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Estimates of genetic variability, correlation and path analysis for yield and yield contributing traits in bell pepper

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ABSTRACT

The objective of the current investigation was to explain the genotypic variability associated to distinct characteristics across 26 different bell pepper genotypes. The findings revealed a statistically significant variation among the assessed genotypes, signifying their suitability for subsequent hybridization breeding programmes within bell pepper breeding programs. For characteristics such as fruit yield per plant (27.35, 27.10) and number of seeds per fruit (35.00, 34.87), the phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were high. Higher heritability was observed in other characteristics such as days to first picking (83.29), plant height (97.50), fruit length (97.90) and fruit breadth (97.00), number of fruits per plant (91.30), number of lobes per fruit (83.80), pericarp thickness (88.20), fruit weight (97.00), number of seeds per fruit (99.30), fruit yield per plant (98.20), and ascorbic acid (97.50). UHF CAP-13 and UHF CAP-1 were highest yield contributing genotypes primarily on account of either a greater number of fruit and increased fruit length, breadth and weigh and longer harvest durations. Among the above parameters number of fruits per plant, fruit length, fruit breadth and fruit weight had proved highly significant positive correlations with the fruit yield per plant.

Key words: *Capsicum annuum* L., variability, heritability, correlation coefficient, path coefficient, yield.

INTRODUCTION

The bell pepper (*Capsicum annuum* L., Solanaceae) is a vegetable of considerable demand in India, the Middle East, USA, Europe and Southeast Asian nations. Widely recognized for their remarkable versatility and extensive applications across various industries, culinary practices, and decorative uses, peppers hold a prominent position as one of the most important vegetables globally (Silvar and García-González, 13). Progressive farmers, consumers and international market traders have shown keen interest in this vegetable due to its abundant nutritional content and expanding export potential. With rich concentrations of vitamins, A (370 IU/100 g) and C (99.5 mg/100 g) (USDA, 16), this crop exhibits significant therapeutic potential, contributing to cholesterol reduction, improved blood circulation, strengthened immunity, and prevention of arthritis and also protect against cancer, cataracts (Sood *et al.,* 15; Dlamini *et al.,* 6). The imperative to foster global food security intensifies with the rapid expansion of the global population and abrupt climatic changes. The lack of high-yielding cultivars and genetic uniformity stands as the primary reason for low yield. The success of crop improvement programs is aided by the availability of genetically diverse germplasm within a crop species' gene pool. Nevertheless, the full utilization of genetic diversity in a species are barely fully tapped by breeder's constraints arising from insufficient information regarding the extent of diversity among breeding materials.

The systematic breeding programme involved several steps such as collecting genetic material, assessing gene differences, creating genetic variety, choosing the best options and finding the best types for commercial use (Ferdousi *et al.,* 7). In the development of a robust vegetable breeding programme, a thorough understanding of the magnitude and direction of the interrelationships among economically significant quantitative traits is imperative (Arti *et al.,* 3). The most significant prerequisite for planning and executing a successful breeding program is the availability of genetically diverse material with high yield potential and superior quality attributes. Additionally, to enhance production quality, it is essential to explore the links between yield and quality traits. Taking these considerations into account, a research endeavour on genetic variability and trait associations in bell pepper was embarked upon.

MATERIALS AND METHODS

This study was undertaken at the Research Farm of the Department of Vegetable Science, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh), India, during the Kharif season of the year 2021. The soil at the experimental site ranged from gravelly loam to gravelly clay loam, with a pH range of 6.85-7.04. 26 genotypes were

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collected from different source; nineteen (UHF CAP-1, UHF CAP-2, UHF CAP-3, UHF CAP-4, UHF CAP-13, UHF CAP-20, UHF CAP-21, UHF CAP-22, UHF CAP-23, UHF CAP-24, UHF CAP-25, UHF CAP-26, UHF CAP-27, UHF CAP-29, UHF CAP-30, UHF CAP-31, UHF CAP-32, UHF CAP-33 and Solan Bharpur) from Dr YSPUH&F, California Wonder and Yolo Wonder from ICAR - IARI, RS, Katrain and remaining 5 genotypes (IIHR-35, IIHR-36, IIHR-37, IIHR-38 and IIHR-39) form IIHR, Bangalore, Hesaraghatta. Seeds were sown under poly-tunnels during the beginning of February, 2021. After 45-60 days, healthy & stocky seedlings of the material were transplanted in 1st week of April 2021 and were transferred into a 3 × 1.8 m^2 plot with a spacing of 60 cm × 45 cm. The experimentation followed a Randomized Complete Block Design with three replications.

In order to mitigate the impact of border effects, measurements of various traits were carried out on ten randomly chosen plants from the middle rows of the plot. Data were systematically recorded for different traits including Days to 50% flowering (DTF), days to first picking (DFP), harvest duration (HD), plant spread (PS), plant height (PH), number of fruits per plant (NFP), number of lobes per fruit (NLF), fruit length (FL), fruit breadth (FB), fruit weight (FW), pericarp thickness (PT), number of seeds per fruit (NSF), and ascorbic acid (AA).Ascorbic acid content of fruits was determined as per 2, 6-dichlorophenol-indophenol visual titration method as described by Ranganna (11). Ten grams of macerated sample was blended with 3 per cent metaphosphoric acid and volume was finally made up to 100 ml. Out of this, 10 ml solution was taken and titrated against 2, 6- dichlorophenol-indophenol dye till the appearance of rose-pink color. The results thus, obtained were expressed in terms of ascorbic acid per 100 g of sample.

The ascorbic acid (mg/100 g) was calculated by using the following formula:

$$\text{Ascorbic acid (mg/100 g)} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up}}{\text{Aliquot taken for estimation} \times \text{weight of the sample taken for estimation}} \times 100$$

Here, Titre = Volume of dye used to titrate the aliquot of extract of a given sample

The data obtained for the examined traits were subjected to analysis using R software (Version 4.1.2). Genotypic and phenotypic variances were computed using the methodology outlined by Johnson *et al.* (8). Furthermore, genotypic and phenotypic coefficients of variation were calculated following the approach described by Burton (4). The correlation coefficient was estimated using the formula proposed by Singh and Chaudhury (14), and path analysis was performed based on the methodology outlined by Dewey and Lu (5).

RESULTS AND DISCUSSION

The results demonstrated considerable genetic diversity, as indicated by the significant variation among bell pepper genotypes for majority of the evaluated traits (Table 1). Genotypic and phenotypic

Table 1. Estimates of genetic parameters for twenty-six bell pepper genotypes.

Traits	σ2 g	σ2 p	PCV (%)	GCV (%)	h^2b (%)	GA
DTF (days)	7.98	10.59	6.72	5.83	75.40	10.44
DFP (days)	19.75	23.75	6.68	6.09	83.20	11.44
PH (cm)	73.02	74.91	17.02	16.81	97.50	34.18
HD (days)	20.76	26.15	7.00	6.23	79.40	11.44
PS (cm)	8.21	10.39	8.35	7.42	79.10	13.60
NFP	8.36	9.15	25.05	23.94	91.30	47.12
NLF	0.30	0.36	17.38	15.91	83.80	29.99
FL (cm)	1.09	1.12	15.77	15.60	97.90	31.80
FB (cm)	0.75	0.77	14.01	13.80	97.00	27.99
FW (g)	194.99	201.04	19.12	18.83	97.00	38.20
PT (mm)	0.28	0.32	15.32	14.39	88.20	27.83
FYP (g)	71586.79	72899.70	27.35	27.10	98.20	55.32
NSF	7210.16	7262.32	35.00	34.87	99.30	71.58
AA (mg/100 g)	125.50	128.77	7.54	7.45	97.50	15.14

σ2 g: genotypic variance, σ2 p: phenotypic variance, h2 b: heritability, GCV: genotypic coefficient of variation, PCV: phenotypic coefficient of variation and ECV: environmental coefficient of variation, and GA: genetic advance, DTF: Days to 50 % flowering, DFP: days to first picking, PH: plant height, HD: harvest duration, PS: plant spread, NFP: number of fruits per plant, NLF: number of lobes per fruit, FL: fruit length, FB: fruit breadth, FW: fruit weight, PT: pericarp thickness, FYP: fruit yield per plant, NSF: number of seeds per fruit, AA: ascorbic acid

Table 2. Per se performance for characters of twenty-six bell pepper genotypes

Geno types	DTF	DFP	PH	HD	PS	NFP	NLF	FL	FB	FW	PT	FYP	NSF	AA
UHF CAP-1	43.00^{i}	64.33^{i}	50.50^{fg}	65.33^{ijk}	37.60^{ghijk}	16.50^{b}	3.90^{ab}	7.35^{e}	7.87^{b}	92.77^{a}	3.50^{fg}	1429.73^{b}	236.70^{fg}	146.98^{hi}
UHF CAP-2	46.33^{fgh}	64.67^{i}	43.13^{j}	66.00^{ijk}	36.13^{jkl}	12.22^{def}	3.87^{abc}	8.19^{b}	7.16^{d}	69.47^{f}	3.90^{bcde}	862.47^{mn}	290.60^{d}	143.51^{jkl}
UHF CAP-3	44.33^{ghi}	72.33^{efg}	53.46^{de}	73.00^{defgh}	42.10^{abcd}	12.13^{defg}	4.03^{a}	6.63^{fg}	6.33^{f}	76.13^{d}	2.97^{hi}	943.93^{jk}	330.65^{c}	141.39^{l}
UHF CAP-4	46.33^{fgh}	74.67^{cdef}	52.11^{def}	74.67^{cdef}	39.03^{efghi}	10.50^{gh}	3.57^{abcd}	5.83^{jkl}	7.48^{c}	90.33^{ab}	4.27^{b}	934.36^{jkl}	209.50^{h}	159.14^{cd}
UHF CAP-13	47.00^{defg}	78.33^{abc}	51.41^{efg}	78.33^{abc}	41.13^{bcdef}	18.33^{a}	3.77^{abc}	8.62^{a}	6.83^{e}	89.67^{ab}	3.87^{cde}	1582.97^{a}	348.70^{b}	133.59^{m}
UHF CAP-20	51.67^{b}	74.67^{cdef}	64.25^{b}	75.67^{bcde}	42.17^{abc}	12.25^{def}	3,63^{abcd}	5.94^{jk}	5.56^{hij}	50.47^{i}	3.20^{gh}	626.03^{pq}	362.07^{a}	142.53^{kl}
UHF CAP-21	47.67^{cdef}	79.67^{a}	46.41^{i}	79.67^{ab}	39.83^{cdefg}	11.47^{efg}	3.77^{abc}	5.75^{kl}	5.12^{k}	47.60^{j}	3.57^{ef}	565.98^{q}	330.30^{c}	159.66^{cd}
UHF CAP-22	50.00^{bcd}	73.67^{def}	47.30^{hi}	75.00 ^{cdef}	36.45 ^{ijkl}	18.17^{a}	3.57^{abcd}	6.77^{f}	5.42^{ij}	70.20^{f}	3.87^{cde}	1263.60^{de}	323.90^{c}	158.45^{cd}
UHF CAP-23	49.67^{bcde}	72.67^{defg}	47.39^{hi}	72.67 ^{defgh}	39.85 ^{cdefg}	12.27^{def}	3.50^{bcd}	5.86^{jkl}	5.85^{g}	71.73^{ef}	3.67^{ef}	969.47^{ij}	352.93^{ab}	164.63^{b}
UHF CAP-24	46.67^{efg}	75.00^{cdef}	61.86^{c}	75.00 ^{cdef}	38.65 ^{fghij}	11.30^{efg}	3.70^{abc}	6.40^{gh}	5.39^{ij}	61.20^{gh}	4.17^{bc}	681.71^{op}	117.90^{l}	156.72^{de}
UHF CAP-25	50.00^{bcd}	76.00^{abcde}	61.40^{c}	77.00 ^{abcd}	34.73 ^{lm}	13.77^{cd}	3.50^{bcd}	7.49^{de}	7.62^{c}	89.07^{ab}	4.17^{bc}	1211.57^{e}	364.90^{a}	146.60^{hij}
UHF CAP-26	52.33^{b}	73.33^{defg}	54.16^{d}	73.33 ^{defg}	32.83 ^{m}	12.53^{de}	3.17^{d}	5.32^{n}	5.55^{hij}	61.87^{g}	3.77^{def}	891.40^{klm}	227.20^{g}	173.58^{a}
UHF CAP-27	47.33^{cdefg}	72.33^{efg}	42.26^{j}	73.33 ^{defg}	38.48 ^{fghijk}	10.50^{gh}	3.40^{cd}	6.75^{f}	5.78^{gh}	70.00^{f}	2.70^{i}	1115.33^{f}	189.40^{ij}	130.92^{mn}
UHF CAP-29	49.67^{bcde}	75.67^{bcde}	41.33^{j}	76.33^{abcde}	32.37^{m}	14.55^{c}	3.83^{abc}	6.79^{f}	6.22^{f}	69.60^{f}	3.17^{gh}	734.60^{o}	179.00^{j}	128.56^{n}
UHF CAP-30	47.67^{cdef}	76.33^{abcd}	53.23^{de}	76.33^{abcde}	35.70^{kl}	10.65^{fgh}	2.00^{e}	6.71^{f}	5.49^{ij}	57.20^{h}	2.87^{hi}	1010.46^{hi}	244.80^{f}	153.76^{ef}
UHF CAP-31	43.67^{hi}	79.00^{ab}	52.78^{def}	80.33 ^{a}	42.90^{ab}	9.50^{hi}	3.70^{abc}	8.42^{ab}	8.37^{a}	84.67^{c}	5.10^{a}	620.43^{pq}	159.80^{k}	166.70^{b}
UHF CAP-32	47.00^{defg}	71.67^{fg}	67.67^{a}	72.33 ^{efgh}	38.47^{fghijk}	12.65^{de}	3.60^{abcd}	7.89^{c}	6.25^{f}	83.47^{c}	4.07^{bcd}	877.89^{lmn}	117.00^{l}	161.34^{c}
UHF CAP-33	47.00^{defg}	71.67^{fg}	67.67^{a}	72.33 ^{efgh}	38.47^{fghijk}	12.65^{de}	3.60^{abcd}	7.89^{c}	6.25^{f}	83.47^{c}	4.07^{bcd}	1077.19^{fg}	117.00^{l}	161.34^{c}
Solan Bharpur	50.00^{bcd}	78.33^{abc}	45.72^{i}	79.67 ^{ab}	39.67^{defgh}	16.33^{b}	1.90^{e}	5.61^{lm}	5.34^{jk}	48.40^{j}	3.17^{gh}	623.63^{pq}	329.30^{c}	146.60^{hij}
California Wonder	48.00^{cdef}	66.67^{hi}	59.94^{c}	66.67 ^{ijk}	41.63^{abcde}	11.20^{efg}	3.57^{abcd}	7.78^{c}	6.81^{e}	93.33^{a}	4.17^{bc}	1338.80^{c}	92.50^{m}	158.03^{cd}
Yolo Wonder	49.67^{bcde}	78.00^{abc}	45.50^{i}	78.00 ^{abc}	36.60^{hijkl}	8.40^{ij}	3.60^{abcd}	7.74^{cd}	6.66^{e}	91.47^{a}	3.17^{gh}	1226.36^{e}	261.40^{e}	141.28^{l}
IIHR-35	46.33^{fgh}	69.67^{gh}	38.10^{k}	71.00 ^{fgh}	35.67^{kl}	6.73^{k}	3.53^{bcd}	4.77^{o}	5.78^{gh}	78.33^{d}	3.17^{gh}	822.00^{n}	195.33^{i}	145.33^{ijk}
IIHR-36	52.67^{b}	67.33^{hi}	43.00^{j}	65.67 ^{ijk}	38.67^{fghij}	11.40^{efg}	3.20^{d}	6.10^{ij}	6.19^{f}	86.67^{bc}	4.03^{bcd}	1317.67^{cd}	261.00^{e}	140.33^{l}
IIHR-37	50.33^{bc}	76.33^{abcd}	49.33^{gh}	69.67 ^{ghi}	41.97^{abcd}	12.00^{efg}	3.93^{ab}	6.28^{hi}	6.58^{e}	71.33^{ef}	4.07^{bcd}	919.93^{jklm}	285.67^{d}	151.33^{fg}
IIHR-38	56.67^{a}	71.33^{fg}	43.00^{j}	64.33 ^{k}	39.00^{efghi}	7.47^{jk}	2.13^{e}	5.41^{mn}	5.64^{ghi}	75.40^{de}	3.50^{fg}	1040.00^{gh}	161.00^{k}	149.00^{gh}
IIHR-39	48.00^{cdef}	64.00^{i}	39.00^{k}	68.67^{hij}	44.00^{a}	8.53^{ij}	3.40^{cd}	5.97^{jk}	5.48^{ij}	64.27^{g}	4.07^{bcd}	981.00^{hij}	242.00^{f}	151.00^{fg}
Mean	48.42	72.99	50.84	73.09	38.61	12.08	3.44	6.70	6.27	74.16	3.7	987.25	243.48	150.47
CV %	3.33	2.74	2.70	3.18	3.82	7.39	7.01	2.32	2.42	3.32	5.27	3.67	2.97	1.20

DTF: Days to 50 % flowering, DFP: days to first picking, PH: plant height, HD: harvest duration, PS: plant spread, NFP: number of fruits per plant, NLF: number of lobes per fruit, FL: fruit length, FB: fruit breadth, FW: fruit weight, PT: pericarp thickness, FYP: fruit yield per plant, NSF: number of seeds per fruit, AA: Ascorbic acid

Similar letters indicate no significant difference (p≤0.05).

variances exhibited high for plant height (73.02, 74.91), fruit weight (194.99, 201.04), fruit yield per plant (71586.79, 72988.70), number of seeds per fruit (7210.16, 7262.32) and ascorbic acid (125.50, 128.77). The PCV and GCV were high for fruit yield per plant (27.35, 27.10) and number of seeds per fruit (35.00, 34.87). Broad-sense heritability varied from 75.40 % for days to 50 % flowering to 99.30 % number of seeds per fruit. Genetic advance was recorded from low in days to 50 % flowering (10.44) and high in number of seeds per fruit (71.58). These outcomes align with findings reported by Karim *et al.* (9); Rani *et al.* (12) and Alam *et al.* (1). Genotype *viz.*, IIHR-38 displayed the maximum value for days to 50% flowering (56.67 days), whereas the minimum was observed in UHF CAP-1 (43.00 days). Earliest fruit picking was observed in IIHR-39 (64.00 days), whereas the most extended picking was observed in UHF CAP-21 (79.67 days). Longest harvest duration was noted in UHF CAP-31 (80.33 days) while, lowest was observed in IIHR-38 (64.33 days). UHF CAP-13 behaved as the top fruit bearing plant (18.33 fruits/plant) while, IIHR-35 possessed fewer number of fruits per plant (6.73) (Table 2). The smallest fruit length was recorded in IIHR-35 (4.77 cm) whereas, the highest was observed in UHF CAP-13 (8.62 cm). The most increased fruit breadth was observed in UHF CAP-31 (8.37 cm) while, minimum breadth was observed in UHF CAP-21 (5.12 cm). The highest fruit weight was observed in California Wonder (93.33 g) whereas, the lowest value was recorded for UHF CAP-21 (47.60 g). The heigh yielding bell pepper genotype was UHF CAP-13 (1582.97 g) while, low the lowest yielding was UHF CAP-21 (565.98 g).

Correlation serves to depict the inter-relationship between two traits (Table 3). Harvest duration displayed a significantly positive correlation with days to first picking (0.802) whereas, number of fruits per plant had significantly positive correlation with harvest duration (0.248). Moreover, fruit length demonstrated significant positive correlation with plant height (0.377), number of fruits per plant (0.314) and number of lobes per fruit (0.363). However, it exhibited a negative correlation with days to 50 % flowering (-0.402). Fruit breadth showed significant positive correlations with number of lobes per fruit (0.388) and fruit length (0.619). Furthermore, fruit weight illustrated significant positive correlations with number of fruits per lobes (0.346), fruit length (0.521) and fruit breadth (0.727). Similar findings were also reported by Anuradha and Sood (2). Genotypic path coefficient was analysed and presented in Table 4. The highest positive direct effect on fruit yield per plant was observed in fruit weight (1.11), followed by days to first picking (1.02). Furthermore, fruit weight (0.69), fruit length (0.41), number of fruits per plant (0.31) and fruit breadth (0.31) exerted a strong indirect effect on fruit yield per plant. Additionally, the number of lobes per fruit (0.09), number of seeds per fruit (0.05), days to 50 % flowering (0.02) and pericarp thickness (0.02) demonstrated a

Table 3. Correlation coefficients among different yield governing traits.

Traits	DTF (days)	DFP (days)	PH (cm)	HD (days)	PS (cm)	NFP	NLF	FL (cm)	FB (cm)	FW (g)	PT (mm)	NSF	AA (mg/100 g)
DFP (days)	0.101												
PH (cm)	-0.134	0.139											
HD (days)	-0.139	0.802**	0.152										
PS (cm)	-0.143	0.049	0.094	-0.032									
NFP	-0.118	0.164	0.196	0.248*	-0.107								
NLF	-0.424**	-0.106	0.161	-0.019	0.17	0.127							
FL (cm)	-0.402**	0.024	0.377**	0.111	0.075	0.314**	0.363**						
FB (cm)	-0.417**	-0.071	0.153	-0.054	0.079	0.095	0.388**	0.619**					
FW (g)	-0.204	-0.246*	0.139	-0.268*	0.001	-0.018	0.346**	0.521**	0.727**				
PT (mm)	-0.113	-0.057	0.309**	-0.032	0.252*	0.017	0.282*	0.352**	0.482**	0.355**			
NSF	-0.051	0.056	0.395**	0.061	0.079	-0.112	-0.072	-0.11	-0.026	-0.08	0.519**		
AA (mg/100 g)	0.142	0.247*	-0.215	0.281*	0.066	0.392**	0.019	-0.148	-0.085	-0.296**	-0.248*	-0.236*	
FYP (g)	0.002	-0.303**	-0.019	-0.323**	-0.043	0.297**	0.068	0.394**	0.311**	0.668**	0.028	-0.237*	0.05

DTF: Days to 50 % flowering, DFP: days to first picking, PH: plant height, HD: harvest duration, PS: plant spread, NFP: number of fruits per plant, NLF: number of lobes per fruit, FL: fruit length, FB: fruit breadth, FW: fruit weight, PT: pericarp thickness, FYP: fruit yield per plant, NSF: number of seeds per fruit, AA: Ascorbic acid

*and ** indicates Pearson correlation coefficient value significant at 5 % and 1 % levels of probability

Table 4. Estimate of direct and indirect effect of yield governing traits on fruit yield per plant at phenotypic level in bell pepper.

Traits	DTF (days)	DFP (days)	PH (cm)	HD (days)	PS (cm)	NFP	NLF	FL (cm)	FB (cm)	FW (g)	PT (mm)	NSF	AA (mg/100 g)	r_g with fruit yield per plant
DTF (days)	-0.62													0.02
DFP (days)	-0.05	**1.03**												-0.34
PH (cm)	0.10	0.18	**0.02**											-0.01
HD (days)	0.12	0.96	0.01	**-1.45**										-0.38
PS (cm)	0.14	-0.08	0.00	0.09	**-0.22**									-0.06
NFP	0.06	0.17	0.01	-0.33	0.04	**0.11**								0.31
NLF	0.33	-0.15	0.00	0.04	-0.03	0.02	**-0.33**							0.09
FL (cm)	0.30	0.02	0.01	-0.17	-0.02	0.04	-0.13	**0.42**						0.41
FB (cm)	0.31	-0.09	0.00	0.11	-0.01	0.01	-0.14	0.27	**-1.03**					0.31
FW (g)	0.17	-0.29	0.00	0.46	0.00	0.00	-0.12	0.22	-0.78	**1.11**				0.69
PT (mm)	0.10	-0.05	0.01	0.11	-0.07	0.00	-0.10	0.15	-0.53	0.44	**0.21**			0.02
NSF	-0.10	0.28	-0.01	-0.44	-0.02	0.05	-0.01	-0.06	0.10	-0.33	-0.06	**0.62**		0.05
AA (mg/100 g)	0.02	0.06	0.01	-0.06	-0.02	-0.01	0.02	-0.04	0.03	-0.08	0.12	-0.15	**-0.14**	-0.25

Residual effect: 0.1062; Independent variables: DTF: Days to 50 % flowering, DFP: days to first picking, PH: plant height, HD: harvest duration, PS: plant spread, NFP: number of fruits per plant, NLF: number of lobes per fruit, FL: fruit length, FB: fruit breadth, FW: fruit weight, PT: pericarp thickness, FYP: fruit yield per plant, NSF: number of seeds per fruit, AA: Ascorbic acid. Dependent variable: Fruit yield per plan.

positively small indirect effect on fruit yield per plant. These findings are in confirmation with (Raji *et al.,* 10).

The high estimates of PCV, GCV and heritability were noted for fruit yield per plant and number of seeds per fruit indicating a wide range of variations and offered better scope for improvement through selection. Harvest duration exhibited a highly significant positive correlation with days to first picking. Fruit weight and days to first picking showed the highest positive direct effect on per plant fruit yield. These parameters could serve as indirect indicators for selecting improved fruit yield in bell pepper breeding programs aimed at boosting productivity.

AUTHOR'S CONTRIBUTION

Conceptualization and designing of the research work (DA, DKM, AV, RD); Execution of field/lab experiments and data collection (DA); Analysis of data and interpretation (DA, DKM, AV, RD); Preparation of manuscript (DA, DKM, AV, RD, RK, S).

DECLARATION

The authors affirm that they do not have any potential conflicts of interest.

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