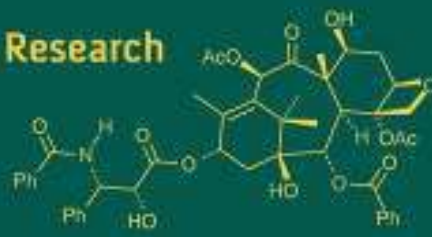
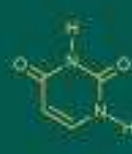
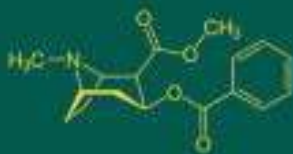


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Correlation analysis of yield and yield-contributing traits in F₃ and F₄ generations of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.)

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Abstract

The present investigation analyzed the correlation between yield and yield-contributing traits in the F₃ and F₄ generations of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). The study was conducted at the Instructional-cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani, during the kharif season of 2022-23. The experiment included five genotypes, which were sown in a Randomized Block Design (RBD) with two replications. Correlation coefficient analysis showed that fruit yield per hectare (q) was significantly and positively correlated with the number of fruits per vine at both phenotypic and genotypic levels in the F₃ and F₄ generations. Additionally, it was positively and significantly correlated with fruit yield per vine (kg) at the phenotypic level in the F₃ generation. In the F₄ generation, it was positively and significantly correlated with the days required for the first harvest and the days required for the first female flower but negatively and significantly correlated with vine length (cm) at the phenotypic level.

Keywords: GCV, PCV, genetic variability, heritability, genetic advance

Introduction

Bottle gourd (*Lagenaria siceraria* (Mol.) Standl.), a significant member of the Cucurbitaceae family, possesses a diploid chromosome configuration of 2n=22. This species predominantly exhibits a cross-pollinated reproductive strategy, characterized by its monoecious and andromonoecious floral architecture. From a nutritional standpoint, bottle gourd offers a modest yet valuable array of essential vitamins and minerals. Its fruits known for their culinary versatility are employed in the preparation of a wide variety of dishes including sweets, pickles (particularly in mountainous regions), kofta, petha, halwa, kopoor kand, paratha, rayata, kheer, pedha and burfi. Nutritional analyses indicate that the fruits contain vitamin C (11 mg), thiamine (0.044 mg), riboflavin (0.023 mg), niacin (0.33 mg) along with mineral matter (0.5%), carbohydrates (2.9%), fats (0.5%), proteins (0.2%) and a moisture content of approximately 96.3%. Furthermore, various parts of the plant are imbued with a plethora of medicinal properties. The dried, hard shells of the fruit are ingeniously crafted into an array of functional items such as bowls, containers, floats for fishing nets, pipes and musical instruments. Additionally, both the seeds and the extracted seed oil are consumable. In the domain of plant breeding, a nuanced understanding of the inheritance patterns of heritable traits is pivotal for enhancing crop characteristics. Key determinants of crop improvement encompass genetic advancement, heritability and variability, which collectively inform breeders strategies to optimize yield and resilience in bottle gourd cultivation. This integrative approach not only fosters enhanced agricultural productivity but also ensures sustainability in the cultivation of this invaluable crop.

Materials and Methods

Five bottle gourd genotypes along with seeds of F₃ progenies of Cross LTR-1 x LTR-5 (C1: 1 x 5) provided from the previous M.Sc. research work carried out at Instructional-cum-Research Farm, Department of Horticulture, College of Agriculture, Latur were grown in a Randomized Block Design in kharif 2022 and selfed to obtained F₄ generation. The F₃ and

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F₄ generation of cross LTR-2 x LTR-4 were evaluated during summer 2023. The experimental plot size was 2 m x 10 m and seed sown at 2 m x 1 m spacing between rows and plants Randomized Block Design (RBD) for each cross. The recommended dose of fertilizer for bottle gourd is 20 t FYM + 100:50:50 kg NPK per ha was applied. The dose of FYM 20 tons per hectare and the 50 per cent recommended dose of nitrogen (50 kg/ha), full dose of phosphorus (50 kg/ha) and potassium (50 kg/ha) were incorporated in the soil at the time of preparation of field. The remaining dose of 50 per cent of nitrogen (50 kg/ha) was applied one month after sowing. The plant protection measures were applied as per recommendation. The gap filling and thinning was done. The vines were trailed on bower to give support.

Observations were made in F₄ generation on ten randomly chosen plants from each genotype, and the mean value was used for statistical analysis for eleven characters length of vine (cm), number of branches per vine, number of nodes per plant, node at which first female flower occur, days required for occurrence of first female flower, number of female flowers per vine, days required for first harvest, number of fruits per vine, fruit yield per vine (kg), fruit yield per plot (kg) and fruit yield per hectare (q).

The formula of (Panse and Sukhatme 1985) [7] will be used to calculate variation for all of the features under consideration. The mean squares from the variance table will be used to determine genotypic and phenotypic variances (Johnson *et al.* 1955) [3]. The significance of correlation coefficients were compared with statistical table value of correlation coefficient at 1 per cent and 5 per cent level of significance.

Estimation of correlation coefficient

In order to study the inter relationship between different characters, the genotypic and phenotypic correlation coefficients (r) were calculated by using the following formula

$$r_g = \frac{\text{Co variance XY (G)}}{\sqrt{\text{Variance X (G) x Variance Y (G)}}}$$

$$r_{ph} = \frac{\text{Co - variance XY (PH)}}{\sqrt{\text{Variance X (PH) x Variance Y (PH)}}}$$

Where,

rg = Genotypic correlation coefficient between character X and Y

rph = Phenotypic correlation coefficient between character X and Y

X, Y = Two variables under consideration

Results and Discussion

The correlation between yield and yield-contributing traits in the F₃ generation

Fruit yield per vine shows positive and non-significant correlation with fruit yield per hectare at genotypic and phenotypic level. It shows positive and significant correlation with fruit yield per hectare at phenotypic level. The vine length shows positive and significant correlation with number of branches per vine and number of nodes per plant at both genotypic and phenotypic level and with number of fruits per vine at phenotypic level. Similar result was found by Kumari *et al.* (2021) [5] and Dubey *et al.*

(2022) [1]. The Number of branches per vine shows positive and significant correlation with number of nodes per plant and number of fruits per vine at both genotypic and phenotypic level. Similar result was found by Kumari *et al.* (2021) [5] in bottle gourd. Number of nodes per plant shows positive and significant correlation with number of fruits per vine at both genotypic and phenotypic level. It shows positive and significant correlation with days required for occurrence of first female flower and days required for first harvest at phenotypic level. Similar result was found by Dubey *et al.* (2022) [1] in bottle gourd.

The node at which first female flower occur shows negative and non-significant correlation with days required for occurrence of first female flower, number of female flowers per vine, days required for first harvest, number of fruits per vine and fruit yield per hectare at genotypic and phenotypic level. The result is in confirmation with finding of Singh *et al.* (2015) [9] in bitter gourd. The days required for occurrence of first female flower shows positive and significant correlation with days required for first harvest at genotypic and phenotypic level. The result is in confirmation with finding of Rani *et al.* (2014) [8], Khan *et al.* (2015) [4], Mahesh *et al.* (2014) [6] in bitter gourd and Dubey *et al.* (2022) [1] in bottle gourd.

The number of female flowers per vine shows positive and significant correlation with number of fruits per vine at both genotypic and phenotypic level. The result is in confirmation with finding of Khan *et al.* (2015) [4], Rani *et al.* (2014) [8] in bitter gourd and Thakur *et al.* (2017) [10].

Days required for first harvest shows negative and non-significant correlation with fruit yield per hectare at both genotypic and phenotypic level. The above results were in arrangement with those of Gupta *et al.* (2015) [2] in bitter gourd and Kumari *et al.* (2021) [5] in bottle gourd. The number of fruits per vine shows positive and significant correlation for number of branches per vine, number of nodes per vine and number of female flowers per vine in F₃ generation at both the level. The above results were in arrangement with those of Gupta *et al.* (2015) [2] in bitter gourd. Data presented in Table 1 and Table 2. Fifteen F₃ progenies were studied for association of relationship between yield and yield contributing characters in F₃ generations and are presented in Table 1 and Table 2.

The correlation between yield and yield-contributing traits in the F₄ generation

The length of vine shows positive and significant correlation with number of branches per vine, number of nodes per plant and number of fruits per vine at both genotypic and phenotypic level. It shows positive and significant correlation with number of female flowers per vine at phenotypic level. Similar result finding by Yadagiri *et al.* (2017) [11] in bitter gourd. The number of branches per vine shows positive and significant correlation with number of nodes per plant and number of fruits per vine at both genotypic and phenotypic level. It shows positive and significant correlation with number of female flowers per vine at phenotypic level. The result is in confirmation with finding Kumari *et al.* (2021) [5] and Dubey *et al.* (2022) [1] in bottle gourd.

Number of nodes per plant shows positive and significant correlation with number of fruits per vine at both genotypic and phenotypic level. It shows positive and significant correlation for number of female flowers per vine at

phenotypic level. The node at which first female flower occur shows negative and non-significant correlation with days required for occurrence of first female flower, days required for first harvest, number of fruits per vine, fruit yield per vine and fruit yield per hectare at genotypic and phenotypic level. The result is in confirmation with finding of Yadav and Kumar (2012) ^[12] in bottle gourd. The days required for occurrence of first female flower shows positive and significant correlation with days required for first harvest at genotypic and phenotypic level. It shows positive and significant correlation for fruit yield per vine and fruit yield per hectare at phenotypic level. The result is in confirmation with finding of Rani *et al.* (2014) ^[8] and Mahesh *et al.* (2014) ^[6] in bitter gourd and Dubey *et al.* (2022) ^[1] in bottle gourd.

The number of female flowers per vine shows positive and significant correlation with number of fruits per vine and fruit yield per plot at phenotypic level. The result is in

confirmation with finding of Rani *et al.* (2014) ^[8] in bitter gourd and Thakur *et al.* (2017) ^[10] in bottle gourd. Days required for first harvest shows positive and non-significant correlation with number of fruits per vine, fruit yield per vine and fruit yield per hectare at both genotypic and phenotypic level. The above results were in agreement with those of Gupta *et al.* (2015) ^[2] in bitter gourd. The number of fruits per vine shows positive and significant correlation for number of branches per vine, number of nodes per vine and number of female flowers per vine in F₄ generation at both the level. The above results were in arrangement with those of Gupta *et al.* (2015) ^[2] in bitter gourd. Fruit yield per vine shows positive and non-significant correlation with fruit yield per hectare at genotypic and phenotypic level. Fifteen F₄ progenies were studied for association of relationship between yield and yield contributing characters F₄ generations and are presented in Table 3 and Table 4.

Table 1: Genotypic Correlation co-efficient for yield and yield contributing characters in F₃ generation of cross LTR-1 x LTR-5 (C1: 1 × 5)

Sr. No.	Character	Length of Vine (cm)	Number of branches per vine	Number of nodes per plant	Node at which first female flower occurs	Days required for first female flower	No. of female flowers per vine	Days required for first harvest	No. of fruits per vine	Fruit yield per vine (kg)	Fruit yield per hectare (q)
1.	Length of Vine (cm)	1.000									
2.	Number of branches per vine	0.9016**	1.000								
3.	Number of nodes per plant	0.8607**	0.8565**	1.000							
4.	Node at which first female flower occurs	-0.0861 NS	-0.101 NS	-0.3819 NS	1.000						
5.	Days required for first female flower	0.3462 NS	0.368 NS	0.5124 NS	-0.2776 NS	1.000					
6.	No. of female flowers per vine	0.1738 NS	0.3091 NS	0.1345 NS	-0.0364 NS	-0.3657 NS	1.000				
7.	Days required for first harvest	0.3462 NS	0.368 NS	0.5124 NS	-0.2776 NS	0.9520**	-0.3657 NS	1.000			
8.	No. of fruits per vine	0.4739 NS	0.6355*	0.6097 *	-0.1926 NS	0.0416 NS	0.6002*	0.0416 NS	1.000		
9.	Fruit yield per vine (kg)	0.5412 NS	-0.0857 NS	-0.0255 NS	-0.3697 NS	0.0854 NS	0.1777 NS	0.0854 NS	0.0218 *	1.000	
10.	Fruit yield per hectare (q)	-0.5596 NS	-0.4992 NS	-0.4098 NS	-0.3685 NS	-0.369 NS	-0.2017 NS	-0.269 NS	0.2153 *	0.5231 NS	1.000

*, **: Significance at 5% and 1% respectively

Table 2: Phenotypic Correlation co-efficient for yield and yield contributing characters in F₃ generation of cross LTR-1 x LTR-5 (C1: 1 × 5)

Sr. No.	Character	Length of Vine (cm)	Number of branches per vine	Number of nodes per plant	Node at which first female flower occurs	Days required for first female flower	No. of female flowers per vine	Days required for first harvest	No. of fruits per vine	Fruit yield per vine (kg)	Fruit yield per hectare (q)
1.	Length of Vine (cm)	1.000									
2.	Number of branches per vine	0.8965 **	1.000								
3.	Number of nodes per plant	0.8570 **	0.8465 **	1.000							
4.	Node at which first female flower occurs	-0.0756 NS	-0.091 NS	-0.3719 NS	1.000						
5.	Days required for first female flower	0.3362 NS	0.357 NS	0.5224 *	-0.2686 NS	1.000					
6.	No. of female flowers per vine	0.1648 NS	0.3079 NS	0.1355 NS	-0.0394 NS	-0.3297 NS	1.000				
7.	Days required for first harvest	0.3642 NS	0.386 NS	0.5324 *	-0.2586 NS	0.9462**	-0.3637 NS	1.000			
8.	No. of fruits per vine	0.4539 *	0.6535 **	0.6297 **	-0.1936 NS	0.0456 NS	0.6062 **	0.0446 NS	1.000		
9.	Fruit yield per vine (kg)	0.5112 NS	-0.0757 NS	-0.0285 NS	-0.3797 NS	0.0899 NS	0.1627 NS	0.0844 NS	0.0210 *	1.000	
10.	Fruit yield per hectare (q)	-0.5496 NS	-0.4961 NS	-0.3092 NS	-0.3707 NS	-0.389 NS	-0.2017 NS	-0.319 NS	0.1143 *	0.5261 **	1.000

*, **: Significance at 5% and 1% respectively

Table 3: Genotypic Correlation co-efficient for yield and yield contributing characters in F₄ generation of cross LTR-1 x LTR-5 (C1: 1 × 5)

Sr. No.	Character	Length of Vine (cm)	Number of branches per vine	Number of nodes per plant	Node at which first female flower occurs	Days required for first female flower	No. of female flowers per vine	Days required for first harvest	No. of fruits per vine	Fruit yield per vine (kg)	Fruit yield per hectare (q)
1.	Length of Vine (cm)	1.000									
2.	Number of branches per vine	0.866 **	1.000								
3.	Number of nodes per plant	0.9037 **	0.9044 **	1.000							
4.	Node at which first female flower occurs	0.0292 NS	-0.2255 NS	-0.1956 NS	1.000						
5.	Days required for first female flower	-0.3624 NS	-0.2265 NS	-0.2536 NS	-0.2102 NS	1.000					
6.	No. of female flowers per vine	0.4775 NS	0.4076 NS	0.5044 NS	0.0775 NS	-0.1556 NS	1.000				
7.	Days required for first harvest	-0.3624 NS	-0.2265 NS	-0.2536 NS	-0.2102 NS	0.09925**	-0.1556 NS	1.000			
8.	No. of fruits per vine	0.659 *	0.6259 *	0.8012 **	-0.3569 NS	0.1612 NS	0.43 NS	0.1612 NS	1.000		
9.	Fruit yield per vine (kg)	-0.0427 NS	0.1861 NS	-0.1255 NS	-0.1465 NS	0.4766 NS	-0.0129 NS	0.4766 NS	0.0012 *	1.000	
10.	Fruit yield per hectare (q)	-0.4827 NS	-0.308 NS	-0.1925 NS	-0.3737 NS	0.4963 NS	-0.2699 NS	0.4963 NS	0.0316 *	0.237 NS	1.000

*, **: Significance at 5% and 1% respectively

Table 4: Phenotypic Correlation co-efficient for yield and yield contributing characters in F₄ generation of cross LTR-1 x LTR-5 (C1:1 × 5)

Sr. No.	Character	Length of Vine (cm)	Number of branches per vine	Number of nodes per plant	Node at which first female flower occurs	Days required for first female flower	No. of female flowers per vine	Days required for first harvest	No. of fruits per vine	Fruit yield per vine (kg)	Fruit yield per hectare (q)
1.	Length of Vine (cm)	1.000									
2.	Number of branches per vine	0.856 **	1.000								
3.	Number of nodes per plant	0.9027 **	0.9020 **	1.000							
4.	Node at which first female flower occurs	0.0282 NS	-0.2145 NS	-0.1746 NS	1.000						
5.	Days required for first female flower	-0.3614 NS	-0.2155 NS	-0.2496 NS	-0.2092 NS	1.000					
6.	No. of female flowers per vine	0.4575 *	0.4016 *	0.4944 *	0.0675 NS	-0.1526 NS	1.000				
7.	Days required for first harvest	-0.3424 NS	-0.2105 NS	-0.2436 NS	-0.2062 NS	0.9910**	-0.1536 NS	1.000			
8.	No. of fruits per vine	0.639 **	0.6029 **	0.8002 **	-0.3469 NS	0.1592 NS	0.4124 *	0.1592 NS	1.000		
9.	Fruit yield per vine (kg)	-0.3427 NS	0.2861 NS	-0.1225 NS	-0.1445 NS	0.4696 *	-0.0109 NS	0.4736 *	0.0010 *	1.000	
10.	Fruit yield per hectare (q)	-0.4627 *	-0.308 NS	-0.1885 NS	-0.3797 NS	0.4962 *	-0.2704 NS	0.4912 *	0.2316 *	0.2069 NS	1.000

*, **: Significance at 5% and 1% respectively

Conclusion

The analysis of the correlation coefficient indicates that there is a significant positive relationship between fruit yield in quintals per hectare and the number of fruits per vine in both the F₃ and F₄ generations. This suggests that as the number of fruits per vine increases, the overall fruit yield also tends to increase both at the phenotypic and genotypic levels. Therefore, selecting for higher fruit count per vine could effectively enhance fruit yield in future breeding programs. This finding underscores the importance of these traits in improving crop productivity.

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