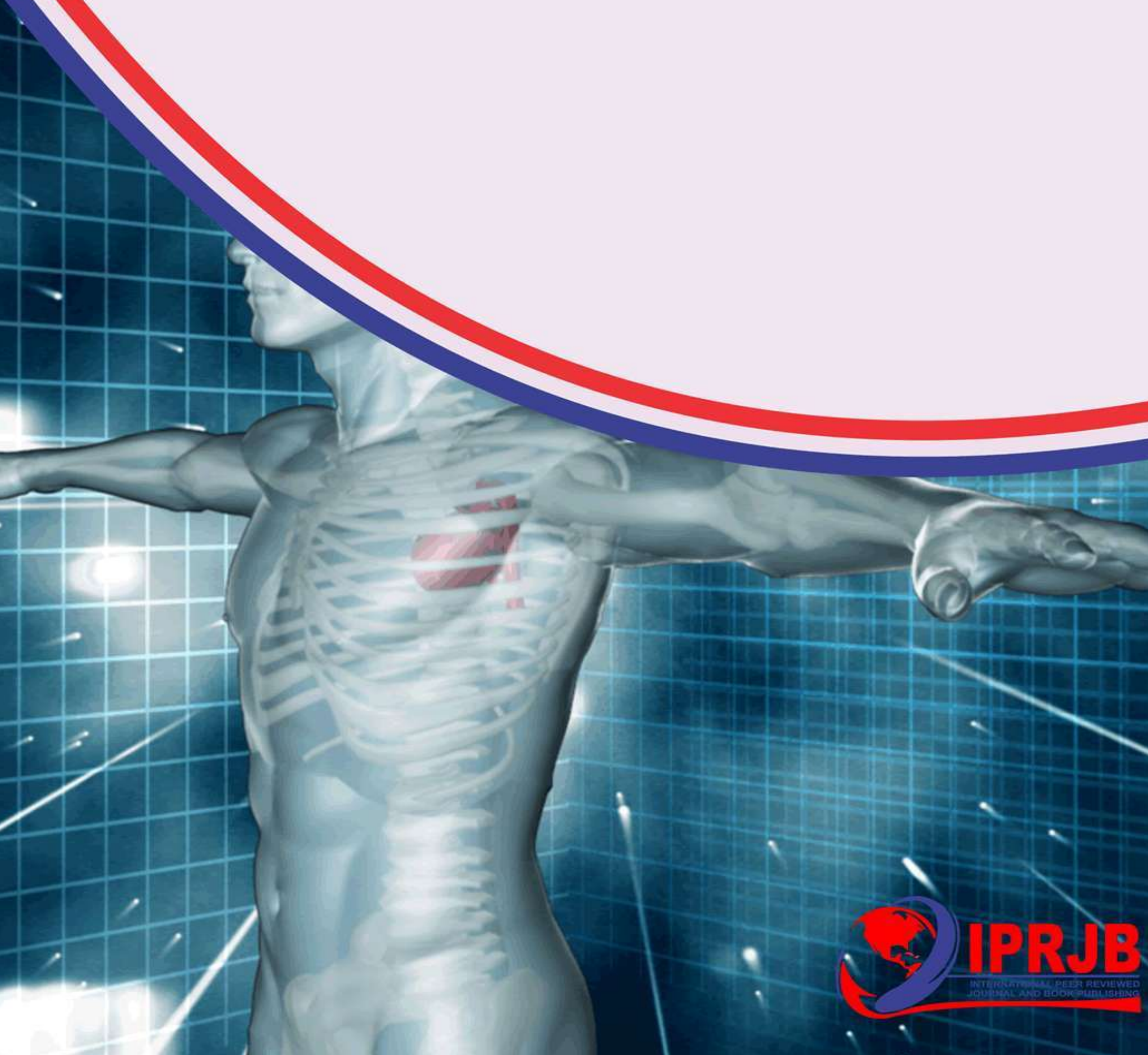

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Evaluation of Tomato Varieties for Morpho-Agronomy and Yield Attributes in Oyo State, Nigeria

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Abstract

Purpose: Tomato seeds used in this study were sourced from the National Centre for Genetic Resources and Biotechnology (NACGRAB) located at Moor Plantation, Ibadan, Oyo State, Nigeria. The aim of this study is to assess tomato genotypes using morpho-agronomic traits with a view to identifying and selecting desirable traits in terms of fruit yield for further improvement in yield.

Methodology: The research was carried out during the 2025–2026 dry season under open field conditions at the Biology Research Farm of Oyo State College of Education, Lanlate, Oyo State. Ten improved tomato genotypes were evaluated for agronomic traits, morphological characteristics, and yield performance using a Randomized Complete Block Design (RCBD) with ten replications.

Findings: The study results demonstrated significant differences ($p < 0.001$) among all measured parameters. The genotypes 'NGB 00729' achieved the greatest plant height (74 cm), closely followed by 'NGB 00696' (62 cm), while the shortest height was observed in 'NGB 00715' (21 cm). In terms of fruit production per plant, 'NGB 00715' recorded the highest mean number of fruits (33.31), followed by 'NGB 00696' (30.67). On the other hand, the lowest mean numbers of fruits per plant were observed in 'NGB 02688' and 'NGB 00729', with averages of 16.67 and 11.67, respectively. These variations were statistically significant ($p<0.001$). Among the varieties assessed, 'NGB 00715' excelled in parameters such as the number of trusses per plant, fruits per plant, and fruits per truss, despite its shorter plant height and smaller fruit weight and diameter.

Unique Contribution to Theory, Practice and Policy: The results of the present study showed, differential response in the tomatoes verities. Hence there is a great possibility of improvement in attributes of this vegetable crop. Based on its superior performance in these aspects, 'NGB 00715' is recommended for potential crossing with either 'NGB 02685', which exhibited the highest fruit weight and diameter, or 'NGB 05076', which achieved the highest fruit yield per plant (496.80 g) and per hectare (13,800.00 g). Such hybridization efforts could effectively enhance yield and overall productivity in tomato cultivation.

Keywords: *Genetic Advance (GA), Genotypes (G), Heredity, Performance, Yield*

INTRODUCTION

The cultivated tomato (*Solanum lycopersicum* L.) traces its lineage to the wild tomato species, *Lycopersicon esculentum* var. *cerasiforme*. Originating in the Peru-Ecuador region, this plant was dispersed across parts of tropical America, initially as a weed. Historical accounts suggest that tomatoes were introduced to West Africa, including Nigeria, by Portuguese traders or transported overland from Egypt and Sudan. However, the first domestication of tomatoes is believed to have occurred in Mexico (Abdul et al., 2020). Tomatoes are among the most significant vegetable crops globally. In 2020, total production reached approximately 186.8 million metric tons, cultivated on 5.05 million hectares with an average yield of 37.1 metric tons per hectare (EC, 2021). China leads global production, followed by India and Turkey, while Nigeria ranks eleventh with an output of roughly 3.69 million metric tons from 844.4 thousand hectares (Abdul et al., 2020). Despite its promise, Nigeria's tomato productivity—averaging just 4.4 metric tons per hectare—is notably low compared to the crop's potential (EC, 2021). Contributing factors include limited access to improved cultivars, lack of locally adapted varieties, susceptibility to diseases, and high input costs for fertilizers, seeds, and chemicals.

Husen et al. (2022) highlighted that Africa's average tomato productivity ranges between 8 and 25 metric tons per hectare, with South Africa at the highest end and Benin and Nigeria at the lowest. Despite its economic and nutritional importance, tomato production faces several challenges. These include a lack of regionally adapted and improved varieties, insufficient knowledge of optimal cultivation and management techniques, inadequate extension services, poor marketing frameworks, and underutilization of this versatile crop. Nevertheless, vegetable cultivation is gaining popularity as consumers' demand for healthy diets increases due to changing lifestyle preferences. Key to successful vegetable farming is raising robust seedlings in well-managed nursery environments. Therefore, the aim of this study is to evaluate tomato genotypes using morpho-agronomic traits in order to identify and select desirable characteristics associated with fruit yield for subsequent yield improvement in Oyo State.

Tomato fruits vary widely in shape and colour, ranging from large and round to oval or elongated forms. When ripe, they can be orange, yellow, multicoloured, or red, containing numerous light brown seeds that are kidney or pear-shaped and often hairy (Bhuwan & Swikriti, 2024). Wild relatives of the tomato offer a valuable gene pool that has been extensively utilized in breeding programs. The cultivated tomato is one of the most thoroughly studied crops at both genetic and genomic levels due to its economic importance and suitability for scientific analysis. Its diploid nature (24 somatic chromosomes), relatively small genome size (950 Mb per haploid nucleus), self-pollinating capability, short generational cycle, ease of propagation by seeds or vegetative means, and compatibility with many wild species make *Solanum lycopersicum* an ideal candidate for genetic research (Kharat et al., 2022). Tomatoes have earned recognition as a "protective food" because of their numerous health benefits derived from their rich nutritional profile (Kharat et al., 2022, Collins et al., 2022, Temesgen et al., 2022).

Tomato Genetic Resources

Traditional tomato genetic resources encompass nine wild and related species which are publicly accessible through the Tomato Genetics Resource Centre (TGRC: http://tgrc.ucdavis.edu/indexcfm). These species, all diploids (2n=2x=24), share similar chromosome numbers and structures, making them viable sources for introducing new genes into tomato breeding programmes. Domestication has shaped the genetic makeup of tomatoes overtime, and these genetic resources offer substantial diversity for specific breeding objectives. For certain traits, breeders may need to incorporate genes from wild ancestors such as *Solanumpennellii*, *S. habrochaites*, *S. pimpinellifolium*, *S.lycopersicoides*, *S. chmielewskii*, and *S. sitiens*to restore lost diversity and enhance yield performance, especially under both optimal and stress conditions. However, breeders must remain cautious, as much of the genetic variability in wild germplasm might negatively affect adaptation to agricultural conditions. The key challenge lies in identifying and utilising beneficial alleles for crop improvement (TGRC: http://tgrc.ucdavis.edu/indexcfm).

Genetic resources can be preserved in various ways, including *exsitu* conservation in gene banks, on-farm preservation of cultivated materials, or *insitu* conservation within wild species populations. These resources encompass traditional and modern tomato cultivars, primitive cultivars, breeding lines, landraces (heirloom tomatoes), and related wild species. Additionally, cloned genes have become significant genetic stocks in modern breeding (Frankel et al., 1995). Since genetic variation within cultivated tomatoes is notably limited, researchers have long investigated exotic and primitive germplasm alongside closely related species to discover new genetic traits. Contemporary breeding strategies enable a thorough evaluation and effective use of the genetic diversity present in wild relatives and heirloom varieties.

Selection for Yield Using Growth and Yield Components

Crop yield is influenced by a multitude of factors, including; weather condition, soil quality, agronomic practices, and cultivar choice. While some factors are modifiable, others are beyond our control. Among these variables, cultivar selection has proven to exert a significant impact on yield outcomes. Over time, as research has uncovered aspects that affect plant performance, there has been a notable increase in yield potential in multiple crops. These influencing components commonly known as growth and yield components—include attributes like plant height, average fruit weight, number of fruits per truss and primary branch count (Oluwagenga et al., 2016).

Heritability of Tomato Yield Components

A successful crop improvement programme hinges on the presence of genetic variability and the degree to which desirable traits are heritable. Rosmaina et al. (2016) highlighted the importance of genetic variability within breeding materials to enable effective selection processes. Broad-sense heritability is quantified as the ratio of genotypic variance to phenotypic variance and expressed as a percentage (Rosmaina et al., 2016). Heritability is typically classified into categories—low (0–30%), moderate (30–60%), and high (60% and above)—a scheme proposed by Rosmaina et al., 2016. High heritability values for various tomato performance indices have been identified by researchers. For instance, traits such as the number of fruits per cluster (Veershetty, 2004), number of fruits per plant (Haydar et al., 2007), average fruit weight, and total fruit yield per plant (Haydar et al., 2007) exhibit high heritability. These findings suggest that simple selection techniques can effectively improve these traits. Additionally, moderate to high heritability has been reported for yield-related traits like number of fruit per plant, average fruit weight, and fruit yield by Sivaprasad (2008). Sivaprasad (2008) also noted that traits with moderate to high heritability indicate an influence from environmental factors on expression. This underscores the need for both simple selections and progeny tests when improving fruit yields through component traits. Conversely, low to moderate heritability was observed for traits like fruits per truss, revealing significant genotype-by-environment (G x E) interactions affecting their expression (Sivaprasad, 2008).

METHODOLOGY

Plant Materials and Study Plan

This study involved ten tomato varieties (genotypes) which were sourced from the National Centre for Genetic Resources and Biotechnology (NACGRAB) Research Station located in More Plantations, Ibadan. The experiment took place during the dry season of 2025/2026 on a research plot measuring approximately14–15m².

Description of the Experimental Site

In total, ten containers were prepared as nursery beds, each measuring 4 m x 1 m, for ten distinct tomato varieties. Loamy soil was used as the growing medium. The soil-filled containers received tomato seeds sown in rows with spacing of 15 cm between rows. After sowing, a layer of dry grass approximately 3 cm thick was used as mulch, and the soil was watered appropriately. Watering was initially carried out twice daily until germination occurred, after which it was reduced to once every two days and then to three times per week. Other essential nursery management practices like weeding, thinning and shade construction were undertaken to foster healthy seedling development. When the seedlings reached the transplanting stage (15–25 cm in height), the experimental field was thoroughly tilled and leveled. A total of one hundred polyethylene bags were filled with loamy soil, with ten bags allocated for each tomato variety. Once the seedlings were sufficiently developed, they were carefully uprooted and transplanted into the polyethylene bags at a spacing of 60 cm x 60 cm between and within rows. No fertilizers were applied to the plants after transplanting.

The morphological and Agronomic Traits Measured at Field

In total, eighteen (18) distinct IPGRI descriptors were employed and measured in order to assign tomato genotypes to morphological and agronomic traits (International Plant Genetic Resources Institute, 1996).

The plants were scored for the following morphological traits:

1. Colour of corolla (COC): The colours of corolla were determined by visual examination (e.g. yellow, light yellow, red).
2. Shape of fruit (SOF): The shapes of the fruits were recorded for each of the genotype examined as ridge, round, oblong etc.
3. Colour of fruit (COF): The colours of fruits were determined by visual method i. e. red, yellow, multicolour etc.
4. Plant growth habit either determinant or non-determinant.

Table 1: Growth and Yield Agronomic Characters Evaluated

S/N	Variable	Symbol	Method of scoring
1	Plant height	PH	Tape rule (cm)
2	Number of leaves per plant	NLP	Counted
3	Number of branches per plant	NBP	Counted
4	Days of 50% flowering	DFF	Calculated
5	Number of flowers per truss	FPT	Counted
6	Truss number per plant	TNP	Counted
7	Harvest sample date	HSD	Calculated
8	Number of fruits per truss	NFT	Calculated
9	Weight of fruit	WOF	Scale (g)
10	Diameter of a fruit	DOF	Vernier caliper
11	Total number of fruits per plant	TNF	Calculated
12	Fruit yield / plant in gram (g)	FYP (g)	Calculated
13	Fruit yield in kilogram per hectare (kg/ha)	FY (kg/ha)	Calculated
14	Number of seeds per fruit	NSF	Counted

Statistical Analysis

Analysis of Variance (ANOVA)

One-way ANOVA (significance level $p < 0.05$) was used to analyse the data collected from the various genotypes. The mean values for all traits were compared to evaluate the performance differences among genotypes. When significant differences were detected, Duncan's Multiple Range Test (DMRT) was applied to separate mean values. The analysis was carried out using IBM SPSS Statistics Software (version 27). Microsoft Excel was additionally employed for calculation of certain genetic parameters.

Correlation Analysis

Simple correlation coefficients were computed for different pairs of variables across all varieties by using the mean values associated with each variable.

Genetic Parameters Estimates

The variability present in the population was estimated by measure mean, phenotypic and genotypic variance and coefficient of variation. To estimate the phenotypic and genotypic variance, genotypic and phenotypic coefficients of variation were estimated based on formula (Rosmaina et al., 2016 and Fatih, et al., 2017) as follow:

Where: $\delta^2 g$ = Genotypic variance;

Genotypic variance ($\delta^2 g$) = (Mean sum of squares due to genotypes (MSS) − Error mean sum of squares) ÷ Replication (r)

Phenotypic variance ($\delta^2 p$) = $\delta^2 g + \delta^2 e$

Environmental variance ($\delta^2 e$) = (Error mean sum of squares) ÷ Replication (r)

(Source: Meena et al., 2017, Dragov, et al., 2022)

Genotypic and Phenotypic Coefficients of Variability

Genotypic and phenotypic coefficients of variability were estimated according to the Meena et al. (2017) and Fatih et al. (2017) using the following formulae:

$$\text{Phenotypic Coefficient of variation (PCV (\%)} = \frac{\sqrt{\delta 2p}}{\pi} \times 100$$

$$\text{Genotypic Coefficient of variation GCV (\%)} = \frac{\sqrt{\delta 2g}}{\pi} \times 100$$

Where: π=grand mean of a character

The mean values were used for genetic analyses to determine Phenotypic Coefficient of Variation (PCV) and Genotypic Coefficient of Variation (GCV), according to Boryana and Darina (2014). Also, PVC and GCV were classified as suggested by Meena et al. (2017 and Fatih et al. (2017).

Less than 10% = Low

10 - 20% =Moderate

More than 20% = High

Estimation of Heritability in Broad Sense

Broad sense heritability (h^2bs) of all the traits was calculated according to the formula as described by Rosmaina et al. (2016) and Meena et al. (2017) as follow:

$$h^2(bs) = \frac{\delta^2 g}{\delta^2 ph} \times 100$$

The heritability (h^2 (b)) was categorised as suggested by Johnson et al. (1955) referenced by Rosmaina et al. (2016).

0	-	30%	=	Low;
31	-	60%	=	Medium;
61 % and above			=	High

Estimation of Genetic Advance

Genetic advance (GA) was estimated as per formula given by Rosmaina et al. (2016) and Arshad et al. (2017).

$$GA = K \times \delta ph \times H^2 (b)$$

Where:

K = the selection differential (K = 2.06 at 5% selection intensity);

δPh = the phenotypic standard deviation of the character or square root of the phenotypic variance of a particular trait

H^2 = broad sense heritability.

Estimation of Genetic Advance over Mean: Genetic advance over mean was calculated using the following formula and was expressed in percentage:

$$GAM = \frac{GA}{\pi} \times 100$$

Genetic advance over mean (GAM) was categorised as suggested by Johnson *et al.* (1955) referenced by Meena et al. (2017) and Haithm et al. (2022).

Less than 10% = Low ;

10 - 20% = Moderate;

More than 20% = High

RESULTS

The germination characteristics of ten seed varieties were analysed based on observations. A total of 250 seeds were planted for each variety. Among these, only the varieties NGB 00696, NGB 00725, NGB 00749, and NGB 05077 achieved germination rates exceeding 50%, while all other varieties exhibited germination rates below 50%. The variety with the highest germination percentage was NGB 00749, whereas NGB 00715 had the lowest. In terms of survival rate, NGB 05077 demonstrated the highest performance. The number of germinated seeds, survival rates, and their corresponding percentages are presented in Table 2 below.

Table 2: The Number of Seeds Planted, Germination Rate and Survival Rate of Tomato Seedling

Genotype	NSP	NG	%GN	SV	%SV
NGB 00696	250	190	76	81	42.63
NGB 00715	250	70	28	24	34.29
NGB 00725	250	150	60	87	58
NGB 00729	250	120	48	60	50
NGB 00737	250	100	40	24	24
NGB 00749	250	230	92	126	54.78
NGB 02685	250	90	36	30	33.33
NGB 02688	250	110	44	60	54.55
NGB 05076	250	115	46	64	55.65
NGB 05077	250	130	52	78	60

Note: NSP – number of seeds planted per variety; **NG** – germinated number; **%NG** – percentage germinated; **SV** – survival rate; **%SV** - percentage of survival

The transplanting results revealed that NGB 00715 had the least number of leaves, while NGB 00737 recorded the highest. The highest mean value for leaves' number was found in NGB 00737 (6.33), and lowest in NGB 00715, with a mean value of 3.00 during the transplanting stage. In terms of seedling height at this stage, the highest mean value was observed in NGB 05077 at 16.83, followed by NGB 00737 at 13.17, while NGB 00715 exhibited the lowest mean height at 4.83. Further details on the minimum and maximum ranges for leaf number and seedling height at the transplanting stage are provided in Table 3.

Table 3: The Mean Range of Number of Leaves and Height at Transplanting Stages

	Number of leaves			Height		
Genotype	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
NGB 00696	4	4.67	5	6	8.17	12.5
NGB 00715	2	3	4	4	4.83	5.5
NGB 00725	5	5.33	6	11	12.33	13
NGB 00729	5	5.33	6	11	12.33	14
NGB 00737	5	6.33	7	12	13.17	15
NGB 00749	5	5	5	8.5	9.33	10
NGB 02685	5	5.33	6	9.5	10.5	11.5
NGB 02688	4	5.33	6	9.5	10	10.5
NGB 05076	4	5	6	10.33	10.33	11
NGB 05077	4	4.67	6	16	16.83	17.5
Grand Total	**4.3**	**5**	**5.7**	**9.783**	**10.782**	**12.05**

In morphological traits four (4) discrete were employed and measured in order to assign tomato genotypes to morphological traits. In the evaluation of qualitative attributes, all the genotypes under study exhibited variations in fruit colour. The genotype NGB 00749 displayed an oval-round fruit shape. Genotypes NGB 00696, NGB 00715, NGB 02688, NGB 00729, and NGB 00737 were observed to have a predominantly round fruit shape. Meanwhile, genotypes NGB 00725 and NGB 00737 were noted for their ridged fruit shape, whereas all other genotypes produced fruits with an oblong shape, as detailed in Table 4. The ten tomato genotypes analysed were characterised based on attributes such as flower colour, fruit colour, fruit shape and type, as well as maturity period. These characteristics displayed noticeable differences among the genotypes. Most genotypes produced bright yellow flowers and red fruits, with the exception of NGB 02685, which bore yellow fruits (refer to Table 4).

Table 4: Evaluation of Tomato Genotypes for Growth, Development and Qualitative Characters

Genotypes	**Source / Origin**	**Plant growth Habit**	**Flowers' colour**	**Fruits' colour**	**Fruit shape**
			Accessions		
NGB 00696	NACGRAB	Determinate	Yellow	Bright red	Round
NGB 00715	NACGRAB	Determinate	Yellow	Red	Round
NGB 00725	NACGRAB	Determinate	Yellow	Brown	Ridge
NGB 00729	NACGRAB	Determinate	Bright yellow	Bright red	Oblong
NGB 00737	NACGRAB	Determinate	Bright yellow	Red	Ridge
NGB 00749	NACGRAB	Determinate	Yellow	Light yellow	Oval-round
NGB 02685	NACGRAB	Determinate	Red	Yellow	Oblong
NGB 02688	NACGRAB	Determinate	Light Red	Red	Round
NGB 05076	NACGRAB	Determinate	Red	Red	Round
NGB 05077	NACGRAB	Determinate	Red	Red	Round

The present investigation on growth and development parameters revealed significant differences by Duncan Multiple Range Test (DMRT) among the examined genotypes, as shown in Tables 5a and 5b. The mean performance of various genotypes across different traits, along with the overall grand mean, is summarized in Table 6. The tallest plant height (74.00 cm) was observed in the genotype NGB 00729, followed by NGB 00696 and NGB 00737 which recorded heights of 62.00 cm and 56.00 cm, respectively. In contrast, the shortest plant height (21.00 cm) was noted for genotype NGB 02685, as detailed in Tables 5a and 6a. Statistical analysis indicated a notable variation in plant height among tomato varieties (p> 0.05). Additional parameters, including the number of leaves per plant, number of branches per plant, days to 50% flowering, number of flowers per truss, truss number per plant, and harvest sample dates, also exhibited significant differences (p> 0.05) as presented in Tables 5a and 6a. Genotype NGB 00696 recorded the highest mean number of leaves per plant (19.33) and branches per plant (3.33). Conversely, genotype NGB 05077 exhibited the lowest number of leaves per plant (10), while three genotypes—NGB 02685, NGB 02688, and NGB 05077—shared the lowest mean number of branches per plant (3), as listed in Table 6a. Results regarding flowering time and harvest sample dates are summarised in Table 6a. The analysis showed a grand mean of 112.43 days for 50% flowering across all genotypes and an average of 119.90 days for harvesting sample dates, measured from the date of planting.

Table 5a: Duncan Multiple Range Test (DMRT) of Growth and Vegetative Parameters of Agronomic Importance of Ten Tomatoes Varieties

S/N	Genotypes	PH (cm)	NLP	NBP	DFF	FPT	TNP	HSD
1	NGB 00696	58.00a	19.99a	5.33a	106.00cd	6.00ab	5.67ab	118.00bcde
2	NGB 00715	27.00d	14.67abc	3.67bcd	115.00ab	8.00a	6.00a	122.67abc
3	NGB 00725	31.67cd	14.67abc	4.33ab	113.00abc	7.00ab	3.67bc	122.33abc
4	NGB 00729	58.33a	14.33bc	3.33bcd	1.6.00cd	6.33ab	2.67c	113.00e
5	NGB 00737	43.67abcd	13.33bcd	3.33bcd	104.67d	6.33ab	4.00abc	120.00abcd
6	NGB 00749	44.33abc	15.33ab	4.00bc	109.00bcd	5.33b	5.33ab	116.00de
7	NGB 02685	40.33bcd	12.67bcd	3.00cd	114.67ab	7.00ab	5.00ab	117.00cde
8	NGB 02688	27.67cd	9.33d	2.67d	120.33a	5.67b	4.67ab	124.33a
9	NGB 05076	52.33ab	16.33ab	3.33bcd	115.33ab	8.00a	3.67bc	122.00abc
10	NGB 05077	39.00bcd	10.00cd	3.00cd	120.33a	5.33b	4.00abc	123.67ab

Note*: Mean in a column with any group followed by the same letters are significant difference using DMRT (Duncan Multiple Range Test):* ***PH*** *=Plant height in (cm);* ***NLP*** *= Number of leaf per plant;* ***NBP*** *= Number of branch per plant;* ***DFF*** *=Day fifty percent (50%) flowering;* ***FPT***= Number of flowers per truss; ***TNP*** = Truss number per plant, ***HSD*** = Harvest sample date

Tables 5b and 6b present the results of an evaluation of ten tomato varieties based on several parameters, including the number of fruits per truss, fruit weight, fruit diameter, total number of fruits per plant, fruit yield per plant, yield in kilograms per hectare, and the number of seeds per fruit. Table 5b revealed significant differences across all measured traits related to yield and associated characteristics. The variety NGB 02685 recorded the highest fruit weight at 13.40 g, while NGB 00715 had the lowest at 3.65 g. As shown in Table 6b, the maximum yield per hectare was observed in NGB 05076 at 13,800.00 kg/ha, whereas the minimum yield per hectare was recorded for NGB 00729 at 1,755.56 kg/ha. These findings indicate that NGB 05076 demonstrated the highest fruit yield per plant, the greatest yield in kilograms per hectare and the highest total number of seeds per fruit.

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Table 5b: Duncan Multiple Range Test (DMRT) For Yield and Yield Related Parameters of Ten Tomatoes Varieties

S/N	Genotypes	NFT	WOF	DOF	TNF	FYP(g)	FY(kg/ha)	NSF
1	NGB 00696	5.33bc	8.37d	11.33abc	30.67ab	261.11abc	7252.96abc	63.67a
2	NGB 00715	5.67b	3.65e	7.00c	33.33a	123.17c	3421.30c	39.67b
3	NGB 00725	4.67bc	11.17bc	12.00ab	17.33bc	194.27bc	5396.30bc	48.00ab
4	NGB 00729	4.33b	7.99d	11.33abc	11.67c	93.99c	2610.74c	37.33b
5	NGB 00737	4.33bc	10.47c	12.00ab	17.67bc	181.30bc	5035.19bc	39.00b
6	NGB 00749	4.33bc	13.33a	11.67ab	23.33abc	313.33ab	8703.7ab	50.67ab
7	NGB 02685	4.33bc	13.40a	14.67a	21.67abc	295.27abc	8201.85ab	51.33ab
8	NGB 02688	3.67d	10.97bc	9.33bc	16.67bc	180.83bc	5023.15bc	63.00a
9	NGB 05076	8.00a	12.80ab	11.67ab	29.67ab	380.70a	10575.00a	61.33a
10	NGB 05077	4.67bc	11.87abc	14.00ab	19.33bc	235.53abc	6542.59abc	64.67a

Note: *Mean in a column with any group followed by the same letters are significant difference using DMRT (Duncan Multiple Range Test)*NFT = number of fruits per truss; WOF = weight of fruit; DOF = Diameter of fruit; TNF = total number of fruit per plant; FYP (g) = fruit yield per plant; FY (kg/ha) = fruit yield in kilogram per hectare; NSF = number of fruit per fruit

	Range			Range			Range			Range			Range			Range			Range		
	PH			NLP			NBP			DFF			FPT			TNP			HSD		
Genotype	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**Π**	**Max**	**Min**	**π**	**Max**	**Min**	**Π**	**Max**	**Min**	**π**	**Max**
NGB 00696	53	58	62	16	19.33	24	5	5.33	6	104	106	108	4	6	7	5	5.67	7	116	118	120
NGB 00715	25	27	30	13	14.67	16	3	3.67	4	111	115	120	8	8	8	5.00	6.00	8.00	120	122	126
NGB 00725	27	26.67	36	12	14.47	16	3	4.33	5	111	113	115	6	7	8	2.00	3.67	5	119	122.33	125
NGB 00729	47	58.33	74	13	14.33	16	3	3.33	4	104	106	108	6	6.33	7	2	2.67	3	110	113	115
NGB 00737	32	43.67	56	10	14	16	3	3.33	4	100	104.67	108	5	6.33	7	3	4	5	118	120	122
NGB 00749	40	31.33	50	14	15.33	16	3	4	5	105	109	112	5	5.33	6	5	5.33	6	115	116	118
NGB 02685	21	40.33	53	8	12.67	16	3	3	3	106	114.67	120	6	7	8	4	5	6	111	117	121
NGB 02688	25	27.67	28	8	9.33	10	2	2.67	3	118	120.33	123	4	5.67	8	4	4.67	5	120	124	128
NGB 05076	50	52.33	54	15	11.67	18	3	3.67	4	113	115.33	118	7	8	9	3	3.67	4	120	122	124
NGB 05077	31	39	44	8	10	12	3	3	3	31	39	44	5	5.33	6	3	4	5	122	123.67	126
Grand Total	**21.00**	**42.23**	**74.00**	**8.00**	**14.00**	**24.00**	**2.00**	**3.60**	**6.00**	**100.00**	**112.43**	**128.00**	**4.00**	**6.50**	**9.00**	**2.00**	**4.47**	**8.00**	**110.00**	**119.90**	**128.00**

Table 6a: The mean range of Agronomy traits of ten varieties tomato

Note: ***PH*** *=Plant height in (cm);* ***NLP*** *= Number of leaf per plant;* ***NBP =*** *Number of branch per plant;* ***DFF*** *=Day fifty percent (50%) flowering;* ***FPT***= Number of flowers per truss;***TNP*** = Truss number per plant, ***HSD*** = Harvest sample date

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Table 6b: The Mean Range of Yield Components of Ten Varieties Tomato Studied

	Range			Range			Range			Range			Range			Range			Range		
	NFT			WOF			DOF			TNF			FPY(g)			FY(kg/ha)			NSF		
Genotype	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**π**	**Max**	**Min**	**Π**	**Max**	**Min**	**π**	**Max**
NGB 00696	4.00	5.33	6.00	7.90	8.37	9.06	10.50	11.33	12.00	20.00	30.67	42.00	158.00	261.10	380.52	4388.89	7252.96	10570.00	42.00	63.67	90.00
NGB 00715	5.00	5.67	6.00	3.15	3.65	4.10	6.00	7.00	8.00	30.00	33.33	40.00	94.50	123.17	164.00	2625.00	3421.30	4555.56	37.00	39.67	42.00
NGB 00725	4.00	4.67	6.00	20.30	11.17	12.50	10.00	12.00	14.00	8.00	24.00	24.00	85.60	194.27	250.00	2377.78	5396.30	6944.45	45.00	48.00	50.00
NGB 00729	4.00	4.33	5.00	7.48	7.99	8.60	9.00	11.33	13.00	8.00	11.67	15.00	63.20	93.99	129.00	1755.56	2610.74	3583.33	28.00	37.33	52.00
NGB 00737	4.00	4.33	5.00	9.50	10.47	11.00	10.00	12.00	14.00	12.00	17.67	25.00	135.50	181.30	237.50	3666.67	5035.19	6597.22	32.00	39.00	49.00
NGB 00749	3.00	4.33	5.00	12.50	13.33	14.50	11.00	11.67	12.00	15.00	23.33	30.00	187.50	313.33	390.00	5208.33	8703.33	10833.33	47.00	50.67	55.00
NGB 02685	4.00	4.33	5.00	11.60	13.40	14.80	12.00	14.67	18.00	16.00	21.67	25.00	185.60	295.27	355.20	5155.56	8201.85	9866.67	47.01	51.33	55.03
NGB 02688	3.00	3.67	5.00	9.80	10.97	12.20	4.00	9.33	12.00	15.00	16.67	20.00	163.50	180.83	196.00	4541.67	5023.15	5444.44	54.02	63.00	70.00
NGB 05076	7.00	8.00	9.00	11.70	12.80	13.80	8.00	11.67	14.00	21.00	29.67	36.00	270.90	380.70	496.80	7525.00	10575.00	13800.00	58.00	61.33	66.00
NGB05077	4.00	4.67	6.00	10.90	11.87	12.90	12.00	14.00	16.00	12.00	19.33	30.00	130.80	235.53	387.00	3633.33	6542.59	10750.00	54.04	84.87	80.00
Grand Total	**3.00**	**4.90**	**9.00**	**3.15**	**10.40**	**14.80**	**4.00**	**11.50**	**18.00**	**8.00**	**22.13**	**42.00**	**63.20**	**225.94**	**496.80**	**1755.56**	**6276.28**	**13800.00**	**28.00**	**51.87**	**90.00**

Note: NFT = number of fruits per truss; WOF = weight of fruit; DOF = Diameter of fruit; TNF = total number of fruit per plant; FYP (g) = fruit yield per plant; FY (kg/ha) = fruit yield in kilogram per hectare; NSF = number of fruit per fruit

In Table 7, the correlation coefficient analysis revealed seventeen positive and significant correlations among the traits, out of which twelve were highly significant ($p < 0.01$). The strongest positive correlation was observed between the total number of fruits (TNF) versus the number of fruits per truss (NFT) (r = 0.70**). This was followed by correlations between fruit yield per plant (FYP, g) and the total number of fruits (TNF) (r = 0.65**), fruit yield per hectare (FY, kg/ha) and the total number of fruits (r = 0.65**), harvest sample date (HSD) and days to 50% flowering (DFF) (r = 0.63**), number of branches and number of leaves (r = 0.61**), plant height and number of leaves (r = 0.60**), diameter of fruit (DOF) and weight of fruits (WOF) (r = 0.59**), and fruit yield per plant (FYP, g) and number of fruits per truss (NFT) (r = 0.58**). Additionally, five correlation coefficients in Table 7 were positive and significant at $p < 0.05$. These include correlations between the total number of fruits (TNF) and the number of leaves per plant (NLP), as well as between the number of seeds per fruit (NSF) and days to 50% flowering (DFF) (r = 0.36*). Other significant correlations at this level include the number of branches per plant (NBP) and plant height (PH), the number of fruits per truss (NFT) and the number of leaves per plant (NLP), and the total number of fruits per plant (TNF) and the number of flowers per truss (FPT), each showing a coefficient of r = 0.33*. Lastly, there was a negative and significant correlation between days to 50% flowering (DFF) and plant height (PH) at $p < 0.05$, with r = -0.33, as shown in Table 7.

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Table 7: Correlation Coefficients of Growth and Yield Parameters of Agronomic Important Traits of 10 Genotypes of *Solanum* Lycopersicum

Traits	PH	NLP	NBP	DFF	FPT	TNP	HSD	NFT	WOF	DOF	TNF	FYP (g)	FY (kg/ha)	NSF
PH	1													
NLP	0.60**	1												
NBP	0.34*	0.61**	1											
DFF	-0.33*	-0.31	-0.32	1										
FPT	-0.10	0.19	0.08	0.00	1									
TNP	-0.12	0.22	0.29	0.09	0.04	1								
HSD	-0.37	-0.14	-0.15	0.63**	0.04	0.14	1							
NFT	0.25	0.34*	0.08	0.00	0.46**	0.05	0.16	1						
WOF	0.14	-0.14	-0.16	0.17	0.14	-0.11	0.03	-0.04	1					
DOF	0.27	0.05	-0.01	0.08	-0.00	-0.23	0.08	0.07	0.59**	1				
TNF	0.09	0.40*	0.30	0.03	0.34*	0.74	0.17	0.70**	-0.16	-0.21	1			
FYP(g)	0.26	0.24	0.13	0.09	0.14	0.41	0.09	0.58**	0.62**	0.29	0.65**	1		
FY (kg/ha)	0.26	0.24-	0.13	0.09	0.14	0.41	0.09	0.58**	0.62**	0.29	0.65**	1	1	
NSF	0.14	0.04	0.02	0.36*	-0.15	0.14	0.29	0.26	0.31	0.11	0.24	0.41	0.41	1

Note**: **PH** =Plant height in (cm); **NLP** = Number of leaf per plant; **NBP** = Number of branch per plant; **DFF** =Day fifty percent (50%) flowering; **FPT**=* Number of flowers per truss; ***TNP = Truss number per plant, ***HSD*** = Harvest sample date; NFT = number of fruits per truss; WOF = weight of fruit; DOF = Diameter of fruit; TNF = total number of fruit per plant; FYP (g) = fruit yield per plant; FY (kg/ha) = fruit yield in kilogram per hectare; NSF = number of fruit per fruit. *Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Analysis of Genetic Parameters

The findings from the genetic analysis of tomato genotypes are summarised in Table 8. Key parameters, including phenotypic and genotypic variances, phenotypic coefficient of variance (PCV), genotypic coefficient of variance (GCV), genetic advance (GA), genetic advance as a percentage of the mean (GAM), and broad-sense heritability, are presented. The Duncan Multiple Range Test (DMRT) results revealed significant differences across all fourteen traits examined among the ten tomato genotypes, indicating notable variability in growth, morphological qualities, and yield-related traits. This variation highlights a substantial potential for selection and breeding. For most traits assessed, high GCV and PCV values were observed across the ten genotypes. Notable estimates include fruit yield per plant (60.78% and 60.79%), fruit yield per hectare (kg/ha) (60.78% and 60.78%), weight of fruit (WOF) (44.93% and 66.83%), number of fruits per plant (49.33% and 49.92%), plant height (42.12% and 42.46%), number of fruits per truss (NFT) (38.18% and 59.02%), truss number per plant (TNP) (36.21% and 52.92%), number of branches per plant (NBP) (33.67% and 66.37%), number of seeds per fruit (NSF) (32.40% and 32.57%), number of leaves per plant (NLP) (32.30% and 35.36%), diameter of fruit (DOF) (29.04% and 31.96%), and number of flowers per truss (FPT) (23.46% and 33.07%). Moderate GCV and PCV estimates (ranging from 10–20%) were not observed in this study, but low (<10%) GCV and PCV estimates were noted for days to fifty percent flowering (DFF) (7.96% and 8.23%) and harvest sample date (HSD) (4.85% and 5.18%).

Broad-sense heritability estimates varied from 25.74% for the number of branches per plant to an impressive 99.99% for fruit yield in kilograms per hectare. Moderate heritability values (31–60%) were observed for traits such as FPT (50.34%), TNP (46.81%), WOF (45.21%), and NFT (41.86%). Lower heritability (<30%) was recorded for NBP at just 25.74%. In addition, genetic advance over mean (GAM) estimates reflected predominantly moderate or low percentages. Moderate GAM values were found for TNP (11.42%) and NFT (10.32%), whereas other traits ranged from 0.02% (fruit yield in kg/ha) to 9.78% for NBP, as detailed in Table 8.

Table 8: Estimation of Genetic Parameters for Different Quantitative Traits in Ten Genotypes of Tomato

Traits	δ^2g	δ^2p	GCV (%)	PCV (%)	H^2 (%)	GA	GAM (%)
PH	316.33	321.50	42.12	42.46	98.39	0.86	2.04
NLP	20.44	24.50	32.30	35.36	83.45	0.61	4.34
NBP	1.47	5.71	33.67	66.37	25.74	0.35	9.78
DFF	80.00	85.57	7.96	8.23	93.50	0.16	0.14
FPT	2.33	4.62	23.46	33.07	50.34	0.34	5.28
TNP	2.62	5.60	36.21	52.92	46.81	0.51	11.42
HSD	33.78	38.51	4.85	5.18	87.73	0.09	0.08
NFT	3.54	8.47	38.18	59.02	41.86	0.51	10.32
WOF	21.84	48.30	44.93	66.83	45.21	0.62	5.98
DOF	11.16	13.51	29.04	31.96	82.58	0.54	4.73
TNF	119.18	122.04	49.33	49.92	97.66	1.00	4.54
FYP(g)	18860.73	18863.72	60.78	60.79	99.98	1.25	0.55
FY(kg/ha)	14553649.00	14553652.00	60.78	60.78	99.99	1.25	0.02
NSF	282.38	285.45	32.40	32.57	98.93	0.66	1.28

Note**: **PH** =Plant height in (cm); **NLP** = Number of leaf per plant; **NBP** = Number of branch per plant; **DFF** =Day fifty percent (50%) flowering; **FPT**=* Number of flowers per truss; ***TNP = Truss number per plant, ***HSD*** = Harvest sample date; NFT =number of fruits per truss; WOF = weight of fruit; DOF = Diameter of fruit; TNF = total number of fruit per plant; FYP (g) = fruit yield per plant; FY (kg/ha) = fruit yield in kilogram per hectare; NSF = number of fruit per fruit.

Discussion

One of the primary goals of any breeding programme is to develop high-yielding, well-adapted, and high-quality plant varieties for release to farmers. Achieving this goal necessitates the availability of sufficient genetic variability among genotypes, providing a pool from which desired traits can be selected for further improvement. Studying growth parameters is, therefore, essential to evaluate the environmental adaptability of introduced tomato genotypes. The present study aimed to assess the performance of ten tomato genotypes in terms of their growth characteristics, yield, and yield-related components. The study revealed significant differences among tomato genotypes in colour of corolla (COC), shape of fruit (SOF), colour of fruit, plant growth habit either determinant or non-determinant, plant height (PH) and days to maturity. These differences are likely due to variations in the genetic makeup of the genotypes as well as environmental factors (Athinodorou, et al., 2021). This finding aligns with previous studies (Osekita and Ademiluyi, 2014; Jalloh et al., 2017; Renna, et al., 2019,), which reported that different genotypes may exhibit varying performance even under identical environmental conditions. Furthermore, differences in climatic conditions, such as soil nutrient status during the experimental period, may have contributed to the observed variability in genotype performance. Genetic constitution also plays a pivotal role in growth traits like plant height, as supported by research conducted by Sajjan et al. (2002) and Jalloh et al. (2017).

Similarly, Iken and Anusa (2004) emphasised selecting suitable crop varieties for specific agro-ecological zones for optimal performance. Among critical traits in tomato production is the number of days to flowering. This trait signifies the transition to the reproductive stage and serves as an indicator of early maturity. Variations among genotypes in this trait are likely due to genetic differences that exert a strong influence on plant development and growth.

Yield and Yield-Related Components of Ten Tomato Genotypes

Yield and its related components are complex yet fundamental traits in cultivating tomatoes, particularly from a production perspective. For plant breeders, improving yield is often a central focus in selection programs. The variability observed among the tested genotypes in parameters such as the number of fruits per truss, fruits per plant, and fruit yield per plant can largely be attributed to genetic differences. The ability of some genotypes to produce and retain a higher number of flowers capable of developing into fruits was likely a key factor. Conversely, genotypes with lower fruit set per plant may have suffered from flower loss or failure of flower development into fruits, as similarly noted by Jalloh et al. (2017). In addition to genetic factors, variation in traits such as the number of fruits per truss, fruit weight, fruit diameter, total number of fruits per plant, and fruit yield per plant (grams) may have been influenced by environmental conditions. These findings align with Jalloh et al. (2017), who reported significant variability in numerous traits among tomato genotypes.

Genetic Advance

Broad-sense heritability is a useful indicator for determining the relative contributions of genetic and environmental factors within a given germplasm population. Another critical measure in plant breeding is genetic advance as a percentage of the mean (GAM %), which evaluates the effectiveness of selection methods to improve desirable traits (Pooja et al., 2022). High GAM% combined with high heritability suggests a greater potential for achieving significant genetic progress through selection (Eppakayala et al., 2021). In this study, moderate GAM% was observed for two traits: truss number per plant (11.42%) and the number of fruits per truss (10.32%). The combined insight from heritability and GAM% highlights a strong potential for successful selection. It also provides a more comprehensive framework for predicting breeding outcomes, thereby aiding in pinpointing promising genotypes (Mahebub et al., 2021; Sandeep et al., 2025). In cases where genetic variability is limited, hybridisation may be necessary to broaden genetic diversity and enhance selection efficiency (Behera et al., 2020). Notably, genetic gain as a percentage of mean values ranged from 0.02% to 11.42%.

Conclusion

This study highlights the genetic diversity among the ten tomato genotypes evaluated for various traits. Notably, accession NGB05076 demonstrated outstanding performance, yielding the highest fruit output per plant and achieving the maximum yield per hectare (13,800kg/ha).Its superior traits establish it as a strong candidate for commercial production of high-quality tomatoes. Furthermore, NGB05076 can be effectively crossed with accession NGB00715, which exhibited the highest number of fruits per truss. The study found strong positive correlations between the number of fruits per truss, total number of fruits per plant, fruit yield per plant, and yield per hectare, suggesting that enhancing one trait will likely lead to improvements in the others, subsequently boosting the productivity of these genotypes. High estimates of broad-sense heritability for all evaluated traits suggest that genetic fact play a significant role in determining these characteristics, providing a reliable basis for selecting suitable parental lines in future breeding programs. The substantial genetic diversity observed in the ten tomato accessions, as corroborated by the dendrogram analysis, offers further evidence of their potential utility in crop improvement.

Contribution to Knowledge

The presence of genetic diversity in cultivated tomatoes using morpho-agronomic traits and yield attributes has been established. Comprehensive information of this kind is currently lacking in Nigerian tomatoes.

It has been generally established in this study that number of truss per plant had highest direct effect on fruit yield in tomatoes, these traits should be emphasized when selecting for fruit yield in tomatoes.

It has also been established and indicated that desirable improvement in fruits yield can easily be achieved on implementation of effective selection scheme for tomatoes fruits.

REFERENCES

Abdul, I.M., Yerima, A.K., & Suleiman, B. (2020). Review of the problems of tomato value chain in Nigeria: Remedial Option. *International Journal of Agriculture, Forestry and Fisheries,* 8(3): 90-95.

Arshad iqbal, Iftikhar, H. K., Syed, M. A. S., & Muhammad, S. K. (2017). Estimation of heritability, genetic advance and correlation for morphological traits in Spring Wheat. *Sharhad Journal of Agriculture Peshawar, Pakistan*, 33(4) 674-679.

Athinodorou, F., Foukas, P., Tsaniklidis, G., Kotsiras, A., Chrysargyris, A., Delis, C., Kyratzis, A. C., Tzortzakis, N., Nikoloudakis, N. (2021). Morphological Diversity, Genetic Characterization, and Phytochemical Assessment of the Cypriot Tomato Germplasm. *Plants* 10, 1698. 1-24. https://doi.org/10.3390/plants10081698.

Behera, M., Jagadev, P., Das, S., Pradhan, K., & Sahoo, B. (2020). Assessment of genetic variability, heritability and genetic advance in Tomato. *Int. J. Chem. Stud*. 8, 481– 483.

Bhuwan, J., & Swikriti, S. (2024). Evaluation of tomato varieties for yield attributes in Godawari, Lalitpur. *Agriculture Extension in Developing Countries*, 2(2)*: 81-84*.

Boryana D., & Darina V. (2014). Heritability, Variance Components and Genetic Advance of Yield and Some Yield Related Traits in Barley Doubled Haploid Lineswww.turkjans.com *Turkish Journal of Agricultural and Natural Sciences Special* Issue: 1, 2014.

Collins, E. J., Bowyer, C., Tsouza, A., & Chopra, M. (2022). Tomatoes: An extensive review of the associated health impacts of tomatoes and factors that can affect their cultivation. *Biology*, 11: 239. https://doi.org/10.3390/biology11020239.

Dragov, R., Uhr, Z., & Dimitrov, E. (2022). Genetic variability, heritability and genetic advance for important quantitative traits of durum wheat: Part I. *Bulg. J. Agric. Sci.*, 28 (4), 691–698

EC, (2021). European Union Agricultural outlook for markets, income and environment, 2021-2031. European Commission, DG Agriculture and Rural Development, Brussels. p 83 https://europa.eu/european-union/contact_en

Eppakayala, K., Pidigam, S., Natarajan, S., Amarapalli, G., & Komatireddy, R. R. (2021). Study of genetic variability, heritability and genetic advance for yield and yield parameters in tomato (*Solanum lycopersicum* L.) germplasm. *J. Pharm. Phytochem.* 10, 768–771.

Fatih, E. A. H., Gamal, E. K., Amin, A. I., & Sir A. (2017). Assessment of genotypic and phenotypic variability, heritability and genetic advance for seed yield and related agronomic traits in Faba bean (*Vicia faba* L.) genotypes in the Northern State, Sudan. *Net Journal Agricultural Science* 5(2), 48 – 52.

Frankel, O. H, Brown, A. H. D., & Burdon, J. J. (1995). The Conservation of Plant Biodiversity, UK, Cambridge University Press, Cambridge, 299.

Haitham, E. M., Z., & Khlode, S. A. R. (2022). Estimates of genotypic and phenotypic variance, heritability, and genetic advance of horticultural traits in developed crosses of cowpea (Vigna unguiculata (L.) Walp. Front plant Sci. 13:987985. https://doi.org/dio.103389/fpls.2022,987985.

Haydar, A., Mandal, M. A., Ahmed, M. B., Hannan, M. M., Karim, R., Razvy, M. A., Roy, U. K., & Salahin, M. (2007). Studies on genetic variability and interrelationship among the different traits in tomato. *Middle-East J. Sci. Res.*, 2(3-4): 139-142.

Husen, Y. S., Temsgen, B. & Mastewal, G. (2022). Evaluating performance of recently released tomato (*Lycopersicon esculentum* Mill.) varieties at highland areas of West Hararghe, Ethiopia. *International Journal of Research in Agronomy* 5(2): 18-24 DOI: https://doi.org/10.33545/2618060X.2022.v5.i2a.105

Iken, J. E., & Anusa, A. (2004). Maize Research and Production in Nigeria. *African Journal of Bio Technology*. 3(6), 302-307.

International Plant Genetic Resources Institute (IPGRI) (1996). Descriptors for Tomato (*Lycopersicon* spp.). IPGRI, Rome, Italy. 1- 48.

Jalloh, S. O., Kanneh, S. M. & Bah Alieu M. (2017). Evaluation of Tomato (Solanum Lycopersicum L.) genotypes for adaptation and yield components on the Njala Upland Soil Southern Sierra Leone. *International Journal of Agriculture Innovations and Research.* 6(2), 2319-1473.

Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybean. *Agron. J.*, 47, 314–318.

Kharat1, K. P., Chandanshive, A. V., Gaikwad, S. D., Handal, B. B., Patil, B. T., & Ranpise, S. A. (2022) .Evaluation of tomato (*Solanum lycopersicum* L.) genotypes for qualitative and quantitative characteristics. *J. Agric. Res. Technol.*, 47(3), 281-289. https://doi.org/10.56228/JART.2022.47307.

Mahebub, P. A., Babu, M. R., & Sasikala, K. (2021). Studies on genetic variability in tomato (*Solanum lycopersicum* L.) for growth, yield and quality traits. *Pharma Innov. J.*10 (10), 1741–1743.

Meena, B. L., Das, S. P., Meena, S. K., Kumari, R., Devi, A. G., & Devi, H. L. (2017). Assessment of GCV, PCV, heritability and genetic advance for yield and its components in field pea (*Pisum sativum* L.). *Int. J. Curr. Microbiol. App. Sci.*, 6(5), 1025-1033. doi: https://doi.org/10.20546/ijcmas.2017.605.111.

Osekita, O. S., & Ademiluyi, A. T. (2014). Genetic advance, heritability and character association of component of yield in some genotypes of tomato *Lycopersicon esculentum* (Mill.) Wettsd. Acad. *J. Biotechnol*. 2(1): 006-010.

Oluwagbenga, D., Gideon, A., Christopher M. A. &Abiodun, G. (2016). Comparison of growth, yield and fruit quality performance of tomatoes varieties under controlled environment condition of the Southern Guinea Savannah. *American – Eurasian J. Agric. & Environ. Sci*, 16 (10): 1662 – 1665. https://doi.org/doi:10.5829/idosi.aejaes.2016.1662.1665.

Pooja, H., Gasti, V. D., Bhavidoddi, A., Yashavantakumar, H., Prashantha, A., & Srikantaprasad, D. (2022). Genetic variability, heritability and genetic advance in determinate types of tomato (*Solanum lycopersicum* L.). *Pharm. Innov. J.* 11, 222–225.

Renna, M., D'Imperio, M., Gonnella, M., Durante, M., Parente, A., Mita, G., Santamaria, P., Serio, F., (2019). Morphological and chemical profile of three tomato (Solanum lycopersicum L.) landraces of a semi-arid mediterranean environment. *Plants*, 8, 273.

Rosmaina, S., Hasrol, F.Y., & Juliyanti, Z., (2016). Estimation of variability, heritability and genetic advance among local chilli pepper Genotypes cultivated in peat lands. *Bulgarian Journal of Agricultural Science,* 22(3), 431-436. Agricultural academy.

Sajjan, A. S., Shekhargounda, M., & Badanur, O. (2002). Influence of data of sowing, spacing and levels of nitrogen on yield attributes and seed yield of Okro. Ikamataka *Journal of Agricultural Science* 15(2), 267-274.

Sandeep Y., Ram, C. N., Aastik, J. H. A., Riya, Y., Lokesh, Y., Ankit, Y., & Vinay, K. P. (2025). Study of genetic variability, heritability and genetic advance for inter-traits relationship for yield and quality traits in cherry tomato (*Solanum lycopersicum* L. var. cerasiforme). http://www.plantarchives.org 25: 1705-1709doiurl:https://doi.org/10.51470/plantarchives.2025.v25.supplement-2.215

Sivaprasad, K. (2008). Genetic variability and correlation studies in biparental mating population of tomato (*Solanum lycopersicon (Mill*.) Wettsd). dissertation. University of Agricultural Sciences, Dharwad.

Temesgen, B., Husen, Y. S., & Mastewal, G. (2022). Evaluating performance of recently released tomato (*Lycopersicon esculentum* Mill) varieties at Highland Areas of West Hararghe, Ethiopia. *American-Eurasian J. Agric. & Environ. Sci.*, 22(3), 154-162, https://doi.org/doi:10.5829/idosi.aejaes.2022.154.162.

Tomato Genetics Resource Centre (TGRC). http://tgrc.ucdavis.edu/indexcfm.

Veershetty, V. (2004). Studies on variability, character association and genetic diversity in tomato (*Lycopersicon esculentum Mill*). *Unpublished M.Sc. (Agric.) Thesis,* Uni. Agric. Sci.,Dharwad (India).