Assessment of morphological, fruit yield and quality characters in hybrid chilli (*Capsicum annum* L.)

THESIS

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In

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(VEGETABLE SCIENCE)

By

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CERTIFICATE – I

This is to certify that the thesis entitled **"Assessment of morphological, fruit yield and quality characters in hybrid chilli (*Capsicum annum* L.)"** submitted in partial fulfillment of the requirement for the degree of **MASTER OF SCIENCE** in **Department of Vegetable Science** of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, is a record of the bona-fide research work carried out by **Mr. Ravindra Patidar ID No 13559** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instruction.

No part of the thesis has been submitted for any other degree or diploma or has been published. All the assistance and help received during the course of investigation has been acknowledged by the scholar.

Date…………………… **(Dr. M. S. Parihar)**

Place………………….. Chairman of the Advisory Committee

MEMBER OF STUDENT'S ADVISORY COMMITTEE

Chairman	(Dr. M. S. Parihar)	……………………………………..
Member	(Prof. K.N. Tambi)	……………………………………..
Member	(Dr. S. R. Ramgiry)	……………………………………..

CERTIFICATE – II

This is to certify that the thesis entitled **"Assessment of morphological, fruit yield and quality characters in hybrid chilli (*Capsicum annum* L.)"** submitted by **Mr. Ravindra Patidar ID No 13559** to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, in partial fulfillment of the requirements for the degree of Master of Science in **Agriculture** in the Department of **Vegetable Science** has been accepted after evaluation by the External Examiner and approved by the Student's Advisory Committee after an oral examination of the same.

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Head of Department ……………………………………..

Dean of the college ……………………………………..

Director of Instruction ………………………………………

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ABBREVIATIONS USE IN TEXT

/	:	Per
@	:	At the rate of
%	:	Percentage
ANOVA	:	Analysis of variance
B: C	:	Benefit cost ratio
C.D	:	Critical difference
cm	:	Centimeter
^{0}C	:	Degree Celsius
cv.	:	Cultivar
D.F.	:	Degree of Freedom
DAP	:	Dia Ammonium Phosphate
DAS	:	Days after sowing
et.al.	:	and others
Fig.	:	Figure
g	:	Gram
ha	:	Hectare
HI	:	Harvest index
R.V.S.K.V.V	:	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior
K	:	Potassium
Kg/ha	:	Kilogram per hectare
Max.	:	Maximum
Min.	:	Minimum
mg	:	Milligram
MOP	:	Murate of potash
M.S.S	:	Mean sum of square
No.	:	Number
P	:	Phosphorus
R.H.	:	Relative humidity
Rs.	:	Rupees
S.Em.	:	Standard Error of Mean
Sq m	:	square meter
Sig.	:	Significant
q/ha	:	Quintal per hectare
Viz.	:	(Videlicet) Namely

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Place:

Date: **Ravindra Patidar**

CHAPTER - I

INTRODUCTION

Chilli (*Capsicum annum* L*.,* 2n=24*)* is the most important warm season vegetable grown throughout the world. It belongs to the family Solanaceae and said to be the native of South America. Chilli was known to Indians about 400 years ago, when this crop was first introduced into India by Portuguese, towards the end of the 15th century. Its cultivation became popular in the 17th century. It is an important cash crop in India and is grown for its pungent fruits, which are used both green and ripe (the latter in the dried form) to impart pungency, spicy taste and colour to the food.

The composition of green chilli per 100 g of edible portion is moisture (85.7g), protein (2.9g), fat (0.6g), minerals(1.0g), fiber (6.8g), carbohydrates (3.0g), calcium (30mg), magnesium (24mg), riboflavin (0.39mg), nicotinic acid (0.9mg), phosphorous (80mg), iron (1.2mg), sodium (6.5mg), potassium (217mg), Vitamin A (292 I.U.) and Vitamin C (111mg). In fact, Vitamin C was first purified from *Capsicum* fruits in 1928 by Hungarian biochemist Albert Szent Gyorgyi which helped him to receive the Nobel Prize in physiology and medicine during 1937 (Kumar *et al*., 2006). Green chillies are rich in Vitamin A and C, minerals and protein. Dry chillies are also rich in Vitamin A and D. As a condiment, it has become indispensable in every Indian home. It is also used medicinally, sauces, chutneys and pickles. The pungency is due to the oleoresin 'capsaicin' (a condensation product of 3 hydoxy-4-methoxy benzylamine and decylenic acid). It is secreted by the outer walls of the fruit. At ripening stage, fruit become red in colour due to presence of capsanthin pigment.

Chilli is extensively cultivated in Asia, Africa, Europe, and Central Northern part of America. In India, the major chillies growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh, and Rajasthan. India occupies 0.794 million ha area and annual production 1.304 million tons, while in Madhya Pradesh it occupies 0.054 million ha area and produce 0.093 million tons (NHB, 2013).

Chilli is one of the most important vegetable cum spice crops in India. In spite of its high nutritive value, well acceptability among consumers and wide range of genetic variability, the optimum productivity in chilli still remain to be achieved. Therefore, much concerted efforts are necessary to improve its yield and yield attributes. Fruit yield as well as quality improvement efforts continue to be the major objective of chilli improvement programme. Fruit yield is a complex inherited character influenced by several attributes of the plant. A wide range of variability is available in chilli genotypes which provide great scope for improving fruit yield through systematic breeding. Estimation of genetic variability present in the germplasm of a crop is a pre-requisite for designing effective breeding programme. However, utilization of this variability requires its systematic evaluation to understand and to estimate the genetic variability, heritability and genetic advance of various yield and physiochemical components (Amit *et al*. 2014).

The extent of genetic variation for major economic traits in a crop is pre-requisite for its improvement due to fact that the efficiency of selection depend mainly on it. Genetic improvement of traits depends upon nature and amount of genetic variability present in parents and their inheritance pattern are equally important for further upgrading yield level.

A comprehensive knowledge of the available variability within the breeding material of a crop species for desired characters enables the breeders to identify most potential genotype. The phenotypic variation arises as a result of phenotypic, genotypic and interaction between genotypic and environmental variations, but for making effective selections, the heritable unit *i.e.,* the genetic variation is most important. Burton (1952) suggested that genetic variability along with heritability should be considered for assessing the maximum and accurate effect of selection. Shift in the gene frequency towards desirable combinations under selection procedure is termed as genetic advance as percentage of mean .

Correlation and path analysis have been successfully used for architectring ideotypes for improvement to enhance productivity. However, under complex situation, correlations alone become insufficient to explain relationships among characters and thus path analysis of economic yield components with yield is most important the similar published information's is scanty in chilli (Krishna *et al.* 2007 and Hosamani and Shivkumar, 2008). Keeping in view these points the present investigation was carried out "Assessment of morphological, fruit yield & quality characters in hybrid chilli (*Capsicum annum* L.)" with the following objectives:

1. To estimate extent of genetic variation for growth and fruit yield traits.
2. To estimate heritability and genetic advance for growth and fruit yield traits.
3. To find out major fruit yield traits through correlation and path analyses.

CHAPTER – II
REVIEW OF LITERATURE

The literature pertinent to the various aspects of the present investigation entitled **"Assessment of morphological, fruit yield & quality characters in hybrid chilli *(Capsicum annum* L.*)*"** is reviewed under the following heads:

2.1 Genetic Variability

2.2 Heritability and Genetic Advance

2.3 Correlation and path analysis

2.1 Genetic Variability

Genetic variability is a measure of the tendency of individual genotypes in a population to vary from one another. Variability is the amount of variation seen in a particular population.

Munshi and Behera (2000) indicated existence of considerable amount of genetic variability for all the characters except fruit girth. The number of fruits per plant exhibited highest values of GCV and PCV.

Manju and Sreelathakumary (2002) recorded high coefficients of phenotypic (PCV) and genotypic (GCV) variation for several characters, the highest being for fruits per plant, followed by yield per plant, seeds per fruit and fruit weight. The lowest PCV and GCV were for days to first flowering. The GCV was near to PCV for most of the characters, indicating a highly significant effect of genotype on phenotypic expression with very little effect of environment.

Ananthi *et al.* (2006) indicated that the genetic material in the present investigation possessed high variability. High estimates of PCV and GCV were obtained for green fruit yield per plant, vulnerability index, average fruit weight and number of fruits per plant indicated a good deal of variability for these characters.

Bharadwaj *et al.* (2007) planted twenty seven genotypes of diverse origin of chilli [*Capsicum annuum* (L.)] to work out variability for fruit yield and nine other related characters. High GCV observed for number of fruits per plant.

Farhad *et al.* (2008) observed fourteen quantitative characters viz. days to 50% flowering, time between fruit set and maturity, plant height, primary branches per plant, number of secondary branches per plant, fruit length, fruit girth, fruit weight, number of fruits per plant, seeds per fruit, 100 seed weight, fruit pedicel length, vitamin-C content and dry fruit yield per plant. The analysis of variance revealed remarkable variation among the genotypes for the characters concerned. The magnitudes of phenotypic coefficient of variations were higher than corresponding genotypic coefficients of variations. Higher genotypic as well as phenotypic coefficient of variations were computed for vitamin-C content, number of secondary branches per plant, number of primary branches per plant and yield per plant.

Tembhurne *et al.* (2008) reported the differences between phenotypic and genotypic coefficient of variation were low for days to 50% flowering, plant height, fruit diameter and number of fruits per plant.

Gupta *et al.* (2009) recorded maximum genotypic & phenotypic coefficient of variations for fruits per plant, fruit yield, fruit length and low values for plant height, primary branches per plant, number of secondary branches per plant.

Sarkar *et al.* (2009) evaluated forty-nine genotypes of chilli to study the genetic variability for 12 growth and fruit characters. There was significant variation among the genotypes. Fruit yield (g) per plant, number of fruits per plant, fruit length (cm), placenta length (cm), fruit weight (g), number of seeds per fruit and plant height (cm) showed high values of GCV and PCV.

Sharma *et al.* (2009) reported that the phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were high for fruit yield per plant and ascorbic acid content indicating that these traits had wide genetic variability and would respond better to selection.

Chattopadhyay *et al.* (2011) recorded phenotypic and genotypic coefficient of variation values for green fruit weight (119.95%, 111.26%), green fruit girth (89.76%, 48.93%), weight of red ripe fruit (112.02%, 111.93%), weight of dry fruit (111.63%, 110.97%) and number of fruits per plant (86.05%, 85.02%).

Ullah *et al.* (2011) studied genetic variability for morphological traits in chilli genotypes. Statistically, significant variation was observed among tested materials for all the characters studied. The higher genotypic coefficient of variations was found in case of fruit yield per plant followed by fruits per plant, average fruit weight and fruit length.

Singh *et al.* (2013) reported that the average of mean data reflects maximum variability for yield per plant itself followed by number of fruits per plant, fruit length, fruit width, plant height, days to 50% flowering and days to 50% fruiting. On the basis of mean performance and range of varietal mean of yield and their components, these genetic materials have enough variability.

2.2 Heritability and Genetic Advance

Heritability is an index of transmissibility of traits from one generation to another generation. The concept of heritability is important to determine whether the phenotypic differences observed among various individuals are due to differences in their genetic make-up or simply as result of environmental factors.

According to Comstock and Robinson (1952) the genetic advance is an improvement in the genetic value in the new population as compared to original one and depends upon the following three factors namely heritability, phenotypic and the intensity of selection.

Manju and Sreelathakumary (2002) estimated heritability for most of the characters ranged from 39.35 (primary branches per plant) to 99.38 per cent (yield per plant). Higher magnitude of heritability (>90 per cent) resulting from high GCV was also registered for fruits per plant, fruit length, fruit girth, fruit weight, seeds per fruit, 1000-seed weight, pollen viability, days to maturity and number of harvests. The study revealed high heritability coupled with high genetic advance for several biometric characters including yield per plant, fruit per plant, fruit weight, fruit girth and fruit length.

Shreelathakumary and Rajamony (2004) noticed high estimates for heritability with high genetic advance for branches per plant, fruit yield, seeds per plant, plant weight while low for fruit dry weight.

Abu and Uguru (2006) recorded high heritability for plant height, length, fruit diameter, fruit weight and number of fruit per plant for 10 genotypes of chilli.

Bharadwaj *et al.* (2007) planted twenty seven genotypes of diverse origin of chilli [*Capsicum annuum* (L.)] to work out heritability for fruit yield and nine other related characters. High heritability along with genetic advance observed for number of fruits per plant indicated that number of fruits per plant may be governed by additive genes.

Shirshat *et al.* (2007) estimated genetic variability in seventy-two germplasm lines and three commercial cultivars. The analysis of variance and other genetic parameters indicated considerable genetic variability for different characters among the genotypes. The phenotypic coefficient of variation was higher than genotypic coefficient of variation for all characters indicating the influence of environment on these characters. Fruit attributes viz., fruit length, fruit surface area, weight of dry fruit, pericarp weight of fruit, number of seeds per fruit, weight of seeds per fruit, stalk length, ascorbic acid and sugar content showed very narrow differences between phenotypic and genotypic coefficient of variation, indicating lesser sensitivity to environmental influence.

Shirshat *et al.* (2007) estimated heritability in respect of fruit length, fruit surface area, number of seeds per fruit, weight of seeds per fruit, weight of dry fruit, pericarp weight of fruit, ascorbic acid content and sugar content were high ranging from 74.00 per cent to 99.40 per cent. Moderate genetic advance was observed for the characters like number of fruits per plant, number of seeds per fruit and sugar content of the fruit. Heritability was high in these characters except for number of fruits per plant. In case of attributes like fruit length, fruit surface area, weight of dry fruit, pericarp weight of fruit, number of seeds per fruit and weight of seeds per fruit, the genetic advance was low to moderate coupled with high heritability. Yield per plant, the complex trait, which is dependent on several component characters showed moderate heritability with low genetic advance.

Vani *et al.* (2007) reported that high heritability coupled with high genetic advance was noticed through number of fruits per plant, number of seeds per fruit, seed yield, and fruit length. The phenotypic and genotypic coefficients of variation were highest for dry fruit yield per plant, number of fruits per plant and seed yield per plant.

Ukkund *et al.* (2007) estimated high heritability for plant height (93.40%), days to first flowering (83.50%), percent fruit set (70.70%), number of fruits per plant (81.10%), fruit length (92.40%), ten fruit weight (92.40%) and total green fruits per plant (88.40%). Most of these characters also had moderate to high estimates of genetic advances as a percent over mean except days to first flowering.

Farhad *et al.* (2008) observed fourteen quantitative characters viz. days to 50% flowering, time between fruit set and maturity, plant height, primary branches per plant, number of secondary branches per plant, fruit length, fruit girth, fruit weight, number of fruits per plant, seeds per fruit, 100 seed weight, fruit pedicel length, vitamin-C content and dry fruit yield per plant. Among them, heritability estimates were higher for all the characters except days to 50% flowering and pedicel length. High heritability coupled with high genetic advances was estimated for seeds per fruits and plant height.

Singh and Yadav (2008) investigated high to moderate heritability with high to moderate genetic advance for number of seeds per fruit, ascorbic acid content, number of fruits per plant, fresh fruit weight per plant, fresh fruit yield (qperha), seed weight per plant and seed yield (qperha) showing dominancy of additive gene effects.

Tembhurne *et al.* (2008) observed high heritability and high genetic advance values for fruits per plant.

Pandit *et al.* (2009) recorded the high heritability and genetic advance for number of seeds per fruit, fruits yield per plant, fruit length, days to 50% flowering and plant height.

Sarkar *et al.* (2009) reported high heritability in broad sense coupled with high Genetic Advance in % grand mean was recorded for fruit yield per plant, number of fruits per plant, fruit length, days to 50% flowering and plant height indicating such characters were controlled by additive gene action

Singh *et al.* (2009) noted high heritability coupled with high genetic advance for marketable fresh and dry yield per plant, average fruit weight, numbers of marketable fruit, fruit diameter, and oleoresin and capsaicin content, which indicated the role of additive gene action for the inheritance of these traits. These traits are likely to respond better to selection

Wilson and Philip (2009) reported the maximum heritability with maximum genetic advance for number of fruits and fruits yield per plant.

Sharma *et al.* (2010) recorded high heritability and high genetic advance for average fruit weight, fruit yield per plant, fruit diameter, number of lobes per fruit, days to first harvest, leaf area and ascorbic acid content. They indicated the role of additive gene action for the inheritance of these traits.

Chattopadhyay *et al.* (2011) reported that Green fruit yield per plant, ascorbic acid content, and number of fruits per plant showed very high broad-sense heritability and genetic advance.

Ullah *et al.* (2011) observed high heritability for all the tested characters except fruit diameter. High heritability with high genetic advance in percentage of mean was recorded for the characters fruit yield per plant, fruits per plant, plant height and days to 50% flowering indicating role of additive gene action in the expression of these traits.

Amit *et al.* (2014) reported that all the characters showed high heritability estimates. Number of the fruits per plant, green fruit yield per plant, dry (red) yield per plant, number of seeds per plant and plant height exhibited high genetic advance as percentage of mean indicating additive gene effect.

Anandhi and Anand (2014) recorded High heritability (above 80%) assisted with high genetic advance as percent of mean (above 20%) was observed for green fruit yield per plant, duration of crop, number of seeds per fruit, days to first flowering, duration of flowering, pedicel fruit ratio, number of fruits per plant and average fruit weight.

Pandit *et al.* (2014) recorded high genetic advance(as % of mean) in fruit yield per plant and moderately high in days to 50% flowering, placenta length, number of fruits per plant and number of seeds per plant, indicating that these characters are most likely governed by additive gene action.

2.3 Correlation and Path Analysis

Correlation study gives the relationship of one character with the other. Yield, itself is not a unitary character but the end product of various component characters either jointly or singly. Therefore, knowledge of genetic association of yield and various component characters are of economic worth in formulating and executing the breeding programme. Hence, the prime requirement is to have precise and clear-cut information on the strength and direction of association of these traits with any worth character and also *inter se* relation among themselves. The selection efficiency is improved by making judicious combinations of the characters. The degree of associations between any character and its contributors can be estimated by correlation coefficient at genotypic and phenotypic levels. Correlation coefficient measure the association between any two characters. The literature available on correlation studies in chilli is reviewed as follows:

Ben-Chaim *et al.* (2003) founded the highest genetic correlation coefficients among pairs of traits between fruit weight and each of the three width characters: fruit diameter, pericarp thickness and pedicel diameter. In contrast, fruit weight had a low correlation coefficient with fruit length, indicating that the size of the pepper fruit in this cross was determined primarily by its width.

Mishra *et al.* (2003) reported the number of fruits per plant showed maximum positive direct effect on fruit yield per plant, followed by fruit weight and fruit diameter at phenotypic level and at genotypic levels

Ajjapplavara *et al.* (2005) studied the correlation and path coefficient analysis in 36 genotypes in chilli for 18 different quantitative characters. The correlation study indicated that significant and desirable correlation between dry fruit yield per plant with all other characters except number of primary and secondary branches, fruit diameter, fruit volume, powdery mildew disease incidence and leaf curl complex incidence. Path analysis revealed that importance should be given to fruit weight and fruits per plant.

Smitha and Basavaraja (2006) studied correlation and revealed that importance should be given to number of fruits per plant, fruit weight, number of primary branches, fruit length, fruit diameter and plant height during selection process, because these characters are going to contribute directly towards the yield.

Vani *et al.* (2007) observed the high positive direct effect of yield attributing characters such as fruit length and fruit weight resulted in significant correlation with yield. Number of fruits per plant and average fruit weight also contributed indirectly through all characters, which made the correlation significant.

Bharadwaj *et al.* (2007) planted twenty seven genotypes of diverse origin of chilli [*Capsicum annuum* (L.)] to work correlation association for fruit yield and nine other related characters. Fruit yield was positively associated with no. of branches per plant and no. of fruits per plant. Number of branches per plant is also positively correlated with fruit width, no. of fruits per plant, capsaicin content and fruits yield. They reported that selection for improvement of fruits yield is possible through positively associated yield contributing characters. However, these characters are influenced by environment. Therefore, selection of genotypes for improvement of fruit yield through no. of branches per plant and no. of fruits per plant is appropriate in the present set of material since these characters are not much influenced by environment.

Farhad *et al.* (2008) reported that dry fruit yield per plant showed significant and positive correlation with number of secondary branches per plant, fruit girth, fruit weight, fruits per plant, seeds per fruit and 100-seed weight. Fruits per plant and fruit weight exerted highest positive direct effect both at genotypic and phenotypic levels.

Tembhurne *et al.* (2008) reported that fruit yield exhibited positive association with most of the growth traits and high between fruit per plant with fruit diameter

Gupta *et al.* (2009) reported that the fruit yield per plant showed positively associated with fruits per plant and fruit length in chilli.

Patel *et al.* (2009) reported that the green fruit yield per plant showed highly significant and positive correlation with primary branches per plant, secondary branches per plant, number of fruits per plant, fruit length, fruit girth and fruit weight. Path coefficient analysis showed highly positive direct effect of number of fruits per plant, fruit weight, fruit length and number of primary branches per plant on green fruit yield per plant.

Sarkar *et al.* (2009) revealed that number of fruits per plant, fruit weight and 1000 seed weight had positive and high direct effect on fruit yield indicating their reliability as selection criteria to improve yield of chilli

Misra *et al.* (2010) performed genetic associations and path-coefficient analysis in 38 elite genetic stocks per accessions of chilli (*Capsicum annuum*). The capsaicin content was significantly associated with number of primary branches per plant and days to first flowering followed by weak positive association with days to fruit initiation and negative association with fruit weight dry and fruit weight fresh. In path-coefficient analysis, the number of primary branches per plant was found to be the premium direct contributor to the capsaicin content followed by fruit length. Fruit diameter exhibited the third highest direct effects. Primary branches per plant and days to first flowering emerged as a reliable component in selection criterion in breeding high capsaicin content yielding chilli (*Capsicum annuum*).

Sharma *et al.* (2010) revealed that at genotypic levels, the traits fruit length, fruit diameter and number of fruits per plant had significant positive correlation with fruit yield per plant. Number of fruits per plant exhibited the highest positive direct effect followed by average fruit weight, number of branches per plant, pedicel length and harvest duration at genotypic level.

Chattopadhyay *et al.* (2011) studied correlation and path coefficient analyses, the number of fruits per plant, green fruit length for green chilli, weight of dry fruit and the number of fruits per plant for dry chilli were found to the most important selection indices.

Ullah *et al.* (2011) studied association of correlation and cause effect analysis for morphological traits in chilli genotypes. Fruits per plant, fruit length and fruit diameter were the major characters contributing to yield as these traits were significantly and positively associated with yield per plant. Maximum contribution of fruits per plant to yield was observed in path analysis, which was followed by average fruit weight, days to first flowering and fruit length through higher direct effect. They revealed that the increasing fruit yield per plant a chilli genotype should have higher number of fruits per plant, coupled with large fruit length, high fruit diameter and high average fruit weight.

Amit *et al.* (2014) recorded that fruit yield (green and red) plant per plant was positively and significantly correlated with number of fruits plant per plant and fruit length. It revealed that the characters viz., plant height, fruit length, number of fruits plant per plant, fruit weight and fruit yield (green & red) are the most important traits for genetic improvement of chilli.

Vikram *et al.* (2014) studied the genetic correlations and path coefficients among twenty traits under study. Green yield per plant showed positive and significant correlation with average green fruit weight, fruit length and fruit breadth at middle while dry fruit yield exhibited the same with fruit length, green yield per plant and â-carotene content indicating the effective improvement in yield (green and dry) through above characters. Path analysis towards dry yield per plant revealed the importance of average dry fruit weight, number of fruits per plant, fruit length, green yield per plant and â-carotene content in improvement of dry yield per plant.

CHAPTER-III

MATERIAL AND METHODS

This chapter comprises the details about the materials used and the methods adopted during the course of present investigation entitled "Assessment of Morphological, Fruit Yield & Quality Characters in Hybrid Chilli *(Capsicum annum L.)*" was carried out in *Kharif* season 2014-15.

3.1 Experimental site

The present experiment was laid out at the field of Horticulture Research Farm, Department of Horticulture, R.A.K. College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Sehore, (M.P.).

3.2 Location and Climate:

The experimental site, R.A.K. College of Agriculture, Sehore is situated on $27^0$12 north latitude and $77^0$0 east longitude at an altitude of 498.77 meters from mean sea level in Vindhyan Plateau of Madhya Pradesh and enjoy sub tropical climate. The average rainfall varies from 689.3 mm concentrated mostly from the month of last July to January (Crop period) less rainfall occurs during the winter season also. The maximum temperature is 46^0C and minimum temperature 6.8^0C. The average annual relative humidity is 74%.

The meteorological parameter during the crop season such as minimum and maximum temperature, rainfall and relative humidity were recorded at Meteorological observatory R.A.K. College of Agriculture, Sehore (M.P.) are presented in Table 3.1

The data (Table 3.1) indicate that the total rainfall received during crop growth period was 783.4 mm in 43 rainy days. There were no rains during standard weather week 40 to 49. The minimum and maximum temperature during crop growth period varied 11.37^0C to 25.28^0C and from 20.94^0C to 32.70^0C, with season's average values of 18.88^0C and 28.76^0 C respectively. The relative humidity ranged between 68.71 to 98.71 % with season's average of 87.39%.

Table 3.1: Meteorological data (week wise) during the crop season of 2014-15 at R.A.K. College of Agriculture, Sehore (M.P.).

SMW	Month and date	Temp (^0C)		Rainfall (mm)	RH (%)
		Max.	Min.		
28	09.07.2014- 15.07.2014	28.8	23.8	14.0	65.9
29	16.07.2014- 22.07.2014	23.8	23	77.5	64.5
30	23.07.2014- 29.07.2014	29.3	22.9	7.0	65.6
31	30.07.2014- 05.08.2014	32.3	23.6	30.0	67.6
32	06.08.2014- 12.08.2014	30.7	23	143.0	66.3
33	13.08.2014- 19.08.2014	28.2	23.2	79.5	65.4
34	20.08. 2014- 26.08. 2014	28.1	22.5	5.5	64.8
35	27.08. 2014- 02.09. 2014	30.9	21.3	0.5	65.7
36	03.09. 2014- 09.09. 2014	32.1	20.8	1.0	66.1
37	10.09. 2014- 16.09. 2014	34.1	20.3	0.0	66.7
38	17.09. 2014- 23.09. 2014	32.3	19.1	0.0	68.5
39	24.09. 2014- 30.09. 2014	31.8	19.8	1.5	65.5
40	01.10. 2014- 07.10. 2014	30.8	17.3	0.0	63.7
41	08.10. 2014- 14.10. 2014	31.1	15.8	0.0	63.0
42	15.10. 2014- 21.10. 2014	30.4	16.8	0.0	63.1
43	22.10. 2014- 28.10. 2014	28.4	18.2	0.0	62.0
44	29.10. 2014- 04.11. 2014	28.3	11.2	0.0	58.4
45	05.11. 2014- 11.11. 2014	28.7	13	0.0	54.7
46	12.11. 2014- 18.11. 2014	26.3	9.5	0.0	57.4
47	19.11. 2014- 25.11. 2014	24.7	9.8	26.0	56.9
48	26.11. 2014- 02.12. 2014	21	6.2	0.0	52.2
49	03.12.2014- 09.12. 2014	21.7	5.4	10.5	53.7
50	10.12.2014- 16.12. 2014	17.6	7.6	25.0	59.2
51	17.12.2014- 23.12. 2014	28.8	23.8	14.0	65.9
52	24.12.2014- 31.12. 2014	23.8	23	77.5	64.5
1	01.01.2015- 07.01. 2015	29.3	22.9	7.0	65.6
2	08.01.2015- 14.01. 2015	21.77	10.94	0	55.93
3	15.01.2015- 21.01. 2015	21.44	6.20	0	61.14
4	22.01.2015- 28.01. 2015	17.14	7.58	1.0	61.74
Total		---	---	422.0	---
Average		27.36	16.84	17.94	62.47

Source: Meteorological Observatory, R.A.K. College of Agriculture

3.3 Soil type

The soil of the experimental field was medium black with good drainage and uniform texture with low, medium and high NPK status, respectively.

3.3.1 Soil

The soil of the experimental field was medium black with 37% clay, 38% salt and 25% sand with pH ranging from 7.2. The soil was low in available nitrogen, medium in available phosphorus and high in available potassium.

Table 3.2: Chemical properties of experimental field

S. No.	Composition	Content	Category	Method used
A.	**Mechanical composition**			
1	Sand (%)	25	-	Bouyoucos Hydrometer method (Piper, 1967)
2	Silt (%)	38	-	
3	Clay (%)	37	-	
4	Textural class		Medium black	
B. Chemical composition				
S. No.	**Particulars**	**Content**	**Level**	**Method adopted by**
1.	Organic carbon (%)	0.47	Low	Walkey& Black method (1934)
2.	Available nitrogen N (kg per ha)	152.6	Low	Alkaline potassium permanganate method (Subbaih and Asija, 1956)
3.	Available phosphorus P (kg per ha)	21.2	Medium	Olsen's method (Olsen *et al.*, 1954)
4.	Available potassium K (kg per ha)	308.0	High	Flame photometer (Jackson, 1967)
5.	Soil pH	7.2	Normal	pH meter (Jackson, 1967)
6.	Electrical conductivity (mmhospercm)	0.5 dsperm	Normal	Conductivity meter at 25ºC (Jackson, 1967)

In order to determine the textural class and fertility status of the experimental area, the soil samples were collected randomly from each plot with the help of soil auger before sowing from the experimental field. Primary samples were mixed to prepare and composite soil sample from each replication was drawn to study physico-chemical properties of the experimental field. The data pertaining to various physico-chemical properties have been presented in Table 3.2.

3.4 Cropping history of the experimental field

The following crops, as given in Table 3.3, were grown during the past four years.

Table 3.3: Previous history of the experimental field

Year	Kharif	Rabi	Summer
2012-13	Onion	Gram	Fallow
2013-14	Cowpea	Gram	Fallow
2014-15	Cowpea	………….	………..

3.5 Experimental details

The experiment was laid out in the Randomized block design with three replications. Each replication was comprised of 18 treatments. The details are given below.

Treatments Detail:

T1	Smriti	T 7	ARCH 930	T 13	S-586
T 2	Aujasvi	T 8	US 612	T 14	Amrita
T 3	Shourya	T 9	US 611Tara	T 15	P. jyoti
T 4	Albeli-333	T 10	Marshal 1857	T 16	Jwala garima-12
T 5	Ujjala	T 11	Saniya (03)	T 17	TS-0017
T 6	Tiger	T 12	Jalsa	T 18	Tara

Table 3.4: Details of layout

Experimental site	**:**	Horticulture Research Farm, R.A.K.College of Agriculture, Sehore (M.P.)
Crop	:	Chilli (*Capsicum annum* L.)
Design	:	Randomized Block Design
Treatments	:	18
Replications	:	03
Total no. of plots	:	54
Distance between replication	:	1 m
Distance between plot	:	0.5 m
Gross plot size	:	3.0 m x 2.5 m
Total area		405 m^2
Row to row Distance	:	60 cm
Plant to plant Distance	:	50 cm
Season	:	Late Kharif, 2014-5
Date of sowing	:	25.08.2014

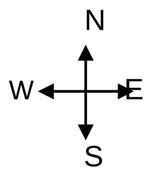
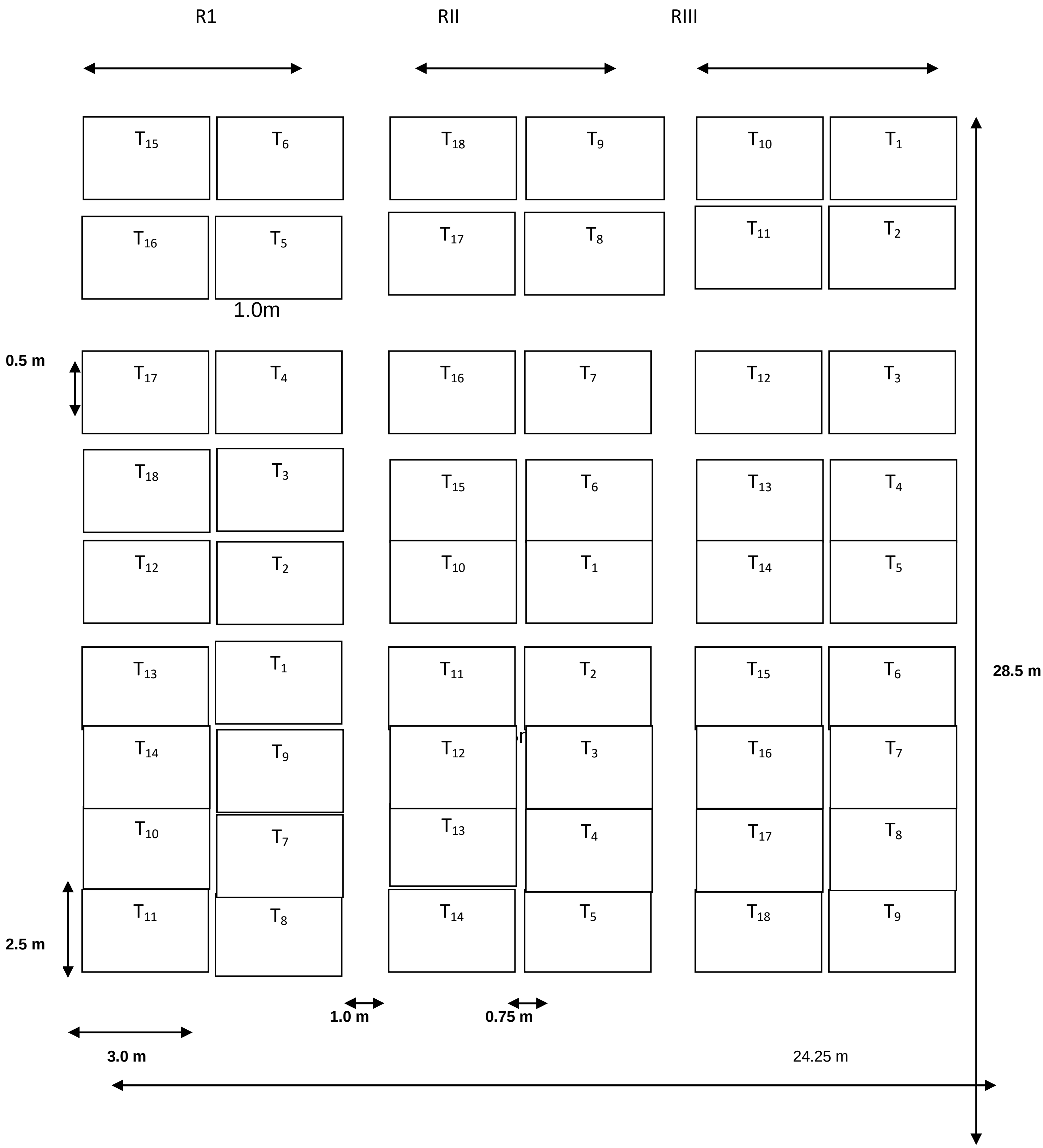


Fig.2 Layout Plan of Experiment

RANDOMIZED BLOCK DESIGN



3.6: Field preparation

The field was prepared with 2 ploughing and a harrowing so as to make the soil well pulverized and free from weeds. The field was laid out for the trial as per given in plan of layout.

3.6.1: Application of manure and chemical fertilizers

The treatments of manure and chemical fertilizers were applied as per respective plot. Full dose of phosphorus, potash, organic manures and 1/3 nitrogen were given to the plot before sowing as basal dose at the time of 2ndploughing. Remaining 2/3 quantity of nitrogen was applied in two split doses i.e. 30 and 60 DAS.

3.6.2: Nursery:

The 200-250 g per ha seed was used for sowing and before sowing it was treated with 3 g Vitavax per kg culture of seed.

3.6.3: Irrigation

A light irrigation was applied for establishment of the seedlings after transplanting. Subsequent irrigations were provided as and when required for growth and development of plants. The irrigation at weekly interval was given as and when required subsequently after one month the irrigation interval was increased up to 10 days as per requirement.

3.6.4: Gap filling and thinning

Healthy and uniform seedlings were selected for planting. Light irrigation was given before uprooting seedlings from the nursery beds so that minimum damage may occur to roots of the seedling. Transplanting was done in the afternoon at 60 x 50 cm distance and immediately followed by light irrigation for proper establishment of the seedlings. A week after transplanting gap filling was done. All the other recommended package of practices was followed to raise a healthy crop.

3.6.5: Weeding

In order to control the weeds and avoid competition between plants and weeds, two hand weedings were also done by manual labour, at 20 and 45 days after sowing.

3.6.6: Plant protection

The crop was sprayed with Diafenthiuron 50% WP broad spectrum insecticide to keep the crop free from pest during crop growth period.

3.6.7: Harvesting

Harvesting of chilli was done at marketable stage at regular interval.

Table 3.5: Schedule of cultural operations carried out during the course of investigation

S.No.		Name of operations	Date
1		Field operation	
	A	Ploughing by tractor	20.08.2014
	B	Two Harrowing	22.08.2014
	C	Planking	22.08.2014
2		Field layout	23.08.2014
3		Fertilizer application	24.08.2014
4		Seed treatment	20.07.2012
5		Seed sowing	21.07.2014
6		Transplanting	25.08.2014
7		Gap filling	30.08.2014
8		Thinning	30.08.2014
9		Dusting of Malathion dust	30.08.2014
10		Spray of insecticide (1^{st})	20.09.2014
11		Spray of insecticide (2^{nd})	05.10.2014
12		Interculture and weeding (1^{st})	10.09.2014
13		Interculture and weeding (2^{nd})	25.09.2014
14		Top dressing of urea (1^{st})	25.09.2014
15		Top dressing of urea (2^{nd})	25.10.2014
16		Irrigation schedule	
	A	1^{st}	25.08.2014
	B	2^{nd}	15.10.2014
	C	3^{rd}	30.10.2014
	D	4^{th}	12.11.2014
	E	5^{th}	24.11.2014
	F	6^{th}	08.12.2014

3.7: Observation and its procedure

Sampling was done at 30 day's interval for growth parameters. Five plants were randomly selected from each treatments and replication for the study.

Observation recorded

A. Growth / Morphological parameters

1. Plant height (cm) at an equal interval 30, 60, 90, 120 DAT and at maturity
2. Number of primary branches per plant at 30, 60, 90, 120 DAT and at maturity.
3. Number of secondary branches per plant at 30, 60,90,120 DAT and at maturity.
4. Days to first flower initiation.
5. Days of 50% flowering
6. Days to first picking of fruits.

B. Yield parameters

1. Days to first fruit initiation
2. Number of fruits per cluster
3. Fruit width (cm)
4. Fruit length (cm)
5. Number of fruits per plant
6. Days to maturity
7. Fresh weight of fruits per plant (g)
8. Fresh weight of fruits per plot (kg)
9. Fresh weight of fruits per ha. (q.)
10. Dry weight of fruits per plant (g)
11. Dry fruit weight per plot (kg)
12. Dry fruits weight per ha. (q.)
13. Number of seeds per fruit
14. 1000 seed weight (g)

C. Phenological parameter

1. Leaf shape and size.
2. Shape and size of fruits.
3. Fruits colour
4. Fruit position per habit
5. Plant type

3.7.1 Growth parameters

3.7.1.1 Plant height (cm)

The height of five randomly selected plants was measured at 30, 60, 90, 120 DAT and at maturity from the base of plant to the tip of the plant with the help of meter scale. The average was worked out.

3.8.1.2 Number of primary branches per plant

Numbers of primary branches per plant were recorded under each treatment at 30, 60, 90, 120 and at maturity DAT from randomly selected five plants and the average was calculated.

3.7.1.3 Number of secondary branches per plant

Numbers of secondary branches per plant were recorded under each treatment at 30, 60, 90, 120 and at maturity DAT from randomly selected five plants and the average was calculated.

3.7.1.4 Days to first flower initiation.

Number of days taken from transplanting to the appearance of first flower on the plant in a plot was recorded. Data was recorded on plot basis.

3.7.1.5 Days of 50% flowering

Number of days required for 50% flowering after sowing were recorded under each treatment and replications.

3.7.1.6 Days to first picking of fruits.

The number of days taken from sowing to the date of first picking was calculated for each treatment and the mean values were determined.

3.7.2 Yield parameters

3.7.2.1 Days to first fruit initiation

The days taken from sowing to the date of first fruit initiation was calculated for each treatment and the mean values were determined.

3.7.2.2 Number of fruits per cluster

Number of fruits was counted on each cluster, 5 clusters were taken on each selected plants.

3.7.2.3 Fruit width (cm)

The fruit width of the selected five mature fruits was measured by the Vernier calipers in centimeter taken from each treatment and the average girth of the fruit was calculated.

3.7.2.4 Fruit length (cm)

The fruit length of five mature fruits of a plant from each plot was recorded and then average fruit length was tabulated.

3.7.2.5 Number of fruits per plant

Number of Mature green fruits that harvested from each picking in the tagged plants were counted and recorded till the final harvest. The average number of fruits per plant was calculated and expressed as number of fruits per plant.

3.7.2.6 Days to maturity

Number of days from the date of transplanting to the date of physiological maturity of the plant in a plot.

3.7.2.7 Fresh weight of fruits per plant (g)

The fresh fruit chilli of selected plants were picked and weighed and fresh five fruits weight was tabulated.

3.7.2.8 Fresh weight of fruits per plot (kg)

The fresh fruit chilli of selected plants were picked and weighed and fresh five plants fruits weight was tabulated.

3.7.2.9 Fresh weight of fruits per ha. (q.)

The fresh fruit chilli of each plots were picked and weighed and calculated from 1 hac. Plant density and tabulated them.

3.7.2.10 Dry weight of fruits per plant (g)

The dry weight of fruit per plant of all the harvests per plant was taken and expressed in grams.

3.7.2.11 Dry fruits weight per plot (kg)

The dry weight of fruit per plot of all the harvests fruits randomly selected plants was taken and expressed in kilo grams.

3.7.2.12 Dry fruits weight per ha. (q.)

The dry yield of fruits per plant recorded was expressed in quintal per hectare.

3.7.2.13 Number of seeds per fruit

The fully matured fruits were harvested and counted their seeds from randomly selected fruits.

3.7.2.14 1000 seed weight (g)

The 1000 seeds were taken from each genotype of selected plants were weighed.

3.7.3 Phenological parameter

3.7.3.1 Leaf shape and size

Recorded at full foliage stage (see figure on page 49)

- Deltoid
- Ovate
- Lanceolate
- Others

Recorded at full foliage stage

- Small
- Medium
- Large
- Others

3.7.3.2 Shape and size of fruits

The shape of fruit was recorded in following categories.

- Straight
- Slightly curved
- Indefinitely curved

The size of fruit was recorded in following categories.

- Big
- Medium
- Small

3.7.3.3 Fruits colour

The colour of the fruits (fresh) was recorded at marketable stage in following categories.

- Dark green
- Green
- Light green
- Purple
- Yellowish green

3.7.3.4 Fruit position per habit

The fruit position per habit of the fruits (fresh) was recorded at harvesting stage in following categories.

3.7.3.5 Plant type

- Bushy
- Tall

3.8 Statistical analysis

The data obtained in respect of all the characters have been subjected to the following statistical analysis.

3.8.1 Mean: It was calculated by using following formula.

$$\text{Mean} = \frac{\Sigma x}{N}$$

Where,

Σx = The sum of all the observation

N = Number of observation

3.8.2 Analysis of variance

The data based on the mean of individual plants selected for observation were statistically analysed described by Panse and Sukhatme (1985) to find out overall total variability present in the material under study for each character and for all the populations. The first and foremost step is to carry out analysis of variance to test the significance of differences among the populations. The skeleton of analysis of variance used is given below.

Table 3.6: ANOVA for completely randomized block design

Source of Variation	**d.f.**	**Sum of Square**	**Mean sum of square**	**F value**	**F_t 5% or 1% table value**
Replication	r-1	RSS	RMS	RMSperEMS	-
Hybrids	g-1	GSS	GMS	GMSperEMS	-
Error	(r-1)(g-1)	ESS	EMS	-	-
Total	**rg-1**	**TSS**	**-**	**-**	**-**

Where,

r = Number of replications

g = Number of hybrids

D.F. = Degree of freedom

RSS = Replication sum of square

GSS = Hybrid sum of square

ESS = Error sum of square

TSS =Total sum of square

RMS = Replication mean sum of square

GMS = Hybrid mean sum of square

EMS = Error mean sum of square

A significant value of F test indicates that the test entries differ significantly among themselves, which requires computing C.D.

$$C.V. = \frac{\sqrt{EMS}}{GM} x100$$

$$SE\ m\pm = \sqrt{\frac{EMS}{r}}$$

$$SE\ \text{diff} = \sqrt{\frac{2\ EMS}{r}}$$

CD at 5% prob. Level = SE diff x $t_{5\%}$ table value

Where,

C.V. %	=	Coefficient of variation
SEm±	=	Standard error of means
S E diff	=	Standard error of difference
GM	=	Grand mean
C.D.	=	Critical difference
t 5%	=	t, table value 5% probability level at error d.f.

Estimation of mean, components of variance, phenotypic, genotypic and environmental coefficient of variation, heritability, genetic advance and genetic advance as percentage of mean:

The mean of different characters were calculated by conventional method:

$$\text{Mean} = \frac{\Sigma xi}{n}$$

Where,

Σx_i = The sum of all the observation for i^{th} character.

N = Number of observations.

Range was recorded by observing the lowest and the highest mean values for each character.

Table 3.7: The component of variance was calculated as follows:

S. No.	**Source**	**M.S.S.**	**Expected M.S.S.**
1.	Replication	-	-
2.	Genotypes	M_i	$\sigma^2 e\ i + r.\ \sigma^2 g\ i$
3.	Error	E_i	$\sigma^2 e\ i$

$$\sigma^2 g_i = \frac{M_i - E_i}{r}$$

$$\sigma^2 e_i = E_i$$

$$\sigma^2 p_i = \sigma^2 g_i + \sigma^2 e_i$$

Where,

$\sigma^2 g_i$ = Genotypic variance for i^{th} character.

$\sigma^2 e_i$ = Environmental variance for i^{th} character.

$\sigma^2 p_i$ = Phenotypic variance for i^{th} character.

Phenotypic and genotypic coefficient of variation (expressed in %) were calculated by using the formula given by Burton (1952). Genotypic coefficient of variation (GCV) was calculated as below:

$$GCV\% = \frac{\sqrt{\sigma^2 g_i}}{\bar{X}_i} \times 100$$

Phenotypic coefficient of variation (PCV)

$$PCV\% = \frac{\sqrt{\sigma^2 p_i}}{\bar{X}_i} \times 100$$

Where,

$\bar{X}_i$ = General mean of the i^{th} character under consideration

$\sigma^2 g_i$ and $\sigma^2 p_i$ = Genotypic and phenotypic standard deviation of the i^{th} character respectively

Heritability and genetic advance

Heritability (broad sense) which is ratio of genotypic variance to the total phenotypic variance is symbolized as h^2 (BS) and expressed in percentage. Estimation of heritability was done as per the formula given by Hanson *et al*. (1956).

$$h^2 \text{ (BS)} = \frac{\sigma^2 g_i}{\sigma^2 p_i} \times 100$$

or

$$= \frac{\text{Genotypic variance of the } i^{th} \text{ character}}{\text{Phenotypic variance of the } i^{th} \text{ character}}$$

Expected genetic advance was calculated by using the method suggested by Johnson *et al*. (1955) at 5% selection intensity.

Genetic advance (GA) = K. P_i .h^2_i

Genetic advance as percentage of mean was calculated as follows:

$$\frac{\text{Genetic advance}}{\bar{X}_i}$$

Where,

K= Selection intensity its value at 5% selection level is 2.06

P_i = Phenotypic standard deviation of the i^{th} character

h^2_i = Broad sense heritability (fraction) of the i^{th} character

$\bar{X}_i$ = General mean of the i^{th} character under consideration

Correlation coefficients

Correlation coefficients were calculated in all possible combinations taking all the characters in to consideration at genotypic, phenotypic and environmental levels by using the formula as proposed by Miller *et al.* (1958).

$$r = \frac{\sum xy - \frac{\sum x \times \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$

Where,

r	=	Correlation coefficient
n	=	Number of treatments
X and Y	=	Character under study

Genotypic, phenotypic and environmental correlations were computed by substituting corresponding variance and covariance in the above formula, e.g.

$$rG\ (Xi\ Xj) = \frac{G\ Cov\ (Xi\ Xj)}{\sqrt{VG\ (Xi).\ VG\ (Xj)}}$$

$$rP\ (Xi\ Xj) = \frac{P\ Cov\ (Xi\ Xj)}{\sqrt{VP\ (Xi).\ VP\ (Xj)}}$$

$$rE\ (Xi\ Xj) = \frac{E\ Cov\ (Xi\ Xj)}{\sqrt{VE\ (Xi).\ VE\ (Xj)}}$$

Testing of correlations

The phenotypic correlations are tested for their significance by following formula based on “t” test:

$$tc = r\sqrt{\frac{n-2}{(1-R2)}} \quad \text{at (n-2) d.f.}$$

Where,

N= Number of treatments.

R= phenotypic correlations coefficient.

The calculated value of "t" is compared with table of "t" at (n-2) d.f. If the calculated value is equal to or greater than table value, it is significant at given probability level. If $t_c < t_T$, it is non significant.

Path coefficient analysis:

The proportion of direct and indirect contributions of various characteristics to the total correlation coefficients with seed yield was estimated through path coefficient analysis as suggested by Wright (1921, 1934) and elaborated by Dewey and Lu (1959).

Path coefficient is a standardized partial regression, which measures the direct influence of one variable upon another and allows partition of correlation coefficient into components of direct and indirect effects.

To estimate various direct and indirect effects, the following set of simultaneous equations were formed and solved.

$r_{1y} = P_{1y} + r_{12}P_{2y} + r_{13}P_{3y} + \dots + r_{1l}P_{ly}$

$r_{2y} = r_{2y}P_{1y} + P_{2y} + r_{23}P_{3y} + \dots + r_{2l}P_{ly}$

$r_{ly} = r_{l1}P_{1y} + r_{l2}P_{2y} + r_{l3}P_{3y} + \dots + P_{ly}$

Where,

r_{1y} to r_{ly} = Coefficient of correlation between causal factor 1 to I and dependent character y,

r_{12} to $r_{l-1,l}$ = Coefficient of correlation among causal factors themselves, and

P_{1y} to P_{ly} = Direct effects of characters 1 to I on character y.

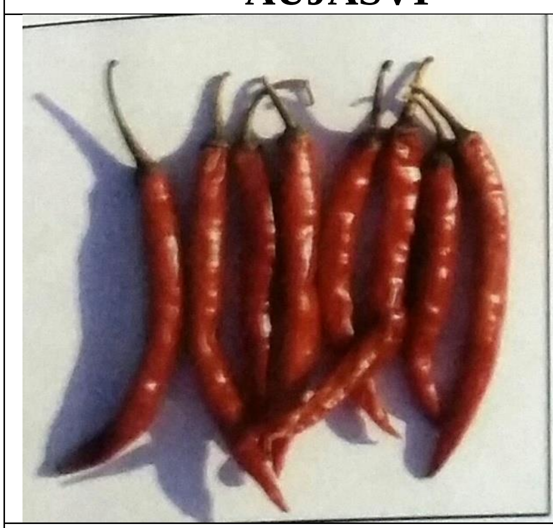
Residual effect, which measures the contribution of the characters not considered in the causal scheme, was obtained as:

Residual effect (P_{RY}) = $\sqrt{1 - R^2}$

Where,

$$R^2 = \sum_{iy} P_i^2 Y + 2 \sum_{\substack{i \neq j \\ i > j}} P_{iy}\, P_{jy}\, R_{ij}$$

Varieties of Chilli

	
AUJASVI	**AMRITA**
	
US 611	**TS 0017**

	
TIGER	**US 612**

CHAPTER - IV

RESULTS

The results obtained from the present investigation entitle "Assessment of Morphological, Fruit Yield and Quality Characters in Hybrid Chilli (*Capsicum annum* L.)" are presented under the following heads:

4.1 Analysis of variance

The analysis of variances for all the characters studied has been presented in Appendix – I to III. Mean squares due to genotypes were highly significantly for all the characters, indicating that the presence of genetic diversity in the existing material.

4.1.1 Mean and range performance of the genotypes

Range and mean performance (Minimum and Maximum) of the ten genotypes of chilli for all the thirty three characters are presented in the table 4.1, 4.2,4.3, 4.4,4.5 and 4.6

4.1.1.1 Plant height (cm)

Plant height varied from 21.97 to 33.33 cm, 38.33 to 64.67 cm, 60.67 to 85.00 cm, 62.33 to 97.00 cm and 64.67 to 97.00 cm with overall mean performance of 28.32, 49.70, 71.13, 76.34 and 76.98 cm at 30, 60, 90, 120 DAT and at maturity, respectively. Hybrid Amrita was observed the tall plant 33.33, 64.67, 85.00, 97.00, and 97.00 cm and genotype S-586 was recorded the dwarf plant with height of 21.97, 38.33, 60.67, 62.33, and 64.67 cm at 30, 60, 90, 120 DAT and at maturity, respectively.

4.1.1.2 Number of primary branches per plant

Range of number of primary branches per plant was 3.67 to 6.00, 7.33 to 12.67, 8.67 to 16.67, 13.33 to 23.00 and 13.33 to 23.00 with an a mean performance of 4.80, 10.30, 13.11, 18.39 and 18.39 at 30, 60, 90, 120 and at maturity, respectively. Maximum number of primary branches 6.00, 12.67, 16.67, 23.00 and 23.00 per plant was observed in hybrid Amrita, while it as recorded minimum in hybrid (S-586) 3.67, 7.33, 8.67, 13.33 and 13.33 at 30, 60, 90, 120 DAT and at maturity, respectively.

4.1.1.3 Number of secondary branches per plant

Range of number of secondary branches per plant was 7.33 to 18.00, 16.00 to 30.67, 25.00 to 41.00, 33.67 to 51.00 and 35.33 to 51.00 with an a mean performance of 14.99, 24.91, 34.89, 40.78 and 42.50 at 30, 60, 90, 120 and at maturity, respectively. Maximum number of secondary branches 18.00, 30.67, 41.00, 51.00 and 51.00 per plant was observed in hybrid Amrita, while it as recorded minimum in hybrid (S-586) 7.33, 16.00, 25.00, 33.67 and 35.33 at 30, 60, 90, 120 DAT and at maturity, respectively.

4.1.1.4 Days to first flower initiation

Early first flower initiation was recorded in Amrita (32.33 days) and hybrid S-586 exhibited in late initiation of first flowering (48.00 days). The overall mean performance of 39.22 days and it was range from 32.33 to 48.00 days.

4.1.1.5 Days to 50% flowering

Days to 50% flowering varied from 62.19 to 70.19 days with overall mean performance to 66.14 days. Hybrid Amrita was recorded the early days to 50% flowering 62.19 days, therefore, hybrid S-586 exhibited in late group which is maximum days to 50% flowering 70.19 days.

4.1.1.6 Days to first picking of fruits

Days to first picking of fruits ranged from 71.19 to 79.19 days with a mean of 75.14 days. Hybrid Amrita was recorded the early first picking in 71.19 days, therefore, hybrid S-586 exhibited in late picking of fruits 79.19 days.

4.1.1.7 Days to first fruit initiation

Days to first fruit initiation varied from 67.52 to 75.52 days with overall mean performance to 71.47 days. Hybrid Amrita was recorded the early fruit initiation in 67.52 days, therefore, hybrid S-586 exhibited in late group which fruit initiation in 75.52 days.

4.1.1.8 Number of fruits per clusters

Number of fruits per cluster varied from 8.10 to 18.47 fruits per cluster and average was 13.12 fruits. The maximum 18.47 fruits per cluster were recorded in hybrid Amrita, while it was found minimum (8.10 fruits) in hybrid S-586.

4.1.1.9 Fruit width (cm)

Hybrid Amrita showed maximum fruit width (0.39 cm) and it was found minimum in hybrid S-586 (0.16 cm). The average for fruit width was 0.22 cm and it varied from 0.16 to 0.39 cm.

4.1.1.10 Fruit length (cm)

Hybrid Amrita showed maximum fruit length (7.69 cm) and it was found minimum in hybrid S-586 (3.37 cm). The average for fruit length was 5.16 cm and it varied from 3.37 to 7.69 cm.

4.1.1.11 Number of fruits per plant

Number of fruits per plant varied from 86.00 to 146.00 fruits per plant and average was 108.41 fruits. The maximum 146.00 fruits per plant were recorded in hybrid Amrita, while it was found minimum (86.00 fruit) in hybrid S-586.

4.1.1.12 Days to maturity

Days to maturity range between 145.71 to 164.21 days with a overall mean performance of 154.78 days. Early maturity was obtained under the hybrid Smriti (145.71 days) and late in the Tara (164.21 days).

4.1.1.13 Fresh fruit yield per plant (g)

Hybrid Tara was recorded maximum fresh fruit yield per plant (692.39 g) followed by TS-0017 (635.51 g) and Jwala garima-12 (616.55 g). Whereas, it was recorded minimum in Smriti (385.58 g). The average yield per plant was 501.41 g and it ranged from 385.58 to 692.39 g.

4.1.1.14 Fresh fruits yield per plot (kg)

hybrid Tara was recorded maximum fresh fruits yield per plot (20.77 kg) followed by TS-0017 (19.07 kg) and Jwala garima- 12 (18.50 kg). Whereas, it was recorded minimum in Smriti (11.57 kg). The average yield per plot was 15.04 kg and it ranged from 11.57 to 20.77 kg.

4.1.1.15 Fresh fruits yield per ha (q)

Hybrid Tara was recorded maximum fresh fruits yield per ha (276.95 q) followed by TS-0017 (254.20 q) and Jwala garima- 12 (246.62 q). Whereas, it was recorded minimum in Smriti (154.23 q). The average yield per ha was 200.57 q and it ranged from 154.23 to 276.95 q.

4.1.1.16 Dry fruits yield per plant (g)

Hybrid Tara was recorded maximum dry fruit yield per plant (230.80 g) followed by TS-0017 (211.84 g) and Jwala Garima- 12 (205.51 g). Whereas, it was recorded minimum in Smriti (128.53 g). The average dry fruit yield per plant was 167.14 g and it ranged from 128.53 to 230.80 g.

4.1.1.17 Dry fruits yield per plot (kg)

Dry fruits yield per plot varied from 3.86 to 6.92 kg with an overall mean performance of 5.01 kg. Highest 6.92, 6.36, 6.17 and 5.74 kg dry fruits yield per plot were recorded in Hybrid Tara, TS-0017, Jwala garima-12 and P. jyoti, respectively and which were at par with each other. However lowest 3.86 kg dry fruits yield per plot exhibited in Smriti.

4.1.1.18 Dry fruit yield per ha (q)

Highest 92.32 q per ha, 84.73 q per ha, 82.21 q per ha and 76.51 q per ha were recorded in hybrid Tara, TS-0017, Jwala garima-12 and P. jyoti, respectively and which were at par with each other. However lowest 51.41 q per ha dry fruits yield per ha exhibited in Smriti.

4.1.1.19 Number of seeds per fruit

Number of seed per fruit varied from 22.67 to 37.00 with the average performance of 28.37 seed. Hybrid Tiger was observed the maximum seeds per fruit (37.00), while it was noted minimum (22.67) in hybrid Marshal 1857 and Shourya.

4.1.1.20 1000 seed weight (g)

1000 seed weight varied from 7.56 to 12.33 g with an overall mean performance of 9.46 g. Hybrid Tiger was recorded maximum 1000 seed weight (12.33 g), while was showed minimum in hybrid Shourya (7.56 g).

Table 4.1 Mean performance of Chilli hybrids for growth characters

Character	Plant Height (cm) 30 DAT	Plant Height (cm) 60 DAT	Plant Height (cm) 90 DAT	Plant Height (cm) 120 DAT	Plant Height (cm) Maturity
Smriti	22.67	42.27	63.00	68.33	70.00
Aujasvi	28.67	45.40	65.50	69.67	70.50
Shourya	26.17	46.27	65.67	70.00	70.67
Albeli-333	29.67	46.50	66.90	70.50	71.67
Ujjala	27.67	47.33	68.00	73.00	73.00
Tiger	29.00	49.67	70.33	73.67	73.67
ARCH 930	30.33	54.33	78.00	83.00	83.00
US 612	32.33	59.00	80.67	89.00	89.00
US 611Tara	33.33	62.33	82.00	91.00	91.00
Marshal 1857	24.50	40.50	61.00	65.00	66.67
Saniya (03)	29.33	49.83	73.00	75.33	75.33
Jalsa	30.67	53.33	77.33	82.67	82.67
S-586	21.97	38.33	60.67	62.33	64.67
Amrita	33.33	64.67	85.00	97.00	97.00
P. jyoti	30.00	51.67	76.00	81.33	81.33
Jwala garima-12	30.00	58.00	80.00	85.67	85.67
TS-0017	24.67	40.67	62.33	67.00	69.60
Tara	25.50	44.40	65.00	69.60	70.33
Mean	**28.32**	**49.69**	**71.13**	**76.34**	**76.99**
S.Em.	0.78	0.81	1.05	1.61	1.17
C.D. at 5%	2.25	2.33	3.02	4.63	3.37
Range Lowest	21.97	38.33	60.67	62.33	64.67
Range Highest	33.33	64.67	85.00	97.00	97.00

Table 4.2 Mean performance of Chilli hybrids for growth characters

Character	Primary Branches per Plant 30 DAT	Primary Branches per Plant 60 DAT	Primary Branches per Plant 90 DAT	Primary Branches per Plant 120 DAT	Primary Branches per Plant Maturity
Smriti	4.33	8.67	10.67	15.00	15.00
Aujasvi	4.33	9.00	11.33	16.33	16.33
Shourya	4.67	10.00	12.33	18.00	18.00
Albeli-333	4.67	10.33	12.33	18.00	18.00
Ujjala	4.67	10.33	12.67	18.33	18.33
Tiger	4.67	10.67	14.00	18.67	18.67
ARCH 930	5.33	11.67	15.00	21.67	21.67
US 612	5.33	12.00	16.00	22.00	22.00
US 611Tara	5.67	12.33	16.67	22.00	22.00
Marshal 1857	4.00	7.67	9.33	14.00	14.00
Saniya (03)	5.00	10.67	14.33	19.00	19.00
Jalsa	5.00	11.33	14.67	21.00	21.00
S-586	3.67	7.33	8.67	13.33	13.33
Amrita	6.00	12.67	16.67	23.00	23.00
P. jyoti	5.00	11.33	14.67	20.00	20.00
Jwala garima-12	5.33	11.67	15.67	21.67	21.67
TS-0017	4.33	8.67	10.00	14.00	14.00
Tara	4.33	9.00	11.00	15.00	15.00
Mean	**4.80**	**10.30**	**13.11**	**18.39**	**18.39**
S.Em.	0.32	0.79	0.55	0.66	0.66
C.D. 5%	0.93	2.27	1.58	1.90	1.90
Range Lowest	3.67	7.33	8.67	13.33	13.33
Range Highest	6.00	12.67	16.67	23.00	23.00

Table 4.3 Mean performance of Chilli hybrids for growth characters

Character	Secondary Branches per Plant 30 DAT	Secondary Branches per Plant 60 DAT	Secondary Branches per Plant 90 DAT	Secondary Branches per Plant 120 DAT	Secondary Branches per Plant Maturity
Smriti	14.33	19.00	27.67	35.33	36.67
Aujasvi	15.00	19.33	32.67	36.33	39.00
Shourya	15.00	25.33	35.00	37.67	40.67
Albeli-333	15.33	27.00	35.33	39.00	41.67
Ujjala	15.67	27.00	37.00	40.33	42.67
Tiger	15.67	27.67	37.67	41.00	43.00
ARCH 930	16.67	28.67	39.00	46.00	47.00
US 612	17.33	29.00	39.67	46.67	48.33
US 611Tara	17.33	30.67	40.00	48.33	49.00
Marshal 1857	9.00	17.00	26.33	33.67	36.00
Saniya (03)	16.00	28.00	37.67	41.67	43.33
Jalsa	16.33	28.67	38.33	45.33	46.67
S-586	7.33	16.00	25.00	33.67	35.33
Amrita	18.00	30.67	41.00	51.00	51.00
P. jyoti	16.33	28.00	38.00	41.67	43.67
Jwala garima-12	17.00	29.00	39.67	46.00	47.67
TS-0017	12.33	18.00	27.33	34.67	36.33
Tara	15.00	19.33	30.67	35.67	37.00
Mean	**14.98**	**24.91**	**34.89**	**40.78**	**42.50**
S.Em.	0.66	0.96	0.68	0.93	1.42
C.D. 5%	1.90	2.76	1.96	2.67	4.07
Range Lowest	7.33	16.00	25.00	33.67	35.33
Range Highest	18.00	30.67	41.00	51.00	51.00

Table 4.4 Mean performance of Chilli hybrids for yield characters

Character	Days to First Picking of Fruits	Days of 50% Flowering	Days to First Fruit Initiation	Fruits per Cluster	Days to First Flower Initiation
Smriti	77.19	68.19	73.52	10.47	44.67
Aujasvi	76.19	67.19	72.52	12.43	43.33
Shourya	75.69	66.69	72.02	12.47	43.00
Albeli-333	75.58	66.58	71.91	12.47	39.67
Ujjala	75.19	66.19	71.52	12.50	37.00
Tiger	75.19	66.19	71.52	13.47	36.67
ARCH 930	74.03	65.03	70.37	14.48	35.33
US 612	72.03	63.03	68.37	16.47	34.33
US 611Tara	71.58	62.58	67.91	17.80	33.33
Marshal 1857	77.58	68.58	73.91	8.37	46.67
Saniya (03)	75.03	66.03	71.37	13.47	36.33
Jalsa	74.58	65.58	70.91	14.47	35.67
S-586	79.19	70.19	75.52	8.10	48.00
Amrita	71.19	62.19	67.52	18.47	32.33
P. jyoti	75.03	66.03	71.37	13.47	35.67
Jwala garima-12	73.19	64.19	69.52	16.43	35.33
TS-0017	77.58	68.58	73.91	9.47	45.33
Tara	76.53	67.53	72.87	11.40	43.33
Mean	**75.14**	**66.14**	**71.47**	**13.12**	**39.22**
S.Em.	0.54	0.54	1.82	0.90	1.46
C.D. 5%	1.55	1.55	5.22	2.58	4.19
Range Lowest	71.19	62.19	67.52	8.10	32.33
Range Highest	79.19	70.19	75.52	18.47	48.00

Table 4.5 Mean performance of Chilli hybrids for yield characters

Character	Fruit Width (cm)	Fruit Length (cm)	Fruits per Plant	Days to Maturity	Fruit Fresh Weight Plant (g)
Smriti	0.17	4.27	92.00	145.71	385.58
Aujasvi	0.18	4.38	98.00	146.61	394.52
Shourya	0.19	4.40	100.00	147.41	403.46
Albeli-333	0.19	4.71	103.00	148.51	412.40
Ujjala	0.19	5.38	105.00	149.61	421.34
Tiger	0.19	5.43	108.00	149.91	439.22
ARCH 930	0.24	5.75	119.00	151.61	448.16
US 612	0.29	6.17	130.00	152.11	461.57
US 611Tara	0.30	7.15	134.00	153.41	470.51
Marshal 1857	0.16	3.40	88.00	155.81	512.27
Saniya (03)	0.20	5.51	109.00	157.61	517.01
Jalsa	0.22	5.75	115.00	158.51	531.23
S-586	0.16	3.37	86.00	159.81	545.45
Amrita	0.39	7.69	146.00	160.61	564.41
P. jyoti	0.21	5.61	112.00	161.01	573.89
Jwala garima-12	0.29	5.92	121.00	161.61	616.55
TS-0017	0.16	3.72	90.00	161.91	635.51
Tara	0.17	4.38	95.33	164.21	692.39
Mean	**0.22**	**5.16**	**108.41**	**154.78**	**501.41**
S.Em.	0.03	0.07	0.76	2.02	54.17
C.D. 5%	0.10	0.20	2.18	5.81	155.70
Range Lowest	0.16	3.37	86.00	145.71	385.58
Range Highest	0.39	7.69	146.00	164.21	692.39

Table 4.6 Mean performance of Chilli hybrids for yield characters

Character	Fruit Fresh Weight per Plot (kg)	Fruit Fresh Weight per ha. (q.)	Fruit Dry Weight per Plant (g)	Fruit Dry Weight per Plot (kg)	Fruit Dry Weight per ha. (q.)	Seeds per Fruit	1000 Seed Weight (g)
Smriti	11.57	154.23	128.53	3.86	51.41	27.67	9.22
Aujasvi	11.83	157.81	131.50	3.94	52.60	26.33	8.78
Shourya	12.10	161.38	134.49	4.04	53.80	22.67	7.55
Albeli-333	12.37	164.96	137.47	4.12	54.99	26.67	8.89
Ujjala	12.64	168.53	140.44	4.21	56.18	34.67	11.55
Tiger	13.17	175.69	146.41	4.39	58.56	37.00	12.33
ARCH 930	13.44	179.26	149.38	4.48	59.75	30.33	10.11
US 612	13.85	184.63	153.85	4.62	61.54	32.33	10.78
US 611Tara	14.12	188.20	156.84	4.71	62.74	28.00	9.33
Marshal 1857	15.37	204.91	170.76	5.12	68.30	22.67	7.55
Saniya (03)	15.51	206.80	172.33	5.17	68.93	23.33	7.78
Jalsa	15.94	212.49	177.07	5.31	70.83	25.33	8.44
S-586	16.36	218.18	181.81	5.45	72.73	27.00	9.00
Amrita	16.93	225.76	188.14	5.64	75.25	29.00	9.67
P. jyoti	17.22	229.55	191.29	5.74	76.52	30.00	10.00
Jwala garima-12	18.50	246.62	205.51	6.17	82.21	27.00	9.00
TS-0017	19.07	254.20	211.84	6.36	84.73	26.67	8.89
Tara	20.77	276.95	230.80	6.92	92.32	34.00	11.33
Mean	**15.04**	**200.56**	**167.14**	**5.01**	**66.85**	**28.37**	**9.46**
S.Em.	1.63	21.67	18.06	0.54	7.22	0.69	0.23
C.D. 5%	4.67	62.28	51.90	1.56	20.76	1.98	0.66
Range Lowest	11.57	154.23	128.53	3.86	51.41	22.67	7.55
Range Highest	20.77	276.95	230.80	6.92	92.32	37.00	12.33

4.2 Genetic Variability :

Environmental coefficient of variation (ECV), Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV)

The PCV was higher in its corresponding GCV and ECV for all the parameters under present study. Data pertaining to genetic parameters are presented in Table 4.7.

4.2.1 Genotypic coefficient of variation (GCV)

The highest GCV value was recorded for fruits width cm (23.99 %), while moderate for fruit length cm (23.10 %), fruits per cluster (21.54 %), secondary branches per plant at 60 DAT (20.30 %), primary branches per plant 90 DAT (18.90 %), secondary branches per plant 30 DAT (18.25 %), primary branches per plant maturity (16.83 %),primary branches per plant 120 DAT (16.83 %), plant height (cm) 60 DAT (15.37 %), fruits per plant (15.45 %), secondary branches per plant 90 DAT (14.98 %), fruit fresh weight plant (g), Fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.) (14.37 %), seeds per fruit, 1000 seed weight (g) (14.16 %), primary branches per plant 60 DAT (13.46 %), secondary branches per plant 120 DAT (13.11 %), plant height (cm) 120 DAT (12.76 %), days to first flower initiation (12.26 %), plant height (cm) maturity (11.90 %), plant height (cm) 30 DAT (11.74 %), plant height (cm) 90 DAT (11.09 %), secondary branches per plant maturity (11.32), primary branches per plant 30 DAT (10.42), days to maturity (3.68 %), days of 50% flowering (3.16 %), days to first picking of fruits (2.78 %) and days to first fruit initiation (1.64 %).

4.2.2 Phenotypic coefficient of variation (PCV)

The highest PCV value was recorded for fruits width cm (36.00 %), while moderate for fruits per cluster (24.59 %), fruit fresh weight per plot (kg), fruit dry weight per plot (kg) (23.60 %), fruit fresh weight plant (g), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per ha. (q.) (23.59 %), Fruit length cm (23.22 %),

Low value for PCV was recorded for days to first fruit initiation (4.69 %), days to maturity (4.32 %), days to 50 % flowering (3.46 %) and days to first fruit picking (3.05 %).

4.2.3 Environmental coefficient of variation (PCV)

The highest ECV value was recorded for fruits width cm (26.85 %), while moderate for fruit fresh weight per plot (kg), fruit dry weight per plot (kg) (18.72 %), fruit fresh weight per plant (g), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per ha (q) (18.71 %).

Low value for ECV was recorded for plant height (cm) at 60 DAT (2.83 %), plant height (cm) at 90 DAT (2.56 %), days to maturity (2.26 %), Days to 50 % flowering (1.41 %), days to first fruit picking (1.24 %) and fruits per plant (1.21 %).

4.3. Heritability

Estimates with regard to heritability (broad sense) have been presented in Table 4.7. Heritability estimates varied from parameter to parameter and also with the change in environment for the same parameters. Therefore heritability estimates in broad sense were classified into three groups: - High more than 80, medium 50 to 80 and low less than 50.

Heritability estimates in broad sense were high for plant height (cm) 30 DAT (86 %), plant height (cm) 60 DAT (97 %), plant height (cm) 90 DAT (95 %), plant height (cm) 120 DAT (92 %), plant height (cm) maturity (95 %), primary branches per plant 90 DAT (87 %), primary branches per plant 120 DAT (88 %), primary branches per plant maturity (88 %), secondary branches per plant 30 DAT (85 %), secondary branches per plant 60 DAT (90 %), secondary branches per plant 90 DAT (95 %), secondary branches per plant 120 DAT (92 %), days to first picking of fruits (83 5), fruit length (cm) (99 %), fruits per plant (99 %), seeds per fruit (92 %),1000 Seed Weight (g) (92 %).

Heritability estimates in broad sense were medium for Primary Branchesper Plant 60 DAT (51 %), Secondary Branches per Plant Maturity (79 %), Days to First Flower Initiation (78 %), Fruits per cluster (77 %), Days to maturity (73 %).

Heritability estimates in broad sense were low for primary branches per plant 30 DAT (44 %), fruit width (44 %), days to maturity, fruit fresh weight plant (g), fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.) (37 %).

4.4 Genetic advance

High value of genetic advance was recorded for Fruit Fresh weight plant (g) (90.39) followed by Fruit Fresh weight per ha. (q) (36.16), Fruit per plant (34.40), Fruit Dry weight per plant (g) (30.13), Plant Height (cm) 120 DAT (19.29), Plant Height (cm) Maturity (18.42), Plant Height (cm) 90 DAT (15.83) and Plant Height (cm) 60 DAT (15.47).

4.5 Genetic advance as percentage of mean

Genetic advance was computed as percentage as mean of the parameter over environment. It has been classified as high (more than 40), medium (25 to 40) and low (less than 25).

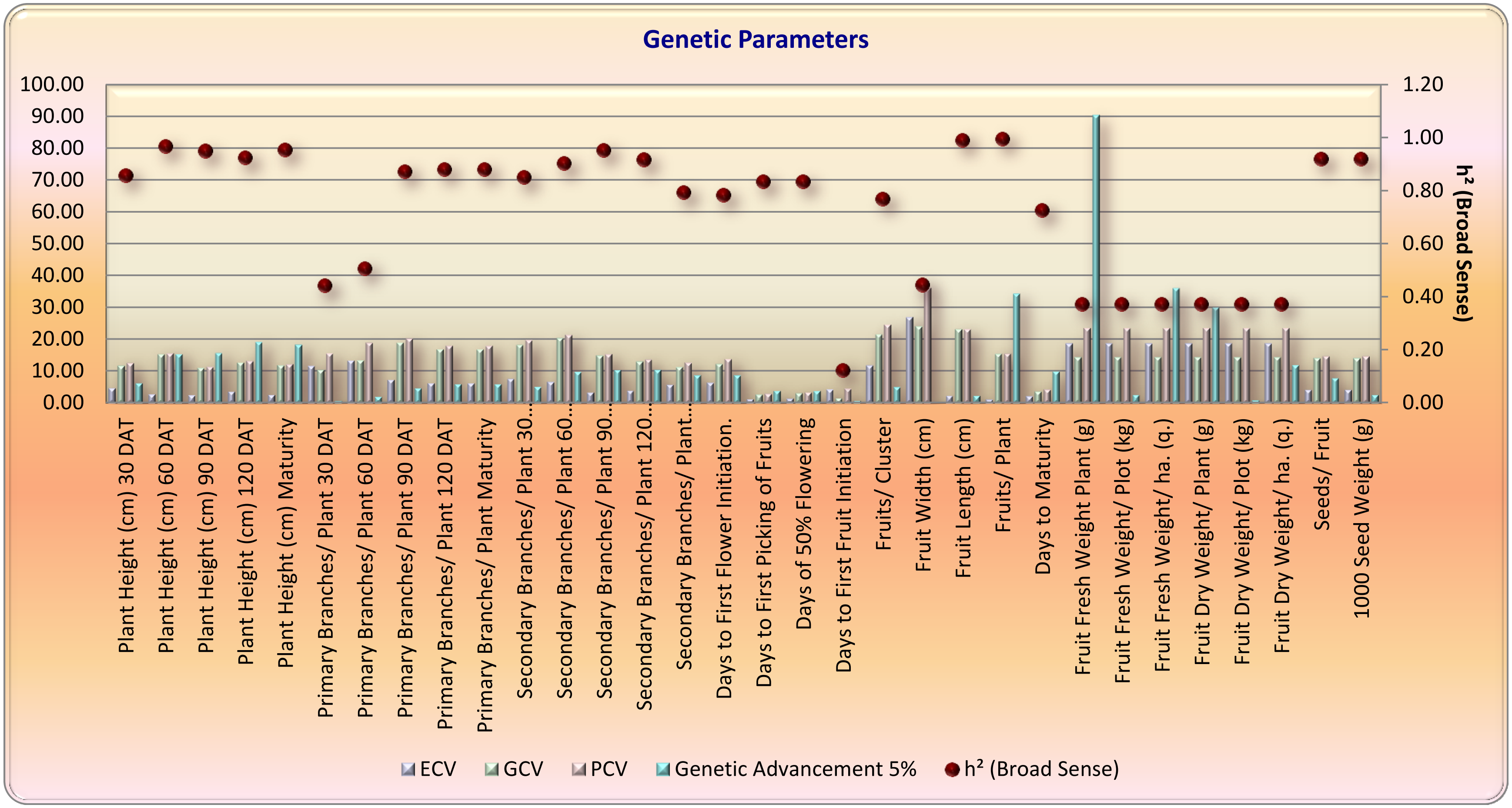
Medium value of genetic advance as percentage of mean was recorded for plant height (cm) 60 DAT (31.13 %), plant height (cm) 120 DAT (25.27 %), primary branches per plant 90 DAT (36.34 %), primary branches per plant 120 DAT (32.51 %), primary branches per plant maturity (32.51 %), secondary branches per plant 30 DAT (34.68 %), secondary branches per plant 60 DAT (39.73 %), secondary branches per plant 90 DAT (30.05 %), secondary branches per plant 120 DAT (25.85 %), fruits per cluster (38.88 %), fruit width (cm) (32.92 %), fruit length (cm) (47.34 %), fruits per plant (31.73 %), seeds per fruit (27.96 %) and 1000 seed weight (g) (27.97 %).

Low value of genetic advance as percentage of mean was recorded for plant height (cm) 30 DAT (22.38 %), plant height (cm) 90 DAT (22.25 %), plant height (cm) maturity (23.93 %), primary branches per plant 30 DAT (14.27 %), primary branches per plant 60 DAT (19.72 %), secondary branches per plant maturity (20.76 %), days to first flower initiation (22.35 %), days to first picking of fruits (5.24 %), days of 50% flowering (5.95 %), days to first fruit initiation (1.18 %), days to maturity (6.45 %), fruits fresh weight per plant (g) (18.03 %),fruits fresh weight per plot (kg) (18.02 %), fruits fresh weight per ha. (q.) (18.03 %), fruits dry weight per plant (g) (18.03 %), fruit dry weight per plot (kg) (18.02 %) and fruit dry weight per ha. (q.) (18.03 %).

Table 4.7: Genetic parameters of fruit yield and its attributing characters in chilli hybrids

	General Mean	PCV	GCV	ECV	Heritability (Broad Sense) %	Genetic Advance 5%	Gen. Adv as % of Mean 5%
Plant Height (cm) 30 DAT	28.32	12.68	11.74	4.80	86	6.34	22.38
Plant Height (cm) 60 DAT	49.69	15.62	15.37	2.83	97	15.47	31.13
Plant Height (cm) 90 DAT	71.13	11.38	11.09	2.56	95	15.83	22.25
Plant Height (cm) 120 DAT	76.34	13.28	12.76	3.66	92	19.29	25.27
Plant Height (cm) Maturity	76.99	12.19	11.90	2.64	95	18.42	23.93
Primary Branches per Plant 30 DAT	4.80	15.67	10.42	11.70	44	0.68	14.27
Primary Branches per Plant 60 DAT	10.30	18.93	13.46	13.31	51	2.03	19.72
Primary Branches per Plant 90 DAT	13.11	20.25	18.90	7.27	87	4.76	36.34
Primary Branches per Plant 120 DAT	18.39	17.95	16.83	6.23	88	5.98	32.51
Primary Branches per Plant Maturity	18.39	17.95	16.83	6.23	88	5.98	32.51
Secondary Branches per Plant 30 DAT	14.98	19.79	18.25	7.65	85	5.20	34.68
Secondary Branches per Plant 60 DAT	24.91	21.37	20.30	6.68	90	9.89	39.73
Secondary Branches per Plant 90 DAT	34.89	15.33	14.95	3.38	95	10.48	30.05
Secondary Branches per Plant 120 DAT	40.78	13.69	13.11	3.95	92	10.54	25.85
Secondary Branches per Plant Maturity	42.50	12.71	11.32	5.78	79	8.82	20.76
Days to First Flower Initiation	39.22	13.85	12.26	6.44	78	8.77	22.35
Days to First Picking of Fruits	75.14	3.05	2.78	1.24	83	3.94	5.24
Days of 50% Flowering	66.14	3.46	3.16	1.41	83	3.94	5.95
Days to First Fruit Initiation	71.47	4.69	1.64	4.40	12	0.84	1.18
Fruits per Cluster	13.12	24.59	21.54	11.85	77	5.10	38.88
Fruit Width (cm)	0.22	36.00	23.99	26.85	44	0.07	32.92
Fruit Length (cm)	5.16	23.22	23.10	2.38	99	2.44	47.34
Fruits per Plant	108.41	15.50	15.45	1.21	99	34.40	31.73
Days to Maturity	154.78	4.32	3.68	2.26	73	9.98	6.45
Fruit Fresh Weight Plant (g)	501.41	23.59	14.37	18.71	37	90.39	18.03
Fruit Fresh Weight per Plot (kg)	15.04	23.60	14.37	18.72	37	2.71	18.02
Fruit Fresh Weight per ha. (q.)	200.56	23.59	14.37	18.71	37	36.16	18.03
Fruit Dry Weight per Plant (g)	167.14	23.59	14.37	18.71	37	30.13	18.03
Fruit Dry Weight per Plot (kg)	5.01	23.60	14.37	18.72	37	0.90	18.02
Fruit Dry Weight per ha. (q.)	66.85	23.59	14.37	18.71	37	12.05	18.03
Seeds per Fruit	28.37	14.77	14.16	4.20	92	7.93	27.96
1000 Seed Weight (g)	9.46	14.77	14.16	4.20	92	2.65	27.97

Fig 4.1: Genetic parameter of fruit yield and its attributing characters in chilli hybrids.



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4.6 Correlation coefficients

Correlation coefficients were worked out at phenotypic, genotypic and environmental levels for all possible combination of eleven yield and its attributing characters (Table 4.8). Results indicated that genotypic correlation coefficient, in general, were of higher magnitude than the corresponding phenotypic correlation coefficient for all the characters.

4.6.1 Genotypic Correlation Coefficients

4.6.1.1 Plant height (cm) at maturity

Plant height expressed positive correlation with primary branches per plant maturity (0.9436), secondary branches per plant maturity (1.0106), fruits per cluster (0.9971), fruit width (cm) (1.1327), fruit length (cm) (0.9616), fruits per plant (0.9906), days to maturity (0.2000) and seeds per fruit (0.1812). Negative association of this character was recorded with days of 50% flowering (-0.9985) and days to first fruit initiation (-1.6590)

4.6.1.2 Number of primary branches per plant at maturity

Correlation coefficient of number of primary branches per plant at maturity was observed positive with number of secondary branches per plant at maturity (1.0839), fruits per cluster (1.0033), fruit width (cm) (1.0036), fruit length (cm) (0.9634), fruits per plant (0.9696) and seeds per fruit (0.1862). Negative association of this character was recorded with days of 50% flowering (-1.0275), days to first fruit initiation (-1.6935) and days to maturity (-0.0377).

4.6.1.3 Number of secondary branches per plant at maturity

Correlation coefficient of number of secondary branches per plant at maturity was observed), fruits per cluster (1.0196), fruit width (cm) (1.1226), fruit length (cm) (0.9968), fruits per plant (1.0151), days to maturity (0.1013) and seeds per fruit (0.1871). Negative association of this character was recorded with days of 50% flowering (-1.0025), days to first fruit initiation (-2.1715)

4.6.1.4 Days to 50% flowering

Association of days to 50% flowering was exhibited positive with days to 1^{st} first fruit initiation (1.9904). Negative association of this character was recorded with fruit per clusters (-1.0861), fruit width (cm) (-1.1540), fruit length (cm) (-0.9898), fruits per plant (-1.0063), days to maturity (-0.0689) and seeds per fruit (-0.2415).

4.6.1.5 Days to first fruit initiation

Correlation coefficient of days to 1st fruit initiation was found positive and significant with days to maturity (0.2100). Significant and negative association of this character was recorded with fruit per clusters (-2.1356), fruit width (cm) (-1.8653), fruit length (cm) (-1.7986), fruits per plant (-1.7835) and seeds per fruit (-0.5256).

4.6.1.6 Number of Fruits per cluster

Correlation coefficient of fruits per cluster was found positive and significant with fruit width (cm) (1.0558), fruit length (cm) (1.0200), fruits per plant (1.0257) and seeds per fruit (0.1890). Significant and negative association of this character was recorded with days to maturity (-0.0144).

4.6.1.7 Fruit width (cm)

Fruit width expressed a significant and positive association with fruit length (cm) (1.1012), fruits per plant (1.1485), days to maturity (0.0904) and seeds per fruit (0.0889).

4.6.1.8 Fruit length (cm)

Fruit length expressed a significant and positive association with fruits per plant (0.9797), days to maturity (0.1030) and seeds per fruit (0.2930).

4.6.1.9 Fruits per plant

Fruits per plant expressed a significant and positive association with days to maturity (0.1193) and seeds per fruit (0.2271).

4.6.1.10 Days to maturity

Days to maturity expressed a negative association with and seeds per fruit (-0.0453).

4.6.2 Phenotypic Correlation Coefficients

4.6.2.1 Plant height (cm) at maturity

Plant height expressed positive phenotypic correlation with primary branches per plant maturity (0.8860), secondary branches per plant maturity (0.8381), fruits per cluster (0.8567), fruit width (cm) (0.7645), fruit length (cm)

(0.9291), fruits per plant (0.9644), days to maturity (0.2145) and seeds per fruit (0.1700). Negative association of this character was recorded with days of 50% flowering (-0.8712) and days to first fruit initiation (-0.6800)

4.6.2.2 Number of primary branches per plant at maturity

Phenotypic correlation coefficient of number of primary branches per plant at maturity was observed positive with number of secondary branches per plant at maturity (0.8360), fruits per cluster (0.8769), fruit width (cm) (0.6912), fruit length (cm) (0.8916), fruits per plant (0.9032), days to maturity (0.0952) and seeds per fruit (0.1922). Negative association of this character was recorded with days of 50% flowering (-0.8097) and days to first fruit initiation (-0.6459).

4.6.2.3 Number of secondary branches per plant at maturity

Phenotypic correlation coefficient of number of secondary branches per plant at maturity was observed), fruits per cluster (0.8750), fruit width (cm) (0.6410), fruit length (cm) (0.8911), fruits per plant (0.8944) and seeds per fruit (0.2091). Negative association of this character was recorded with days of 50% flowering (-0.8942), days to first fruit initiation (-0.3741) and days to maturity (-0.0087).

4.6.2.4 Days to 50% flowering

Association of days to 50% flowering was exhibited positive with days to 1st first fruit initiation (0.5528) and days to maturity (0.0639). Negative association of this character was recorded with fruit per clusters (-0.8174), fruit width (cm) (-0.6701), fruit length (cm) (-0.9096), fruits per plant (-0.9300) and seeds per fruit (-0.1911).

4.6.2.5 Days to first fruit initiation

Phenotypic correlation coefficient of negative association of this character was recorded with fruit per clusters (-0.4388), fruit width (cm) (-0.5489), fruit length (cm) (-0.6000), fruits per plant (-0.6450), days to maturity (-0.1543) and seeds per fruit (-0.0675).

4.6.2.6 Fruits per cluster

Phenotypic correlation coefficient of fruits per cluster was found positive and significant with fruit width (cm) (0.7609), fruit length (cm) (0.8778), fruits per plant (0.8789), days to maturity (0.1034) and seeds per fruit (0.1034).

4.6.2.7 Fruit width (cm)

Fruit width expressed a phenotypic correlation positive association with fruit length (cm) (0.6969), fruits per plant (0.7566), days to maturity (0.2785) and seeds per fruit (0.1730).

4.6.2.8 Fruit length (cm)

Fruit length expressed a significant and positive association with fruits per plant (0.9724), days to maturity (0.0596) and seeds per fruit (0.2741).

4.6.2.9 Fruits per plant

Fruits per plant expressed a significant and positive association with days to maturity (0.0939) and seeds per fruit (0.2075).

4.6.2.10 Days to maturity

Days to maturity expressed a positive association with seeds per fruit (0.230).

Table 4.8 : Genotypic correlation coefficient of fruit yield and its component characters of chilli hybrids.

Character	Plant Height (cm) Maturity	Primary Branches per Plant Maturity	Secondary Branches per Plant Maturity	Days of 50% Flowering	Days to First Fruit Initiation	Fruits per Cluster	Fruit Width (cm)	Fruit Length (cm)	Fruit yield per Plant	Days to Maturity	Seeds per Fruit
Plant Height (cm) Maturity	**1.0000**	0.9436**	1.0106**	-0.9985	-1.6590	0.9971**	1.1372**	0.9616**	0.9906**	0.2000*	0.1812*
Primary Branches per Plant Maturity		**1.0000**	1.0839**	-1.0275	-1.6935	1.0033**	1.0036**	0.9634**	0.9696**	-0.0377	0.1862*
Secondary Branches per Plant Maturity			**1.0000**	-1.0025	-2.1715	1.0196**	1.1226**	0.9968**	1.0151**	0.1013*	0.1871*
Days of 50% Flowering				**1.0000**	1.9904**	-1.0861	-1.1540	-0.9898	-1.0063	-0.0689	-0.2415
Days to First Fruit Initiation					**1.0000**	-2.1356	-1.8653	-1.7986	-1.7835	0.2100*	-0.5256
Fruitsper Cluster						**1.0000**	1.0558**	1.0200**	1.0257**	-0.0144	0.1890*
Fruit Width (cm)							**1.0000**	1.1012**	1.1485**	0.0904*	0.0889*
Fruit Length (cm)								**1.0000**	0.9797**	0.1030*	0.2935*
Fruits per Plant									**1.0000**	0.1193*	0.2271*
Days to Maturity										**1.0000**	-0.0453
Seeds per Fruit											**1.0000**

*** 5% level of significance**

**** 1% level of significance**

Table 4.9 : Phenotypic correlation coefficient of fruit yield and its component characters of chilli hybrids.

Character	Plant Height (cm) Maturity	Primary Branches per Plant Maturity	Secondary Branches per Plant Maturity	Days of 50% Flowering	Days to First Fruit Initiation	Fruits per Cluster	Fruit Width (cm)	Fruit Length (cm)	Fruits per Plant	Days to Maturity	Seeds per Fruit
Plant Height (cm) Maturity	**1.0000**	0.8860**	0.8381**	-0.8712	-0.6800	0.8567**	0.7645**	0.9291**	0.9644**	0.2145**	0.1700**
Primary Branches per Plant Maturity		**1.0000**	0.8360**	-0.8097	-0.6459	0.8769**	0.6912**	0.8916**	0.9032**	0.0952*	0.1922*
Secondary Branches per Plant Maturity			**1.0000**	-0.8942	-0.3741	0.8750**	0.6410**	0.8911**	0.8944**	-0.0087	0.2091*
Days of 50% Flowering				**1.0000**	0.5528**	-0.8174	-0.6701	-0.9096	-0.9300	0.0639*	-0.1911
Days to First Fruit Initiation					**1.0000**	-0.4388	-0.5489	-0.6000	-0.6450	-0.1543	-0.0675
Fruitsper Cluster						**1.0000**	0.7609**	0.8778**	0.8789**	0.1034*	0.2760*
Fruit Width (cm)							**1.0000**	0.6969**	0.7566**	0.2785*	0.1730*
Fruit Length (cm)								**1.0000**	0.9724**	0.0596*	0.2741*
Fruits per Plant									**1.0000**	0.0939*	0.2075*
Days to Maturity										**1.0000**	0.0230*
Seeds per Fruit											**1.0000**

*** 5% level of significance ** 1% level of significance**

E. Path coefficient

A path coefficient is a standardized partial regression coefficient and as such measures the direct influence of one variable upon another and permits partitioning of the correlation coefficients into components of direct and indirect effects. The genotypic and phenotypic correlation coefficients were further partitioned into direct and indirect effects and the results are presented in (Table 4.10).

4.7 Genotypic path coefficient

4.7.1 Direct and Indirect effects

4.7.1.1 Plant height (cm):

Plant height (1.0321) revealed that positive direct effect on fruit dry weight per plant (g) (0.1036) while, it expressed positive indirect correlation primary branches per plant at maturity (0.9739), secondary branches per plant at maturity (1.0431), fruits per cluster (1.0291), fruit width (cm) (1.1737), fruit length (cm) (0.9924), fruits per plant (1.0223), days to maturity (0.2064) and seeds per fruit (0.1870), while it negative indirect effect on days of 50% flowering (-1.0306) and days to first fruit initiation (-1.7122).

4.7.1.2 Number of primary branches per plant

Primary branches per plant (-0.1606) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.2132) while, it expressed positive indirect correlation days to 50% flowering (0.1650), days to first fruit initiation (0.2719) and days to maturity (0.0061), while it negative indirect effect on plant height (cm) at maturity (-0.1515), primary branches per plant at maturity (-0.1606), secondary branches per plant at maturity (-0.1740), fruits per cluster (-0.1611), fruit width (cm) (-0.1612), fruit length (cm) (-0.1547), fruit yield per plant (-0.1557) and seeds per fruit (-0.0299).

4.7.1.3 Number of secondary branches per plant

Secondary branches per plant (-0.4960) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0399) while, it expressed positive indirect correlation days to 50% flowering (0.4973) and days to first fruit initiation (1.0771), while it negative indirect effect on plant height (cm) at maturity (-0.5013), primary branches per plant at maturity (-0.5377), secondary branches per plant at maturity (-0.4960), fruits per cluster (-0.5058), fruit width (cm) (-0.5569), fruit length (cm) (-0.4944), fruit yield per plant (-0.5035), days to maturity (-0.0503) and seeds per fruit (-0.0928).

4.7.1.4 Days to 50% flowering

Days to 50% flowering (-0.3085) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.0474) while, it expressed positive indirect correlation plant height (cm) at maturity (0.3081), primary branches per plant at maturity (0.3170), secondary branches per plant at maturity (0.3093), fruits per cluster (0.3351), fruit width (cm) (0.3561), fruit length (cm) (0.3054), fruits yield per plant (0.3105), days to maturity (0.0213) and seeds per fruit (0.0745), while it negative indirect effect on days to first fruit initiation (-0.6141).

4.7.1.5 Days to first fruit initiation

Days to first fruit initiation (-0.1642) revealed that high positive direct effect on fruit dry weight per plant (g) (0.7547) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2724), primary branches per plant at maturity (0.2781), secondary branches per plant at maturity (0.3566), fruits per cluster (0.3507), fruit width (cm) (0.3063), fruit length (cm) (0.2953), fruits yield per plant (0.2929) and seeds per fruit (0.0863), while it negative indirect effect on days to 50% flowering (-0.3268) and days to maturity (-0.0345).

4.7.1.6 Fruits per cluster

Fruits per cluster (0.8128) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1212) while, it expressed positive indirect correlation plant height (cm) at maturity (0.8104), primary branches per plant at maturity (0.8155), secondary branches per plant at maturity (0.8287), fruit width (cm) (0.8581), fruit length (cm) (0.8291), fruits yield per plant (0.8337) and seeds per fruit (0.1536), while it negative indirect effect on days to 50% flowering (-0.8828) and days to first fruit initiation (-1.7358) and days to maturity (-0.0117).

4.7.1.7 Fruit width (cm)

Fruit width (cm) (0.0043) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1305) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0049), primary branches per plant at maturity (0.0044), secondary branches per plant at maturity (0.0049), fruits per cluster (0.0046), fruit length (cm) (0.0048), fruits yield per plant (0.0050), days to maturity (0.0004) and seeds per fruit (0.0004), while it negative indirect effect on days to 50% flowering (-0.0050) and days to first fruit initiation (-0.0081).

4.7.1.8 Fruit length (cm)

Fruit length (cm) (-0.3004) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0206) while, it expressed positive indirect correlation days to 50% flowering (0.2973) and days to first fruit initiation (0.5402), while it negative indirect effect on plant height (cm) at maturity (-0.2888), primary branches per plant at maturity (-0.2894), secondary branches per plant at maturity (-0.2994), fruits per cluster (-0.3064), fruit width (cm) (-0.3307), fruit length (cm) (-0.3004), fruits yield per plant (-0.2942), days to maturity (-0.0309) and seeds per fruit (-0.0882).

4.7.1.9 Fruits per plant

Fruits per plant (-1.6500) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0290) while, it expressed positive indirect correlation days to 50% flowering (1.6604) and days to first fruit initiation (2.9428), while it negative indirect effect on plant height (cm) at maturity (-1.6345), primary branches per plant at maturity (-1.5999), secondary branches per plant at maturity (-1.6750), fruits per cluster (-1.6924), fruit width (cm) (-1.8951), fruit length (cm) (-1.6165), days to maturity (-0.1969) and seeds per fruit (-0.3747).

4.7.1.10 Days to maturity

Days to maturity (1.1234) revealed that high positive direct effect on fruit dry weight per plant (g) (1.0264) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2246), secondary branches per plant at maturity (0.1138), days to first fruit initiation (0.2359), fruit width (cm) (0.1016), fruit length (cm) (0.1157), fruits yield per plant (0.1341), while it negative indirect effect on primary branches per plant at maturity (-0.0424), days to 50% flowering (-0.0774), fruits per cluster (-0.0162) and seeds per fruit (-0.0509).

4.2.1.11 Seeds per fruit

Seeds per fruit (0.1500) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0155) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0272), primary branches per plant at maturity (0.0279), secondary branches per plant at maturity (0.0281), fruits yield per plant (0.0284), fruit width (cm) (0.0133), fruit length (cm) (0.0440), fruits per plant (0.0341), while it negative indirect effect on days to 50% flowering (-0.0362), days to first fruit initiation (-0.0788) and days to maturity (-0.0068).

4.7 Phenotypic path coefficient

4.7.1 Direct and Indirect effects

4.7.1.1 Plant height (cm):

Plant height (-0.0044) revealed that positive direct effect on fruit dry weight per plant (g) (0.1458) while, it expressed positive indirect correlation days of 50% flowering (0.0039) and days to first fruit initiation (0.0030), while it negative indirect effect on primary branches per plant at maturity (-0.0039), secondary branches per plant at maturity (-0.0037), fruits per cluster (-0.0038), fruit width (cm) (-0.0034), fruit length (cm) (-0.0041), fruits per plant (-0.0043), days to maturity (-0.0010) and seeds per fruit (-0.0008).

4.7.1.2 Number of primary branches per plant

Primary branches per plant (0.0086) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0663) while, it expressed negative indirect correlation days to 50% flowering (-0.0070), days to first fruit initiation (-0.0056), while it positive indirect effect on plant height (cm) at maturity (0.0077), secondary branches per plant at maturity (0.0072), fruits per cluster (0.0076), fruit width (cm) (0.0060), fruit length (cm) (0.0077), fruits per plant (0.0078), days to maturity (0.0008) and seed per fruit (0.0017).

4.7.1.3 Number of secondary branches per plant

Secondary branches per plant (-0.1490) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1332) while, it expressed positive indirect correlation days to 50% flowering (0.1333), days to first fruit initiation (0.0557) and days to maturity (0.0013), while it negative indirect effect on plant height (cm) at maturity (-0.1249), primary branches per plant at maturity (-0.1246), fruits per cluster (-0.1304), fruit width (cm) (-0.0955), fruit length (cm) (-0.1328), fruits per plant (-0.1333) and seeds per fruit (-0.0312).

4.7.1.5 Days to 50% flowering

Days to 50% flowering (-0.0522) revealed that high positive direct effect on fruit dry weight per plant (g) (0.1453) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0454), primary branches per plant at maturity (0.0422), secondary branches per plant at maturity (0.0466), fruits per cluster (0.0426), fruit width (cm) (0.0350), fruit length (cm) (0.0474), fruits per plant (0.0485) and seeds per fruit (0.0100), while it negative indirect effect on days to first fruit initiation (-0.0288) and days to maturity (0.0033).

4.7.1.7 Days to first fruit initiation

Days to first fruit initiation (-0.3229) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.2576) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2196), primary branches per plant at maturity (0.2086), secondary branches per plant at maturity (0.1208), fruits per cluster (0.1417), fruit width (cm) (0.1772), fruit length (cm) (0.1938), fruits per plant (0.2083), days to maturity (0.0218), while it negative indirect effect on days to 50% flowering (-0.1785).

4.7.1.8 Fruits per cluster

Fruits per cluster (0.4140) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0733) while, it expressed positive indirect correlation plant height (cm) at maturity (0.3546), primary branches per plant at maturity (0.3630), secondary branches per plant at maturity (0.3622), fruit width (cm) (0.3150), fruit length (cm) (0.3634), fruits per plant (0.3638), days to maturity (0.0428) and seeds per fruit (0.1143), while it negative indirect effect on days to 50% flowering (-0.3384) and days to first fruit initiation (-0.1816).

4.7.1.9 Fruit width (cm)

Fruit width (cm) (0.0404) revealed that high positive direct effect on fruit dry weight per plant (g) (0.2836) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0309), primary branches per plant at maturity (0.0279), secondary branches per plant at maturity (0.0259), fruits per cluster (0.0308), fruit length (cm) (0.0282), fruits per plant (0.0306), days to maturity (0.0113) and seeds per fruit (0.0070), while it negative indirect effect on days to 50% flowering (-0.0271) and days to first fruit initiation (-0.0222).

4.7.1.10 Fruit length (cm)

Fruit length (cm) (-0.2607) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.0300) while, it expressed positive indirect correlation days to 50% flowering (0.2371) and days to first fruit initiation (0.1564), while it negative indirect effect on plant height (cm) at maturity (-0.2422), primary branches per plant at maturity (-0.2325), secondary branches per plant at maturity (-0.2323), fruits per cluster (-0.2289), fruit width (cm) (-0.1817), fruits per plant (-0.2535), days to maturity (-0.0155) and seeds per fruit (-0.0714).

4.7.1.11 Fruits per plant

Fruits per plant (-0.3580) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0102) while, it expressed positive indirect correlation days to 50% flowering (0.3330) and days to first fruit initiation (0.2309), while it negative indirect effect on plant height (cm) at maturity (-0.3453), primary branches per plant at maturity (-0.3234), secondary branches per plant at maturity (-0.3202), fruits per cluster (-0.3147), fruit width (cm) (-0.2709), fruit length (cm) (-0.3481), days to maturity (-0.0336) and seeds per fruit (-0.0743).

4.7.1.12 Days to maturity

Days to maturity (0.8880) revealed that high positive direct effect on fruit dry weight per plant (g) (0.9425) while, it expressed positive indirect correlation plant height (cm) at maturity (0.1905), primary branches per plant at maturity (0.0846), days to 50% flowering (0.0568), fruits per cluster (0.0918), fruit width (cm) (0.2473), fruit length (cm) (0.0529), fruits per plant (0.0834) and seeds per fruit (0.0204), while it negative indirect effect on secondary branches per plant at maturity (-0.0077) and days to first fruit initiation (-0.1370).

4.7.1.13 Seeds per fruit

Seeds per fruit (0.0816) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0791) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0139), primary branches per plant at maturity (0.0157), secondary branches per plant at maturity (0.0171), fruits per cluster (0.0225), fruit width (cm) (0.0141), fruit length (cm) (0.0224), fruits per plant (0.0169) and days to maturity (0.0019), while it negative indirect effect on days to 50% flowering (-0.0156) and days to first fruit initiation (-0.0055).

Table 4.10 : Genotypic path coefficient of fruit yield and its component characters of chilli hybrids.

Character	Plant Height (cm) Maturity	Primary Branches per Plant Maturity	Secondary Branches per Plant Maturity	Days of 50% Flowering	Days to First Fruit Initiation	Fruits per Cluster	Fruit Width (cm)	Fruit Length (cm)	Fruits per Plant	Days to Maturity	Seeds per Fruit
Plant Height (cm) Maturity	**1.0321**	0.9739	1.0431	-1.0306	-1.7122	1.0291	1.1737	0.9924	1.0223	0.2064	0.1870
Primary Branches per Plant Maturity	-0.1515	**-0.1606**	-0.1740	0.1650	0.2719	-0.1611	-0.1612	-0.1547	-0.1557	0.0061	-0.0299
Secondary Branches per Plant Maturity	-0.5013	-0.5377	**-0.4960**	0.4973	1.0771	-0.5058	-0.5569	-0.4944	-0.5035	-0.0503	-0.0928
Days of 50% Flowering	0.3081	0.3170	0.3093	**-0.3085**	-0.6141	0.3351	0.3561	0.3054	0.3105	0.0213	0.0745
Days to First Fruit Initiation	0.2724	0.2781	0.3566	-0.3268	**-0.1642**	0.3507	0.3063	0.2953	0.2929	-0.0345	0.0863
Fruits per Cluster	0.8104	0.8155	0.8287	-0.8828	-1.7358	**0.8128**	0.8581	0.8291	0.8337	-0.0117	0.1536
Fruit Width (cm)	0.0049	0.0044	0.0049	-0.0050	-0.0081	0.0046	**0.0043**	0.0048	0.0050	0.0004	0.0004
Fruit Length (cm)	-0.2888	-0.2894	-0.2994	0.2973	0.5402	-0.3064	-0.3307	**-0.3004**	-0.2942	-0.0309	-0.0882
Fruits per Plant	-1.6345	-1.5999	-1.6750	1.6604	2.9428	-1.6924	-1.8951	-1.6165	**-1.6500**	-0.1969	-0.3747
Days to Maturity	0.2246	-0.0424	0.1138	-0.0774	0.2359	-0.0162	0.1016	0.1157	0.1341	**1.1234**	-0.0509
Seeds per Fruit	0.0272	0.0279	0.0281	-0.0362	-0.0788	0.0284	0.0133	0.0440	0.0341	-0.0068	**0.1500**
Fruit Dry Weightper Plant (g)	**0.1036**	**-0.2132**	**0.0399**	**-0.0474**	**0.7547**	**-0.1212**	**-0.1305**	**0.0206**	**0.0290**	**1.0264**	**0.0155**
Partial R^2	0.1069	0.0342	-0.0198	0.0146	-0.1239	-0.0985	-0.0006	-0.0062	-0.0478	1.1530	0.0023

R SQUARE = 1.0142 RESIDUAL EFFECT =SQRT(1- 1.0142)

Table 4.11: Categorization of chilli hybrids based on quality parameters

Genotypes	Shape of fruits	Size of fruits	Flowers colour	Fruits colour	Breading habit	Plant type
Smriti	Straight	Long	White	Dark green	Pendent	Bushy
Aujasvi	Straight	Medium	White	Green	Pendent	Bushy
Shourya	Straight	Medium	White	Dark green	Pendent	Bushy
Albeli-333	Straight	Medium	White	Dark green	Pendent	Bushy
Ujjala	Straight	Long	White	Green	Pendent	Tall
Tiger	Straight	Long	White	Dark green	Pendent	Bushy
ARCH 930	Straight	Long	White	Light green	Pendent	Bushy
US 612	Straight	Long	White	Light green	Pendent	Tall
US 611Tara	Straight	Medium	White	Dark green	Pendent	Tall
Marshal 1857	Straight	Medium	White	Dark green	Pendent	Bushy
Saniya (03)	Straight	Medium	White	Light green	Pendent	Bushy
Jalsa	Straight	Medium	White	Light green	Pendent	Bushy
S-586	Straight	Medium	White	Dark green	Pendent	Bushy
Amrita	Straight	Long	White	Green	Pendent	Tall
P. jyoti	Straight	Long	White	Green	Pendent	Bushy
Jwala garima-12	Straight	Medium	White	Dark green	Upright	Tall
TS-0017	Straight	Medium	White	Green	Pendent	Bushy
Tara	Straight	Medium	White	Dark green	Pendent	Bushy

CHAPTER - V

DISCUSSION

The results obtained from the present investigation entitle “Assessment of Morphological, Fruit Yield & Quality Characters in Hybrid Chilli (*Capsicum annum* L.)” are presented under the following heads:

In any crop improvement programme the success of selection depends on genetic variability and correlation among the characters in the population. The genetic variability estimated in terms of genotypic coefficient of variation and phenotypic coefficients of variation only is not adequate for the estimation of heritable variation. The heritability values, in broad sense are also helpful in selection on the basis of phenotypic performance of the quantitative characters. However, heritability estimates alone are not of any use in predicting the results of selection unless the correlation studies which indicate degree of relationship between yield and its components is done. Correlation studies provide information on nature, extent and direction of selection.

The findings obtained under the study has been analyzed and elaborated in the light of published research work as follows.

4.1 Analysis of variance

The analysis of variances for all the characters studied has been presented in Appendix – I to III. Mean squares due to genotypes were highly significantly for all the characters, indicating that the presence of genetic diversity in the existing material.

4.1.1 Mean and range performance of the genotypes

Range and mean performance (Minimum and Maximum) of the ten genotypes of chilli for all the thirty three characters are presented in the table 4.1a, b and c.

Hybrid Amrita was observed the tall plant and hybrid S-586 was recorded the dwarf plant, Maximum number of primary branches per plant was observed in hybrid Amrita, while it as recorded minimum in hybrid (S-586), Maximum number of secondary branches per plant was observed in hybrid Amrita, while it as recorded minimum in hybrid (S-586), Early first flower initiation was recorded in Amrita and hybrid S-586 exhibited in late initiation of first flowering. Hybrid Amrita was recorded the early days to 50% flowering, therefore, hybrid S-586 exhibited in late group which is maximum days to 50% flowering days. Hybrid Amrita was recorded the early first picking in 71.19 days, therefore, hybrid S-586 exhibited in late picking of fruits 79.19 days. Hybrid Amrita was recorded the early fruit initiation in 67.52 days, therefore, hybrid S-586 exhibited in late group which fruit initiation in 75.52 days. The maximum fruits per cluster were recorded in hybrid Amrita, while it was found minimum in hybrid S-586. Hybrid Amrita showed maximum fruit width and it was found minimum in hybrid S-586. Hybrid Amrita showed maximum fruit length (7.69 cm) and it was found minimum in hybrid S-586 (3.37 cm). The maximum 146.00 fruits per plant were recorded in hybrid Amrita, while it was found minimum (86.00 fruit) in hybrid S-586. Early maturity was obtained under the hybrid Smriti and late in the hybrid Tara**.** Hybrid Tara was recorded maximum fresh fruit yield per plant followed by TS-0017 and Jwala garima-12. Whereas, it was recorded minimum in Smriti. Highest dry fruit yield per plot were recorded in hybrid Tara, TS-0017, Jwala garima-12 and P. jyoti, respectively and which were at par with each other. Highest dry fruit yield were recorded in genotype Tara, TS-0017, Jwala garima-12 and P. jyoti, respectively and which were at par with each other. However lowest dry fruit yield per ha exhibited in Smriti. Tinger was observed the maximum seeds per fruit, while it was noted minimum in hybrid Marshal1857 and Shourya. Hybrid Tinger was recorded maximum 1000 seed weight, while was showed minimum in hybrid Shourya.

The findings were quite similar to as reported by Dutonde *et al.* (2006), Tembhurne *et al.* (2008), Jabeen *et al.* (2012) for fresh fruit yield per ha, Dutonde *et al.* (2006), Tembhurne *et al.* (2008) for number of fruits per plant, Dutonde *et al.* (2006), Tembhurne *et al.* (2008), Jabeen *et al.* (2012) for fresh fruit yield per plant.

5.2 Variability studies:

In the present findings PCV were observed higher than the corresponding GCV for all the characters studied, however the differences was narrow which implied their relative resistance to environmental variation. It also described that genetic factors were predominantly responsible for expression of those attributes and selection could be made effectively on the basis of phenotypic performance. The finding of Datta and Jana (2010), Diwaker *et al.* (2012) is similar to that of the present findings.

The highest GCV value was recorded for Fruits width cm (23.99 %), while moderate for fruit length cm (23.10 %), fruits per cluster (21.54 %), secondary branches per plant at 60 DAT (20.30 %), primary branches per plant 90 DAT (18.90 %), primary branches per plant maturity (16.83 %), fruits per plant (15.45 %), secondary branches per plant 90 DAT (14.98 %), fruit fresh weight plant (g), fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.) (14.37 %), seeds per fruit, 1000 seed weight (g) (14.16 %), primary branches per plant 60 DAT (13.46 %), secondary branches per plant 120 DAT (13.11 %), plant height (cm) 120 DAT (12.76 %), days to first flower initiation (12.26 %), plant height (cm) maturity (11.90 %), plant height (cm) 30 DAT (11.74 %), plant height (cm) 90 DAT (11.09 %), secondary branches per plant maturity (11.32), primary branches per plant 30 DAT (10.42), days to maturity (3.68 %), days of 50% flowering (3.16 %), days to first picking of fruits (2.78 %) and days to first fruit initiation (1.64 %).

The highest PCV value was recorded for fruits width cm (36.00 %), while moderate for fruits per cluster (24.59 %), fruit fresh weight per plot (kg), fruit dry weight per plot (kg) (23.60 %), fruit fresh weight plant (g), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per ha. (q.) (23.59 %), fruit length cm (23.22 %), while low value for PCV was recorded for Days to First Fruit Initiation (4.69 %), Days to maturity (4.32 %), Days to 50 % flowering (3.46 %) and Days to first fruit picking (3.05 %). The high values of GCV suggested greater phenotypic and genotypic variability among the genotypes and responsiveness of the attributes for making further improvement by selection. The findings are in close harmony with the result of Mohammed *et al.* (2001) for branches per plant, Rathod *et al.* (2002), Manju and Sreelathakumary (2002a), Mini and Khader (2004), Sreelathakumary and Rajamony (2004), Prabhakaran *et al.* (2004), Varkey *et al.* (2005), Bharadwaj *et al.* (2007), Vani *et al.* (2007), Samadia (2007), Yadwad *et al.* (2008), Gupta *et al.* (2009), Sarkar *et al.* (2009), Sharma *et al.* (2009), Datta and Jana (2010) for number of fruits per plant, Ukkund *et al.* (2006) for number of secondary branches per plant.

The highest ECV value was recorded for fruits width cm (26.85 %), while moderate for fruit fresh weight per plot (kg), fruit dry weight per plot (kg) (18.72 %), fruit fresh weight per plant (g), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per ha (q) (18.71 %). Low value for ECV was recorded for plant height (cm) at 60 DAT (2.83 %), plant height (cm) at 90 DAT (2.56 %), days to maturity (2.26 %), days to 50 % flowering (1.41 %), days to first fruit picking (1.24 %) and fruits per plant (1.21 %).

5.3 Heritability

Heritability which denotes the proportion of genetically controlled variability expressed by a programme for a particular character or a set of character is very important biometrical tool for guiding plant breeders for adoption of appropriate breeding procedures. High heritability in broad sense in helpful in identifying appropriate character for selection and enables the breeder to select superior genotypes on the basis of phenotypic expression of quantitative characters. The estimated values of heritability in broad sense were classified as very high (more than 80%), medium (50-70%) and low (less than 50%).

Heritability estimates in broad sense were high for plant height (cm) 30 DAT (86 %), plant height (cm) 60 DAT (97 %), plant height (cm) 90 DAT (95 %), plant height (cm) 120 DAT (92 %), plant height (cm) maturity (95 %), primary branches per plant 90 DAT (87 %), primary branches per plant 120 DAT (88 %), primary branches per plant maturity (88 %), secondary branches per plant 30 DAT (85 %), secondary branches per plant 60 DAT (90 %), secondary branches per plant 90 DAT (95 %), secondary branches per plant 120 DAT (92 %), days to first picking of fruits (83 5), fruit length (cm) (99 %), fruits yield per plant (99 %), seeds per fruit (92 %),1000 seeds weight (g) (92 %). The results were in close proximate to that of Mohammed *et al.* (2001), Gogoi and Gautam (2002), Ukkund *et al.* (2006) for plant height, Mohammed *et al.* (2001), Gogoi and Gautam (2002), Rathod *et al.* (2002), Ukkund *et al.* (2006) for fruit length, Mohammed *et al.* (2001), Gogoi and Gautam (2002), Rathod *et al.* (2002), Ukkund *et al.* (2006), Bharadwaj *et al.* (2007) for number of fruits per plant, Rathod *et al.* (2002) for 1000 seed weight, Rathod *et al.* (2002) for number of primary branches per plant, Rathod *et al.* (2002), Ukkund *et al.* (2006) for fresh fruit yield, Rathod *et al.* (2002) for dry fruit yield. High values of broad sense heritability for these characters expressed that they were least influenced by environmental modification. It reflected that the phenotypes were the true representative of their genotypes and selection based on phenotypic performance would be reliable.

Heritability estimates in broad sense were medium for primary branches per plant 60 DAT (51 %), secondary branches per plant maturity (79 %), days to first flower initiation (78 %), fruits per cluster (77 %), days to maturity (73 %). The findings were in agreement to Gogoi and Gautam (2002).

Heritability estimates in broad sense were low for primary branches per plant 30 DAT (44 %), fruit width (44 %), days to maturity, fruit fresh weight plant (g), fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.) (37 %). Heritability however indicates only the effectiveness with which selection of a genotype can be based on phenotypic performance, but fails to indicate the genetic progress. Heritability estimates along with genetic gains are more effective and reliable in predicting the improvement through selection (Johnson *et al*., 1955). Estimates of genetic advance helps to predict the extent of improvement that can be achieved for improving the different characters. The estimated values of genetic advance as percent of mean were classified as high (more than 40%), moderate (20-35%) and low (less than 20%).

5.4 Genetic advance

High value of genetic advance was recorded for fruit fresh weight plant (g) (90.39) followed by fruit fresh weight per ha. (q) (36.16), fruit per plant (34.40), fruit dry weight per plant (g) (30.13), plant height (cm) 120 DAT (19.29), plant height (cm) maturity (18.42), plant height (cm) 90 DAT (15.83) and plant height (cm) 60 DAT (15.47). The results were in consonance with Mohammed *et al.* (2001), Jabeen *et al.* (2012) for branches per plant, Mohammed *et al.* (2001), Gogoi and Gautam (2002), Varkey *et al.* (2005), Sharma *et al.* (2009), Singh and Singh (2012) for dry fruit yield, Gogoi and Gautam (2002), Rathod *et al.* (2002), Manju and Sreelathakumary (2002a), Mini and Khader (2004), Prabhakaran *et al.* (2004), Dutonde *et al.*

(2006), Kaur and Singh (2007), Gupta *et al.* (2009), Sarkar *et al.* (2009), Diwaker *et al.* (2012), Singh and Singh (2012), Jabeen *et al.* (2012) for fresh fruit yield per plant, Gogoi and Gautam (2002), Rathod *et al.* (2002), Manju and Sreelathakumary (2002a), Mini and Khader (2004), Varkey *et al.* (2005), Bharadwaj *et al.* (2007), Vani *et al.* (2007), Kaur and Singh (2007), Tembhurne *et al.* (2008), Gupta *et al.* (2009), Sarkar *et al.* (2009), Datta and Jana (2010), Diwaker *et al.* (2012), Jabeen *et al.* (2012) for number of fruits plant^{-1}, Gogoi and Gautam (2002), Mini and Khader (2004), Dutonde *et al.* (2006), Vani *et al.* (2007), Gupta *et al.* (2009), Sarkar *et al.* (2009), Singh and Singh (2012), Jabeen *et al.* (2012) for fruit length, Manju and Sreelathakumary (2002a), Varkey *et al.* (2005), Vani *et al.* (2007), Kaur and Singh (2007), Singh and Singh (2012), Jabeen *et al.* (2012) for number of seeds per fruit, Mini and Khader (2004) for secondary branches per plant, Jabeen *et al.* (2012) for fresh fruit yield ha.

Genetic advance was computed as percentage as mean. It has been classified as high (more than 40), medium (25 to 40) and low (less than 25). Medium value of genetic advance as percentage of mean was recorded for plant height (cm) 60 DAT (31.13 %), plant height (cm) 120 DAT (25.27 %), primary branches per plant 90 DAT (36.34 %), primary branches per plant 120 DAT (32.51 %), primary branches per plant maturity (32.51 %), secondary branches per plant 30 DAT (34.68 %), secondary branches per plant 60 DAT (39.73 %), secondary branches per plant 90 DAT (30.05 %), secondary branches per plant 120 DAT (25.85 %), fruits per cluster (38.88 %), fruit width (cm) (32.92 %), fruit length (cm) (47.34 %), fruits per plant (31.73 %), seeds per fruit (27.96 %) and 1000 seed weight (g) (27.97 %). The results were in consonance with Ukkund *et al.* (2006).

Low value of genetic advance as percentage of mean was recorded for plant height (cm) 30 DAT (22.38 %), plant height (cm) 90 DAT (22.25 %), plant height (cm) maturity (23.93 %), primary branches per plant 30 DAT (14.27 %), primary branches per plant 60 DAT (19.72 %), secondary branches per plant maturity (20.76 %), days to first flower initiation (22.35 %), days to first picking of fruits (5.24 %), days of 50% flowering (5.95 %), days to first fruit initiation (1.18 %), days to maturity (6.45 %), fruit fresh weight plant (g) (18.03 %), fruit fresh weight per plot (kg) (18.02 %), fruit fresh weight per ha. (q.) (18.03 %), fruit dry weight per plant (g) (18.03 %), fruit dry weight per plot (kg) (18.02 %) and fruit dry weight per ha. (q.) (18.03 %).

5.5 Association studies

Correlation coefficient analysis

A wide range of variation in quantitative characters provides the basis for selection in plant breeding programme. The knowledge of association among the characters is useful to the breeder for improving the efficiency of selection. Correlation coefficient analysis measures the mutual relationship between plant characters and determines the component character on which selection can be made for genetic improvement of yield. Investigation regarding the presence of component and nature of association among themselves is essential and pre-requisite for improvement in yield. Correlation coefficient provides a clear picture of the extent of association between a pair of traits and indicates whether simultaneous improvement of the correlated traits may be possible or not. The knowledge of genetic association between yield and its component characters help in improving the efficiency of selection for yield by making proper choice and balancing one component with another.

The magnitude of genotypic correlation was higher than the phenotypic correlation for all the traits that indicated inherent association between various characters. The findings were in agreement to Singh and Singh (2012).

Plant height expressed positive correlation with primary branches per plant maturity (0.9436), secondary branches per plant maturity (1.0106), fruits per cluster (0.9971), fruit width (cm) (1.1327), fruit length (cm) (0.9616), fruits per plant (0.9906), days to maturity (0.2000) and seeds per fruit (0.1812). Negative association of this character was recorded with days of 50% flowering (-0.9985) and days to first fruit initiation (-1.6590). Smitha and Basavaraja (2006) for fresh fruits yield per plant and Padhar and Zaveri (2010) for dry fruits yield per plant.

Correlation coefficient of number of primary branches per plant at maturity was observed positive with number of secondary branches per plant at maturity (1.0839), fruits per cluster (1.0033), fruit width (cm) (1.0036), fruit length (cm) (0.9634), fruits per plant (0.9696) and seeds per fruit (0.1862). Negative association of this character was recorded with days of 50%

flowering (-1.0275), days to first fruit initiation (-1.6935) and days to maturity (-0.0377).

Correlation coefficient of number of secondary branches per plant at maturity was observed), fruits per cluster (1.0196), fruit width (cm) (1.1226), fruit length (cm) (0.9968), fruits per plant (1.0151), days to maturity (0.1013) and seedsperfruit (0.1871). Negative association of this character was recorded with days of 50% flowering (-1.0025), days to first fruit initiation (-2.1715)

Association of days to 50% flowering was exhibited positive with days to 1^{st} first fruit initiation (1.9904). Negative association of this character was recorded with fruitper clusters (-1.0861), fruit width (cm) (-1.1540), fruit length (cm) (-0.9898), fruitsperplant (-1.0063), days to maturity (-0.0689) and seeds per fruit (-0.2415).

Correlation coefficient of days to 1^{st} fruit initiation was found positive and significant with days to maturity (0.2100). Significant and negative association of this character was recorded with fruit per clusters (-2.1356), fruit width (cm) (-1.8653), fruit length (cm) (-1.7986), fruits per plant (-1.7835) and seeds per fruit (-0.5256). These findings corroborated the earlier findings of Diwaker *et al.* (2012) for number of fruits per plant.

Correlation coefficient of fruits per cluster was found positive and significant with fruit width (cm) (1.0558), fruit length (cm) (1.0200), fruits per plant (1.0257) and seeds per fruit (0.1890). Significant and negative association of this character was recorded with days to maturity (-0.0144).

Fruit width expressed a significant and positive association with fruit length (cm) (1.1012), fruits per plant (1.1485), days to maturity (0.0904) and seed per fruit (0.0889).

Fruit length expressed a significant and positive association with fruits per plant (0.9797), days to maturity (0.1030) and seeds per fruit (0.2930). These results are in close harmony with the findings of Mohammed *et al.* (2001) for dry fruits yield per plant, Smitha and Basavaraja (2006), Vani *et al.* (2007), Gupta *et al.* (2009), Singh *et al.* (2009), Patel *et al.* (2009), Diwaker *et al.* (2012) and Singh and Singh (2012) for fresh fruit yield $plant^{-1}$,

Fruits per plant expressed a significant and positive association with days to maturity (0.1193) and seeds per fruit (0.2271). These results are in close harmony with the findings of Mohammed *et al.* (2001) and Padhar and Zaveri (2010) for dry fruits yield per plant, Nehru *et al.* (2003), Nandadevi and Hosamani (2003), Smitha and Basavaraja (2006), Bharadwaj *et al.* (2007), Bharadwaj *et al.* (2007a), Tembhurne *et al.* (2008), Gupta *et al.* (2009), Sarkar *et al.* (2009), Singh *et al.* (2009), Patel *et al.* (2009), Padhar and Zaveri (2010), Diwaker *et al.* (2012), Singh and Singh (2012) and Chaudhary *et al.* (2013) for fresh fruits yield per plant.

Days to maturity expressed a negative association with and seeds per fruit (-0.0453).

Phenotypic Correlation Coefficient

Plant height expressed positive phenotypic correlation with primary branches per plant maturity (0.8860), secondary branches per plant maturity (0.8381), fruits per cluster (0.8567), fruit width (cm) (0.7645), fruit length (cm) (0.9291), fruits per plant (0.9644), days to maturity (0.2145) and seeds per fruit (0.1700). Negative association of this character was recorded with days of 50% flowering (-0.8712) and days to first fruit initiation (-0.6800)

Phenotypic correlation coefficient of number of primary branches per plant at maturity was observed positive with number of secondary branches per plant at maturity (0.8360), fruits per cluster (0.8769), fruit width (cm) (0.6912), fruit length (cm) (0.8916), fruits per plant (0.9032), days to maturity (0.0952) and seeds per fruit (0.1922). Negative association of this character was recorded with days of 50% flowering (-0.8097) and days to first fruit initiation (-0.6459).

Phenotypic correlation coefficient of number of secondary branches per plant at maturity was observed), fruits per cluster (0.8750), fruit width (cm) (0.6410), fruit length (cm) (0.8911), fruits per plant (0.8944) and seeds per fruit (0.2091). Negative association of this character was recorded with days of 50% flowering (-0.8942), days to first fruit initiation (-0.3741) and days to maturity (-0.0087).

Association of days to 50% flowering was exhibited positive with days to 1st first fruit initiation (0.5528) and days to maturity (0.0639). Negative association of this character was recorded with fruit per clusters (-0.8174), fruit width (cm) (-0.6701), fruit length (cm) (-0.9096), fruits per plant (-0.9300) and seeds per fruit (-0.1911).

Phenotypic correlation coefficient of negative association of this character was recorded with fruit per clusters (-0.4388), fruit width (cm) (-0.5489), fruit length (cm) (-0.6000), fruits per plant (-0.6450), days to maturity (-0.1543) and seeds per fruit (-0.0675).

Phenotypic correlation coefficient of fruits per cluster was found positive and significant with fruit width (cm) (0.7609), fruit length (cm) (0.8778), fruits per plant (0.8789), days to maturity (0.1034) and seeds per fruit (0.1034).

Fruit width expressed a phenotypic correlation positive association with fruit length (cm) (0.6969), fruits per plant (0.7566), days to maturity (0.2785) and seeds per fruit (0.1730).

Fruit length expressed a significant and positive association with fruits per plant (0.9724), days to maturity (0.0596) and seeds per fruit (0.2741).

Fruits per plant expressed a significant and positive association with days to maturity (0.0939) and seeds per fruit (0.2075).

Days to maturity expressed a positive association with and seeds per fruit (0.230).

5.4 Path coefficient

5.4.1 Genotypic path coefficient

Plant height (1.0321) revealed that positive direct effect on fruit dry weight per plant (g) (0.1036) while, it expressed positive indirect correlation primary branches per plant at maturity (0.9739), secondary branches per plant at maturity (1.0431), fruits per cluster (1.0291), fruit width (cm) (1.1737), fruit length (cm) (0.9924), fruits per plant (1.0223), days to maturity (0.2064) and seeds per fruit (0.1870), while it negative indirect effect on days of 50% flowering (-1.0306) and days to first fruit initiation (-1.7122).

Primary branches per plant (-0.1606) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.2132) while, it expressed positive indirect correlation days to 50% flowering (0.1650), days to first fruit initiation (0.2719) and days to maturity (0.0061), while it negative indirect effect on plant height (cm) at maturity (-0.1515), primary branches per plant at maturity (-0.1606), secondary branches per plant at maturity (-0.1740), fruits per cluster (-0.1611), fruit width (cm) (-0.1612), fruit length (cm) (-0.1547), fruits per plant (-0.1557) and seeds per fruit (-0.0299).

Secondary branches per plant (-0.4960) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0399) while, it expressed positive indirect correlation days to 50% flowering (0.4973) and days to first fruit initiation (1.0771), while it negative indirect effect on plant height (cm) at maturity (-0.5013), primary branches per plant at maturity (-0.5377), secondary branches per plant at maturity (-0.4960), fruits per cluster (-0.5058), fruit width (cm) (-0.5569), fruit length (cm) (-0.4944), fruits per plant (-0.5035), days to maturity (-0.0503) and seeds per fruit (-0.0928).

Days to 50% flowering (-0.3085) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.0474) while, it expressed positive indirect correlation plant height (cm) at maturity (0.3081), primary branches per plant at maturity (0.3170), secondary branches per plant at maturity (0.3093), fruits per cluster (0.3351), fruit width (cm) (0.3561), fruit length (cm) (0.3054), fruits per plant (0.3105), days to maturity (0.0213) and seeds per fruit (0.0745), while it negative indirect effect on days to first fruit initiation (-0.6141).

Days to first fruit initiation (-0.1642) revealed that high positive direct effect on fruit dry weight per plant (g) (0.7547) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2724), primary branches per plant at maturity (0.2781), secondary branches per plant at maturity (0.3566), fruits per cluster (0.3507), fruit width (cm) (0.3063), fruit length (cm) (0.2953), fruits per plant (0.2929) and seeds per fruit (0.0863), while it negative indirect effect on days to 50% flowering (-0.3268) and days to maturity (-0.0345).

Fruits per cluster (0.8128) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1212) while, it expressed positive indirect correlation plant height (cm) at maturity (0.8104), primary branches per plant at maturity (0.8155), secondary branches per plant at maturity (0.8287), fruit width (cm) (0.8581), fruit length (cm) (0.8291), fruits per plant (0.8337) and seeds per fruit (0.1536), while it negative indirect effect on days to 50% flowering (-0.8828) and days to first fruit initiation (-1.7358) and days to maturity (-0.0117).

Fruit width (cm) (0.0043) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1305) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0049), primary branches per plant at maturity (0.0044), secondary branches per plant at maturity (0.0049), fruits per cluster (0.0046), fruit length (cm) (0.0048), fruits per plant (0.0050), days to maturity (0.0004) and seeds per fruit (0.0004), while it negative indirect effect on days to 50% flowering (-0.0050) and days to first fruit initiation (-0.0081).

Fruit length (cm) (-0.3004) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0206) while, it expressed positive indirect correlation days to 50% flowering (0.2973) and days to first fruit initiation (0.5402), while it negative indirect effect on plant height (cm) at maturity (-0.2888), primary branches per plant at maturity (-0.2894), secondary branches per plant at maturity (-0.2994), fruits per cluster (-0.3064), fruit width (cm) (-0.3307), fruit length (cm) (-0.3004), fruits per plant (-0.2942), days to maturity (-0.0309) and seeds per fruit (-0.0882).

Fruits per plant (-1.6500) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0290) while, it expressed positive indirect correlation days to 50% flowering (1.6604) and days to first fruit initiation (2.9428), while it negative indirect effect on plant height (cm) at maturity (-1.6345), primary branches per plant at maturity (-1.5999), secondary branches per plant at maturity (-1.6750), fruits per cluster (-1.6924), fruit width (cm) (-1.8951), fruit length (cm) (-1.6165), days to maturity (-0.1969) and seeds per fruit (-0.3747).

Days to maturity (1.1234) revealed that high positive direct effect on fruit dry weight per plant (g) (1.0264) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2246), secondary branches per plant at maturity (0.1138), days to first fruit initiation (0.2359), fruit width (cm) (0.1016), fruit length (cm) (0.1157), fruits per plant (0.1341), while it negative indirect effect on primary branches per plant at maturity (-0.0424), days to 50% flowering (-0.0774), fruits per cluster (-0.0162) and seeds per fruit (-0.0509).

Seeds per fruit (0.1500) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0155) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0272), primary branches per plant at maturity (0.0279), secondary branches per plant at maturity (0.0281), fruits per plant (0.0284), fruit width (cm) (0.0133), fruit length (cm) (0.0440), fruits per plant (0.0341), while it negative indirect effect on days to 50% flowering (-0.0362), days to first fruit initiation (-0.0788) and days to maturity (-0.0068).

5.4.2 Phenotypic path coefficient

Plant height (-0.0044) revealed that positive direct effect on fruit dry weight per plant (g) (0.1458) while, it expressed positive indirect correlation days of 50% flowering (0.0039) and days to first fruit initiation (0.0030), while it negative indirect effect on primary branches per plant at maturity (-0.0039), secondary branches per plant at maturity (-0.0037), fruits per cluster (-0.0038), fruit width (cm) (-0.0034), fruit length (cm) (-0.0041), fruits per plant (-0.0043), days to maturity (-0.0010) and seeds per fruit (-0.0008).

Primary branches per plant (0.0086) revealed that high positive direct effect on fruit dry weightperplant (g) (0.0663) while, it expressed negative indirect correlation days to 50% flowering (-0.0070), days to first fruit initiation (-0.0056), while it positive indirect effect on plant height (cm) at maturity (0.0077), secondary branches per plant at maturity (0.0072), fruits per cluster (0.0076), fruit width (cm) (0.0060), fruit length (cm) (0.0077), fruits per plant (0.0078), days to maturity (0.0008) and seeds per fruit (0.0017).

Secondary branches per plant (-0.1490) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.1332) while, it expressed positive indirect correlation days to 50% flowering (0.1333), days to first fruit initiation (0.0557) and days to maturity (0.0013), while it negative indirect effect on plant height (cm) at maturity (-0.1249), primary branches per plant at maturity (-0.1246), fruits per cluster (-0.1304), fruit width (cm) (-0.0955), fruit length (cm) (-0.1328), fruits per plant (-0.1333) and seeds per fruit (-0.0312).

Days to 50% flowering (-0.0522) revealed that high positive direct effect on fruit dry weight per plant (g) (0.1453) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0454), primary branches per plant at maturity (0.0422), secondary branches per plant at maturity (0.0466), fruits per cluster (0.0426), fruit width (cm) (0.0350), fruit length (cm) (0.0474), fruits per plant (0.0485) and seeds per fruit (0.0100), while it negative indirect effect on days to first fruit initiation (-0.0288) and days to maturity (0.0033).

Days to first fruit initiation (-0.3229) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.2576) while, it expressed positive indirect correlation plant height (cm) at maturity (0.2196), primary branches per plant at maturity (0.2086), secondary branches per plant at maturity (0.1208), fruits per cluster (0.1417), fruit width (cm) (0.1772), fruit length (cm) (0.1938), fruits per plant (0.2083), days to maturity (0.0218), while it negative indirect effect on days to 50% flowering (-0.1785).

Fruits per cluster (0.4140) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0733) while, it expressed positive indirect correlation plant height (cm) at maturity (0.3546), primary branches per plant at maturity (0.3630), secondary branches per plant at maturity (0.3622), fruit width (cm) (0.3150), fruit length (cm) (0.3634), fruits per plant (0.3638), days to maturity (0.0428) and seeds per fruit (0.1143), while it negative indirect effect on days to 50% flowering (-0.3384) and days to first fruit initiation (-0.1816).

Fruit width (cm) (0.0404) revealed that high positive direct effect on fruit dry weight per plant (g) (0.2836) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0309), primary branches per plant at maturity (0.0279), secondary branches per plant at maturity (0.0259), fruits per cluster (0.0308), fruit length (cm) (0.0282), fruits per plant (0.0306), days to maturity (0.0113) and seeds per fruit (0.0070), while it negative indirect effect on days to 50% flowering (-0.0271) and days to first fruit initiation (-0.0222).

Fruit length (cm) (-0.2607) revealed that high negative direct effect on fruit dry weight per plant (g) (-0.0300) while, it expressed positive indirect correlation days to 50% flowering (0.2371) and days to first fruit initiation (0.1564), while it negative indirect effect on plant height (cm) at maturity (-0.2422), primary branches per plant at maturity (-0.2325), secondary branches per plant at maturity (-0.2323), fruits per cluster (-0.2289), fruit width (cm) (-0.1817), fruits per plant (-0.2535), days to maturity (-0.0155) and seeds per fruit (-0.0714).

Fruits per plant (-0.3580) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0102) while, it expressed positive indirect correlation days to 50% flowering (0.3330) and days to first fruit initiation (0.2309), while it negative indirect effect on plant height (cm) at maturity (-0.3453), primary branches per plant at maturity (-0.3234), secondary branches per plant at maturity (-0.3202), fruits per cluster (-0.3147), fruit width (cm) (-0.2709), fruit length (cm) (-0.3481), days to maturity (-0.0336) and seeds per fruit (-0.0743).

Days to maturity (0.8880) revealed that high positive direct effect on fruit dry weightperplant (g) (0.9425) while, it expressed positive indirect correlation plant height (cm) at maturity (0.1905), primary branches per plant at maturity (0.0846), days to 50% flowering (0.0568), fruits per cluster (0.0918), fruit width (cm) (0.2473), fruit length (cm) (0.0529), fruits per plant (0.0834) and seeds per fruit (0.0204), while it negative indirect effect on secondary branches per plant at maturity (-0.0077) and days to first fruit initiation (-0.1370).

Seeds per fruit (0.0816) revealed that high positive direct effect on fruit dry weight per plant (g) (0.0791) while, it expressed positive indirect correlation plant height (cm) at maturity (0.0139), primary branches per plant at maturity (0.0157), secondary branches per plant at maturity (0.0171), fruits per cluster (0.0225), fruit width (cm) (0.0141), fruit length (cm) (0.0224), fruits per plant (0.0169) and days to maturity (0.0019), while it negative indirect effect on days to 50% flowering (-0.0156) and days to first fruit initiation (-0.0055).

CHAPTER - VI

SUMMARY, CONCLUSION AND SUGGESTIONS FOR FUTURE WORK

6.1 Summary

The present investigation entitled **"Assessment of Morphological, Fruit Yield & Quality Characters in Hybrid Chilli (*Capsicum annum* L.)''** was undertaken on eighteen hybrid of chilli collected from different sources of Madhya Pradesh. The experiment was laid in Randomized Block Design replicated thrice in *kharif* season during the year 2014-15 at Horticulture Research Field Of RAK College of Agriculture Sehore.

Different observations were recorded on Plant height (cm) at an equal interval 30, 60, 90,120 DAT and at maturity, No. of primary branches per plant at 30, 60, 90,120 DAT and at maturity, No. of secondary branches per plant at 30, 60, 90,120 DAT and at maturity, Days to first flower initiation, Days of 50% flowering, Days to first picking of fruits. Days to first fruit initiation, Number of fruits per cluster, Fruit width (cm), Fruit length (cm), Number of fruits per plant, Days to maturity, Fresh weight of fruit per plant (g), Fresh weight of fruit per plot (kg), Fresh weight of fruit per ha. (q.), Dry weight of fruit per plant (g), Dry fruit weight per plot (kg), Dry fruit weight per ha. (q.), Number of seeds per fruit and 1000 seed weight (g)

6.1 Variability studies:

The highest GCV value was recorded for Fruits width cm, while moderate for fruit length, fruits per cluster, secondary branches per plant at 60 DAT, primary branches per plant 90 DAT, primary branches per plant maturity, fruits per plant, secondary branches per plant 90 DAT, fruit fresh weight plant (g), fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.), Seeds per Fruit, 1000 seeds weight (g), primary branches per plant 60 DAT, secondary branches per plant 120 DAT, plant height (cm) 120 DAT, days to first flower initiation, plant height (cm) maturity, plant height (cm) 30 DAT, plant height (cm) 90 DAT, secondary branches per plant maturity, primary branches per plant 30 DAT, days to maturity, days of 50% flowering, days to first picking of fruits and days to first fruit initiation. The highest PCV value was recorded for fruits width, while moderate for fruits per cluster, fruit fresh weight per plot (kg), fruit dry weight per plot (kg), fruit fresh weight plant (g), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per ha. (q.), fruit length, while low value for PCV was recorded for Days to First Fruit Initiation, Days to maturity, Days to 50 % flowering and Days to first fruit picking.

6.2 Heritability

Heritability estimates in broad sense were high for Plant Height (cm) 30 DAT, plant height (cm) 60 DAT (97 %), plant height (cm) 90 DAT, plant height (cm) 120 DAT, plant height (cm) maturity, primary branches per plant 90 DAT, primary branches per plant 120 DAT, primary branches per plant maturity, secondary branches per plant 30 DAT, secondary branches per plant 60 DAT, secondary branches per plant 90 DAT, secondary branches per plant 120 DAT, days to first picking of fruits, fruit length (cm), fruits per plant, seeds per fruit,1000 seed weight.

Heritability estimates in broad sense were medium for primary branches per plant 60 DAT, secondary branches per plant maturity, days to first flower initiation, fruits per cluster, days to maturity.

Heritability estimates in broad sense were low for primary branches per plant 30 DAT, fruit width, days to maturity, fruit fresh weight plant (g), fruit fresh weight per plot (kg), fruit fresh weight per ha. (q.), fruit dry weight per plant (g), fruit dry weight per plot (kg), fruit dry weight per ha. (q.).

6.3 Genetic advance

High value of genetic advance was recorded for fruit fresh weight plant (g) followed by fruit fresh weight per ha. (q), Fruit yield per plant, fruit dry weight per plant (g), plant height (cm) 120 DAT, plant height (cm) maturity, plant height (cm) 90 DAT and plant height (cm) 60 DAT.

Medium value of genetic advance as percentage of mean was recorded for plant height (cm) 60 DAT, plant height (cm) 120 DAT, primary branches per plant 90 DAT, primary branches per plant 120 DAT, primary branches per plant maturity, secondary branches per plant 30 DAT, secondary branches per plant 60 DAT, secondary branches per plant 90 DAT, secondary branches per plant 120 DAT, fruits per cluster, fruit width (cm), fruit length (cm), fruits per plant, seeds per fruit and 1000 Seed Weight (g).

6.4 Phenotypic Correlation Coefficient

Plant height expressed positive phenotypic correlation with primary branches per plant maturity, secondary branches per plant maturity, fruits per cluster, fruit width (cm), fruit length (cm), fruits per plant, days to maturity and seeds per fruit. Negative association of this character was recorded with days of 50% flowering and days to first fruit initiation.

Primary branches per plant at maturity was observed positive with number of secondary branches per plant at maturity, fruits per cluster, fruit width, fruit length, fruits per plant, days to maturity and seeds per fruit. Negative association of this character was recorded with days of 50% flowering and days to first fruit initiation.

Secondary branches per plant at maturity was observed positive correlation with fruits per cluster, fruit width, fruit length, fruits per plant and seeds per fruit. Negative association of this character was recorded with days of 50% flowering, days to first fruit initiation and days to maturity.

Days to 50% flowering were exhibited positive with days to 1st first fruit initiation and days to maturity. Negative association of this character was recorded with fruitper clusters, fruit width, fruit length, fruits per plant and seeds per fruit.

Correlation coefficient of negative association of this character was recorded with fruit per clusters, fruit width, fruit length, fruits per plant, days to maturity and seeds per fruit.

Fruit length expressed a significant and positive association with fruits per plant, days to maturity and seeds per fruit.

Fruits per plant expressed a significant and positive association with days to maturity and seeds per fruit. Days to maturity expressed a positive association with and seeds per fruit.

6.5 Path coefficients

6.5.1 Genotypic path coefficients

Plant height revealed that positive direct effect on fruit dry weight per plant (g) while, it expressed positive indirect correlation primary branches per plant at maturity, secondary branches per plant at maturity, fruits per cluster, fruit width (cm), fruit length, fruits per plant, days to maturity and seeds per fruit, while it negative indirect effect on days of 50% flowering and days to first fruit initiation.

Primary branches per plant showed high negative direct effect on fruit dry weight per plant while, it expressed positive indirect correlation days to 50% flowering, days to first fruit initiation and days to maturity, while it negative indirect effect on plant height (cm) at maturity, primary branches per plant at maturity, secondary branches per plant at maturity, fruits per cluster, fruit width, fruit length, fruits yield plant and seeds per fruit.

Secondary branches per plant high positive direct effect on fruit dry weightperplant while, it expressed positive indirect correlation days to 50% flowering and days to first fruit initiation, while it negative indirect effect on plant height, primary branches per plant at maturity, secondary branches per plant at maturity, fruits per cluster, fruit width, fruit length, fruits per plant, days to maturity and seeds per fruit.

Days to 50% flowering high negative direct effect on fruit dry weight per plant while, it expressed positive indirect correlation plant height, primary branches per plant, secondary branches per plant, fruits per cluster, fruit width, fruit length, fruits per plant, days to maturity and seeds per fruit, while it negative indirect effect on days to first fruit initiation.

Days to first fruit initiation high positive direct effect on fruit dry weight per plant while, it expressed positive indirect correlation plant height, primary branches per plant at maturity, secondary branches per plant, fruits per cluster, fruit width, fruit length, fruits per plant and seeds per fruit, while it negative indirect effect on days to 50% flowering and days to maturity.

Fruits per cluster high negative direct effect on fruit dry weight per plant, it expressed positive indirect correlation plant height, primary branches per plant, secondary branches per plant, fruit width, fruit length, fruits per plant and seeds per fruit, while it negative indirect effect on days to 50% flowering and days to first fruit initiation and days to maturity.

Fruit width high negative direct effect on fruit dry weight per plant while, it expressed positive indirect correlation plant height, primary branches per plant, secondary branches per plant, fruits per cluster, fruit length, fruits per plant, days to maturity and seeds per fruit, while it negative indirect effect on days to 50% flowering and days to first fruit initiation.

6.7 Conclusion:

The following conclusions have been drawn from the present investigation as:

1. The high genetic variability were observed for major fruit yield traits namely plant height, branches per plant, days to fruit initiation, fruit length and fruit per plant.
2. High genotypic coefficient of variation were noticed for fruit width followed fruit length, fruit per cluster while low magnitudes were recorded for days to first fruit initiation, days to first fruit picking and days to 50% flowering.
3. High heritability estimated were exhibited for traits like fruits per plant, fruit length, plant height at 60 DAT, plant height at 90 DAT, plant height at maturity, secondary branches at 90 DAT, seeds per fruit, 1000 seed weight, However low estimated were noticed by days to first fruit initiation and fresh fruit weight.
4. High heritability coupled with high genetic advance were found for fruits per plant, plant height at 120 DAT and plant height at maturity, While low estimates were shown by days to first fruit initiation followed by fruit dry weight per plant.
5. Significant and positive association of fruit yield per plant were recorded with fruit length, plant height at maturity, primary branches per plant secondary branches per plant and fruits per cluster with it showed significant negative association with days to 50% flowering followed by days to first fruit initiation.
6. The maximum positive direct effect were observed by days to maturity, plant height, fruit per cluster on fruit yield per plant, However significant negative direct effect were observed by secondary branches per plant, days to 50% flowering and fruit length. Similarly maximum positive

indirect effect of plant height via secondary branches per plant, followed by fruits per cluster and fruit width on fruit yield were noticed secondary branches per plant though days to first fruit initiation and fruit per cluster via fruit width and fruit length were recorded.

7. Over all fruit yield contributing traits namely plant height, days to maturity, fruit length, primary branches per plant, fruit per cluster were found promising in chilli hybrids under present investigation.
8. Based on high fruit yield coupled with good quality traits. The hybrids namely Saniya, Jalsa and ARCH 930 were found promising for fresh marketable produce, while Tara, Amrita, Jwala garima-12 and TS0017 were found better for dry chilli purpose.

6.8 Suggestions for further work

1. Stability of distinct traits of chilli hybrid should be established over the years and seasons.
2. Traits identified for high heritability coupled with high or moderate genetic gain may be considered well in selection for the genetic improvement of crop.
3. Characters having desirable association with fresh and dry fruit yield should be given due consideration under selection for genetic improvement in chilli.
4. Some hybrids showing greater yield potential with other desirable qualities may be tested under different agro climatic conditions and those found suitable should be recommended for release for commercial cultivation.
5. The genetic diversity analysis be carried out to determine diverse parents for hybridization purpose to create further new variability

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APPENDIX

ANOVA for Plant Height (cm) 30 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.8411	0.4206	0.2278	0.7975	
Treatments	17	594.8467	34.9910	18.9546	0.0000	***
Error	34	62.7656	1.8460			
General Mean		28.3222	0.7844	95%	99%	
S.E.Diff.		1.1094	Critical Diff.	2.2545	3.0268	
S.E.Diff from Mean		0.7623	Critical Diff.	1.5493	2.08	
Var Environmental		1.846	ECV	4.7973		
Var Genotypical		11.0483	GCV	11.736		
Var Phenotypical		12.8944	PCV	12.6786		
h² (Broad Sense)		0.8568	S.E. of h²	0.7547		
Genetic Advancement		6.3382	8.1227			
Gen.Adv as % of Mean		22.3788	28.6796	(selection intensity at 5% & 1%)		

ANOVA for Plant Height (cm) 60 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	1.3011	0.6506	0.3295	0.7215	
Treatments	17	3007.3284	176.9017	89.6120	0.0000	***
Error	34	67.1189	1.9741			
General Mean		49.6944	0.8112	95%	99%	
S.E.Diff.		1.1472	Critical Diff.	2.3314	3.13	
S.E.Diff from Mean		0.7883	Critical Diff.	1.6021	2.1509	
Var Environmental		1.9741	ECV	2.8273		
Var Genotypical		58.3092	GCV	15.366		
Var Phenotypical		60.2833	PCV	15.6239		
h² (Broad Sense)		0.9673	S.E. of h²	0.7683		
Genetic Advancement		15.4706	19.8263			
Gen.Adv as % of Mean		31.1314	39.8965	(selection intensity at 5% & 1%)		

ANOVA for Plant Height (cm) 90 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.5233	0.2617	0.0791	0.9241	
Treatments	17	3228.2200	189.8953	57.3923	0.0000	***
Error	34	112.4967	3.3087			
General Mean		71.1333	1.0502	95%	99%	
S.E.Diff.		1.4852	Critical Diff.	3.0183	4.0522	
S.E.Diff from Mean		1.0206	Critical Diff.	2.0741	2.7846	
Var Environmental		3.3087	ECV	2.5572		
Var Genotypical		62.1955	GCV	11.0868		
Var Phenotypical		65.5042	PCV	11.3779		
h^2 (Broad Sense)		0.9495	S.E. of h^2	0.7662		
Genetic Advancement		15.8304	20.2875			
Gen.Adv as % of Mean		22.2545	28.5204	(selection intensity at 5% & 1%)		

ANOVA for Plant Height (cm) 120 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	10.8811	5.4406	0.6977	0.5047	
Treatments	17	4974.0947	292.5938	37.5244	0.0000	***
Error	34	265.1122	7.7974			
General Mean		76.3389	1.6122	95%	99%	
S.E.Diff.		2.28	Critical Diff.	4.6334	6.2206	
S.E.Diff from Mean		1.5668	Critical Diff.	3.184	4.2747	
Var Environmental		7.7974	ECV	3.6579		
Var Genotypical		94.9321	GCV	12.7632		
Var Phenotypical		102.7296	PCV	13.2771		
h^2 (Broad Sense)		0.9241	S.E. of h^2	0.763		
Genetic Advancement		19.2945	24.7269			
Gen.Adv as % of Mean		25.2748	32.3909	(selection intensity at 5% & 1%)		

ANOVA for Plant Height (cm) Maturity						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	5.3404	2.6702	0.6485	0.5292	
Treatments	17	4349.3540	255.8444	62.1397	0.0000	***
Error	34	139.9863	4.1172			
General Mean		76.987	1.1715	95%	99%	
S.E.Diff.		1.6568	Critical Diff.	3.3669	4.5202	
S.E.Diff from Mean		1.1385	Critical Diff.	2.3137	3.1062	
Var Environmental		4.1172	ECV	2.6356		
Var Genotypical		83.909	GCV	11.8984		
Var Phenotypical		88.0263	PCV	12.1868		
h^2 (Broad Sense)		0.9532	S.E. of h^2	0.7666		
Genetic Advancement		18.4234	23.6106			
Gen.Adv as % of Mean		23.9305	30.6682	(selection intensity at 5% & 1%)		

ANOVA for Primary Branchesper Plant 30 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.9537	0.4769	1.5134	0.2346	
Treatments	17	18.0953	1.0644	3.3782	0.0013	**
Error	34	10.7130	0.3151			
General Mean		4.7963	0.3241	95%	99%	
S.E.Diff.		0.4583	Critical Diff.	0.9314	1.2505	
S.E.Diff from Mean		0.315	Critical Diff.	0.6401	0.8593	
Var Environmental		0.3151	ECV	11.7033		
Var Genotypical		0.2498	GCV	10.4201		
Var Phenotypical		0.5649	PCV	15.6699		
h^2 (Broad Sense)		0.4422	S.E. of h^2	0.7012		
Genetic Advancement		0.6846	0.8774			
Gen.Adv as % of Mean		14.274	18.2929	(selection intensity at 5% & 1%)		

ANOVA for Primary Branchesper Plant 60 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	5.4815	2.7407	1.4594	0.2466	
Treatments	17	129.9259	7.6427	4.0696	0.0003	***
Error	34	63.8519	1.8780			
General Mean		10.2963	0.7912	95%	99%	
S.E.Diff.		1.1189	Critical Diff.	2.2739	3.0529	
S.E.Diff from Mean		0.7689	Critical Diff.	1.5626	2.0979	
Var Environmental		1.878	ECV	13.3096		
Var Genotypical		1.9216	GCV	13.4632		
Var Phenotypical		3.7996	PCV	18.9315		
h^2 (Broad Sense)		0.5057	S.E. of h^2	0.7097		
Genetic Advancement		2.0307	2.6025			
Gen.Adv as % of Mean		19.7231	25.2762	(selection intensity at 5% & 1%)		

ANOVA for Primary Branchesper Plant 90 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	5.7778	2.8889	3.1799	0.0542	
Treatments	17	328.6667	19.3333	21.2806	0.0000	***
Error	34	30.8889	0.9085			
General Mean		13.1111	0.5503	95%	99%	
S.E.Diff.		0.7782	Critical Diff.	1.5816	2.1233	
S.E.Diff from Mean		0.5348	Critical Diff.	1.0868	1.4591	
Var Environmental		0.9085	ECV	7.2698		
Var Genotypical		6.1416	GCV	18.9017		
Var Phenotypical		7.0501	PCV	20.2516		
h^2 (Broad Sense)		0.8711	S.E. of h^2	0.7565		
Genetic Advancement		4.7649	6.1064			
Gen.Adv as % of Mean		36.3423	46.5746	(selection intensity at 5% & 1%)		

ANOVA for Primary Branchesper Plant 120 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	1.3333	0.6667	0.5075	0.6065	
Treatments	17	510.8333	30.0490	22.8731	0.0000	***
Error	34	44.6667	1.3137			
General Mean		18.3889	0.6617	95%	99%	
S.E.Diff.		0.9359	Critical Diff.	1.9019	2.5534	
S.E.Diff from Mean		0.6431	Critical Diff.	1.3069	1.7546	
Var Environmental		1.3137	ECV	6.233		
Var Genotypical		9.5784	GCV	16.8303		
Var Phenotypical		10.8922	PCV	17.9474		
h^2 (Broad Sense)		0.8794	S.E. of h^2	0.7575		
Genetic Advancement		5.9787	7.662			
Gen.Adv as % of Mean		32.5124	41.6664	(selection intensity at 5% & 1%)		

ANOVA for Primary Branchesper Plant Maturity						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	1.3333	0.6667	0.5075	0.6065	
Treatments	17	510.8333	30.0490	22.8731	0.0000	***
Error	34	44.6667	1.3137			
General Mean		18.3889	0.6617	95%	99%	
S.E.Diff.		0.9359	Critical Diff.	1.9019	2.5534	
S.E.Diff from Mean		0.6431	Critical Diff.	1.3069	1.7546	
Var Environmental		1.3137	ECV	6.233		
Var Genotypical		9.5784	GCV	16.8303		
Var Phenotypical		10.8922	PCV	17.9474		
h^2 (Broad Sense)		0.8794	S.E. of h^2	0.7575		
Genetic Advancement		5.9787	7.662			
Gen.Adv as % of Mean		32.5124	41.6664	(selection intensity at 5% & 1%)		

ANOVA for Secondary Branchesper Plant 30 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	2.7037	1.3519	1.0299	0.3679	
Treatments	17	403.6482	23.7440	18.0888	0.0000	***
Error	34	44.6296	1.3126			
General Mean		14.9815	0.6615	95%	99%	
S.E.Diff.		0.9355	Critical Diff.	1.9011	2.5523	
S.E.Diff from Mean		0.6428	Critical Diff.	1.3064	1.7539	
Var Environmental		1.3126	ECV	7.6475		
Var Genotypical		7.4771	GCV	18.2521		
Var Phenotypical		8.7898	PCV	19.7895		
h² (Broad Sense)		0.8507	S.E. of h²	0.754		
Genetic Advancement		5.1953	6.6581			
Gen.Adv as % of Mean		34.6784	44.4422	(selection intensity at 5% & 1%)		

ANOVA for Secondary Branchesper Plant 60 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	9.1481	4.5741	1.6512	0.2068	
Treatments	17	1351.2037	79.4826	28.6925	0.0000	***
Error	34	94.1852	2.7702			
General Mean		24.9074	0.9609	95%	99%	
S.E.Diff.		1.359	Critical Diff.	2.7617	3.7078	
S.E.Diff from Mean		0.9339	Critical Diff.	1.8978	2.5479	
Var Environmental		2.7702	ECV	6.6823		
Var Genotypical		25.5708	GCV	20.3022		
Var Phenotypical		28.341	PCV	21.3737		
h² (Broad Sense)		0.9023	S.E. of h²	0.7604		
Genetic Advancement		9.8947	12.6806			
Gen.Adv as % of Mean		39.7261	50.9111	(selection intensity at 5% & 1%)		

ANOVA for Secondary Branchesper Plant 90 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	2.1111	1.0556	0.7600	0.4754	
Treatments	17	1412.0000	83.0588	59.8024	0.0000	***
Error	34	47.2222	1.3889			
General Mean		34.8889	0.6804	95%	99%	
S.E.Diff.		0.9623	Critical Diff.	1.9555	2.6254	
S.E.Diff from Mean		0.6612	Critical Diff.	1.3438	1.8041	
Var Environmental		1.3889	ECV	3.3779		
Var Genotypical		27.2233	GCV	14.9549		
Var Phenotypical		28.6122	PCV	15.3316		
h² (Broad Sense)		0.9515	S.E. of h²	0.7664		
Genetic Advancement		10.4841	13.436			
Gen.Adv as % of Mean		30.0501	38.5108	(selection intensity at 5% & 1%)		

ANOVA for Secondary Branchesper Plant 120 DAT						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3333	0.1667	0.0642	0.9380	
Treatments	17	1500.6666	88.2745	33.9774	0.0000	***
Error	34	88.3333	2.5980			
General Mean		40.7778	0.9306	95%	99%	
S.E.Diff.		1.3161	Critical Diff.	2.6745	3.5907	
S.E.Diff from Mean		0.9044	Critical Diff.	1.8379	2.4675	
Var Environmental		2.598	ECV	3.9527		
Var Genotypical		28.5588	GCV	13.1053		
Var Phenotypical		31.1569	PCV	13.6884		
h² (Broad Sense)		0.9166	S.E. of h²	0.7621		
Genetic Advancement		10.5398	13.5073			
Gen.Adv as % of Mean		25.8468	33.1241	(selection intensity at 5% & 1%)		

ANOVA for Secondary Branchesper Plant Maturity						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3333	0.1667	0.0276	0.9728	
Treatments	17	1282.1666	75.4216	12.5089	0.0000	***
Error	34	205.0000	6.0294			
General Mean		42.5	1.4177	95%	99%	
S.E.Diff.		2.0049	Critical Diff.	4.0744	5.4701	
S.E.Diff from Mean		1.3777	Critical Diff.	2.7999	3.759	
Var Environmental		6.0294	ECV	5.7776		
Var Genotypical		23.1307	GCV	11.3163		
Var Phenotypical		29.1601	PCV	12.7059		
h^2 (Broad Sense)		0.7932	S.E. of h^2	0.7468		
Genetic Advancement		8.8239	11.3083			
Gen.Adv as % of Mean		20.7622	26.6078	(selection intensity at 5% & 1%)		

ANOVA for Days to First Flower Initiation.						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	19.1111	9.5556	1.4980	0.2380	
Treatments	17	1287.3334	75.7255	11.8709	0.0000	***
Error	34	216.8889	6.3791			
General Mean		39.2222	1.4582	95%	99%	
S.E.Diff.		2.0622	Critical Diff.	4.1909	5.6265	
S.E.Diff from Mean		1.4171	Critical Diff.	2.8799	3.8664	
Var Environmental		6.3791	ECV	6.4394		
Var Genotypical		23.1155	GCV	12.258		
Var Phenotypical		29.4946	PCV	13.8465		
h^2 (Broad Sense)		0.7837	S.E. of h^2	0.7456		
Genetic Advancement		8.768	11.2366			
Gen.Adv as % of Mean		22.3546	28.6486	(selection intensity at 5% & 1%)		

ANOVA for Days to First Picking of Fruits						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3341	0.1671	0.1919	0.8263	
Treatments	17	237.9830	13.9990	16.0787	0.0000	***
Error	34	29.6022	0.8707			
General Mean		75.1413	0.5387	95%	99%	
S.E.Diff.		0.7619	Critical Diff.	1.5483	2.0786	
S.E.Diff from Mean		0.5235	Critical Diff.	1.064	1.4284	
Var Environmental		0.8707	ECV	1.2418		
Var Genotypical		4.3761	GCV	2.784		
Var Phenotypical		5.2468	PCV	3.0484		
h^2 (Broad Sense)		0.8341	S.E. of h^2	0.7519		
Genetic Advancement		3.9356	5.0437			
Gen.Adv as % of Mean		5.2376	6.7122	(selection intensity at 5% & 1%)		

ANOVA for Days of 50% Flowering						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3341	0.1671	0.1919	0.8263	
Treatments	17	237.9830	13.9990	16.0787	0.0000	***
Error	34	29.6022	0.8707			
General Mean		66.1413	0.5387	95%	99%	
S.E.Diff.		0.7619	Critical Diff.	1.5483	2.0786	
S.E.Diff from Mean		0.5235	Critical Diff.	1.064	1.4284	
Var Environmental		0.8707	ECV	1.4107		
Var Genotypical		4.3761	GCV	3.1628		
Var Phenotypical		5.2468	PCV	3.4632		
h^2 (Broad Sense)		0.8341	S.E. of h^2	0.7519		
Genetic Advancement		3.9356	5.0437			
Gen.Adv as % of Mean		5.9503	7.6256	(selection intensity at 5% & 1%)		

ANOVA for Days to First Fruit Initiation						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	2.2553	1.1276	0.1141	0.8925	
Treatments	17	237.9830	13.9990	1.4160	0.1891	
Error	34	336.1343	9.8863			
General Mean		71.4746	1.8153	95%	99%	
S.E.Diff.		2.5673	Critical Diff.	5.2173	7.0045	
S.E.Diff from Mean		1.7642	Critical Diff.	3.5852	4.8134	
Var Environmental		9.8863	ECV	4.3991		
Var Genotypical		1.3709	GCV	1.6381		
Var Phenotypical		11.2572	PCV	4.6942		
h² (Broad Sense)		0.1218	S.E. of h²	0.6569		
Genetic Advancement		0.8417	1.0787			
Gen.Adv as % of Mean		1.1776	1.5092	(selection intensity at 5% & 1%)		

ANOVA for Fruitsper Cluster						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3371	0.1685	0.0697	0.9328	
Treatments	17	448.5953	26.3880	10.9077	0.0000	***
Error	34	82.2529	2.4192			
General Mean		13.1209	0.898	95%	99%	
S.E.Diff.		1.27	Critical Diff.	2.5809	3.4649	
S.E.Diff from Mean		0.8727	Critical Diff.	1.7735	2.381	
Var Environmental		2.4192	ECV	11.8542		
Var Genotypical		7.9896	GCV	21.5426		
Var Phenotypical		10.4088	PCV	24.5887		
h² (Broad Sense)		0.7676	S.E. of h²	0.7435		
Genetic Advancement		5.1014	6.5377			
Gen.Adv as % of Mean		38.8801	49.8269	(selection intensity at 5% & 1%)		

ANOVA for Fruit Width (cm)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.0010	0.0005	0.1449	0.8657	
Treatments	17	0.2000	0.0118	3.3952	0.0012	**
Error	34	0.1178	0.0035			
General Mean		0.2193	0.034	95%	99%	
S.E.Diff.		0.0481	Critical Diff.	0.0977	0.1311	
S.E.Diff from Mean		0.033	Critical Diff.	0.0671	0.0901	
Var Environmental		0.0035	ECV	26.8453		
Var Genotypical		0.0028	GCV	23.9871		
Var Phenotypical		0.0062	PCV	36.0007		
h² (Broad Sense)		0.4439	S.E. of h²	0.7015		
Genetic Advancement		0.0722	0.0925			
Gen.Adv as % of Mean		32.9239	42.1938	(selection intensity at 5% & 1%)		

ANOVA for Fruit Length (cm)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.4288	0.2144	14.2375	0.0000	***
Treatments	17	72.7945	4.2820	284.3532	0.0000	***
Error	34	0.5120	0.0151			
General Mean		5.1628	0.0708	95%	99%	
S.E.Diff.		0.1002	Critical Diff.	0.2036	0.2734	
S.E.Diff from Mean		0.0689	Critical Diff.	0.1399	0.1879	
Var Environmental		0.0151	ECV	2.3769		
Var Genotypical		1.4223	GCV	23.1002		
Var Phenotypical		1.4374	PCV	23.2222		
h² (Broad Sense)		0.9895	S.E. of h²	0.7711		
Genetic Advancement		2.4439	3.132			
Gen.Adv as % of Mean		47.3365	60.6642	(selection intensity at 5% & 1%)		

ANOVA for Fruitsper Plant						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	320.0370	160.0185	92.7966	0.0000	***
Treatments	17	14338.3701	843.4335	489.1169	0.0000	***
Error	34	58.6296	1.7244			
General Mean		108.4074	0.7582	95%	99%	
S.E.Diff.		1.0722	Critical Diff.	2.1789	2.9253	
S.E.Diff from Mean		0.7368	Critical Diff.	1.4973	2.0103	
Var Environmental		1.7244	ECV	1.2113		
Var Genotypical		280.5697	GCV	15.4512		
Var Phenotypical		282.2941	PCV	15.4986		
h^2 (Broad Sense)		0.9939	S.E. of h^2	0.7716		
Genetic Advancement		34.3999	44.0853			
Gen.Adv as % of Mean		31.7321	40.6663	(selection intensity at 5% & 1%)		

ANOVA for Days to Maturity						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	3.7378	1.8689	0.1524	0.8592	
Treatments	17	1858.9199	109.3482	8.9161	0.0000	***
Error	34	416.9827	12.2642			
General Mean		154.7767	2.0219	95%	99%	
S.E.Diff.		2.8594	Critical Diff.	5.8109	7.8015	
S.E.Diff from Mean		1.9649	Critical Diff.	3.9932	5.3611	
Var Environmental		12.2642	ECV	2.2626		
Var Genotypical		32.3613	GCV	3.6754		
Var Phenotypical		44.6255	PCV	4.316		
h^2 (Broad Sense)		0.7252	S.E. of h^2	0.7382		
Genetic Advancement		9.9793	12.7891			
Gen.Adv as % of Mean		6.4476	8.2629	(selection intensity at 5% & 1%)		

ANOVA for Fruit Fresh Weight Plant (g)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	31038.9043	15519.4521	1.7627	0.1869	
Treatments	17	414423.6875	24377.8633	2.7689	0.0057	**
Error	34	299347.1250	8804.3271			
General Mean		501.4117	54.1736	95%	99%	
S.E.Diff.		76.613	Critical Diff.	155.695	209.0291	
S.E.Diff from Mean		52.6472	Critical Diff.	106.991	143.6415	
Var Environmental		8804.3269	ECV	18.7134		
Var Genotypical		5191.1789	GCV	14.3694		
Var Phenotypical		13995.5059	PCV	23.5939		
h^2 (Broad Sense)		0.3709	S.E. of h^2	0.6916		
Genetic Advancement		90.3939	115.8446			
Gen.Adv as % of Mean		18.0279	23.1037	(selection intensity at 5% & 1%)		

ANOVA for Fruit Fresh Weightper Plot (kg)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	27.8947	13.9474	1.7594	0.1875	
Treatments	17	373.0112	21.9418	2.7678	0.0057	**
Error	34	269.5368	7.9276			
General Mean		15.0422	1.6256	95%	99%	
S.E.Diff.		2.2989	Critical Diff.	4.6719	6.2723	
S.E.Diff from Mean		1.5798	Critical Diff.	3.2105	4.3102	
Var Environmental		7.9276	ECV	18.7179		
Var Genotypical		4.6714	GCV	14.3685		
Var Phenotypical		12.599	PCV	23.5969		
h^2 (Broad Sense)		0.3708	S.E. of h^2	0.6916		
Genetic Advancement		2.7111	3.4744			
Gen.Adv as % of Mean		18.0234	23.098	(selection intensity at 5% & 1%)		

ANOVA for Fruit Fresh Weightper ha. (q.)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	4966.1411	2483.0706	1.7627	0.1869	
Treatments	17	66307.6250	3900.4482	2.7689	0.0057	**
Error	34	47894.9688	1408.6755			
General Mean		200.5648	21.6693	95%	99%	
S.E.Diff.		30.645	Critical Diff.	62.2778	83.6111	
S.E.Diff from Mean		21.0588	Critical Diff.	42.7963	57.4563	
Var Environmental		1408.6755	ECV	18.7133		
Var Genotypical		830.591	GCV	14.3694		
Var Phenotypical		2239.2665	PCV	23.5938		
h^2 (Broad Sense)		0.3709	S.E. of h^2	0.6916		
Genetic Advancement		36.1578	46.3381			
Gen.Adv as % of Mean		18.028	23.1038	(selection intensity at 5% & 1%)		

ANOVA for Fruit Dry Weightper Plant (g)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	3448.4624	1724.2312	1.7625	0.1869	
Treatments	17	46047.0977	2708.6528	2.7688	0.0057	**
Error	34	33261.4219	978.2770			
General Mean		167.1367	18.058	95%	99%	
S.E.Diff.		25.5379	Critical Diff.	51.8989	69.677	
S.E.Diff from Mean		17.5492	Critical Diff.	35.6641	47.881	
Var Environmental		978.2771	ECV	18.7137		
Var Genotypical		576.7919	GCV	14.3694		
Var Phenotypical		1555.069	PCV	23.5941		
h^2 (Broad Sense)		0.3709	S.E. of h^2	0.6916		
Genetic Advancement		30.1309	38.6143			
Gen.Adv as % of Mean		18.0277	23.1034	(selection intensity at 5% & 1%)		

ANOVA for Fruit Dry Weightper Plot (kg)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	3.1014	1.5507	1.7600	0.1874	
Treatments	17	41.4468	2.4380	2.7671	0.0057	**
Error	34	29.9565	0.8811			
General Mean		5.0143	0.5419	95%	99%	
S.E.Diff.		0.7664	Critical Diff.	1.5575	2.0911	
S.E.Diff from Mean		0.5267	Critical Diff.	1.0703	1.4369	
Var Environmental		0.8811	ECV	18.7197		
Var Genotypical		0.519	GCV	14.3672		
Var Phenotypical		1.4001	PCV	23.5976		
h^2 (Broad Sense)		0.3707	S.E. of h^2	0.6916		
Genetic Advancement		0.9036	1.1579			
Gen.Adv as % of Mean		18.0196	23.0931	(selection intensity at 5% & 1%)		

ANOVA for Fruit Dry Weightper ha. (q.)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	551.6238	275.8119	1.7622	0.1870	
Treatments	17	7367.1948	433.3644	2.7688	0.0057	**
Error	34	5321.6216	156.5183			
General Mean		66.8546	7.2231	95%	99%	
S.E.Diff.		10.215	Critical Diff.	20.7592	27.8703	
S.E.Diff from Mean		7.0196	Critical Diff.	14.2654	19.152	
Var Environmental		156.5183	ECV	18.7133		
Var Genotypical		92.282	GCV	14.369		
Var Phenotypical		248.8003	PCV	23.5936		
h^2 (Broad Sense)		0.3709	S.E. of h^2	0.6916		
Genetic Advancement		12.052	15.4453			
Gen.Adv as % of Mean		18.0272	23.1028	(selection intensity at 5% & 1%)		

ANOVA for Seedsper Fruit						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	3.5973	1.7986	1.2641	0.2954	
Treatments	17	847.2592	49.8388	35.0278	0.0000	***
Error	34	48.3764	1.4228			
General Mean		28.3704	0.6887	95%	99%	
S.E.Diff.		0.9739	Critical Diff.	1.9793	2.6573	
S.E.Diff from Mean		0.6693	Critical Diff.	1.3601	1.826	
Var Environmental		1.4228	ECV	4.2045		
Var Genotypical		16.1386	GCV	14.1602		
Var Phenotypical		17.5615	PCV	14.7712		
h^2 (Broad Sense)		0.919	S.E. of h^2	0.7624		
Genetic Advancement		7.9333	10.1669			
Gen.Adv as % of Mean		27.9633	35.8365	(selection intensity at 5% & 1%)		

ANOVA for 1000 Seed Weight (g)						
Source of Variations	**df**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**Probability**	
Replicate	2	0.3972	0.1986	1.2571	0.2974	
Treatments	17	94.1760	5.5398	35.0617	0.0000	***
Error	34	5.3720	0.1580			
General Mean		9.4565	0.2295	95%	99%	
S.E.Diff.		0.3246	Critical Diff.	0.6596	0.8855	
S.E.Diff from Mean		0.223	Critical Diff.	0.4532	0.6085	
Var Environmental		0.158	ECV	4.2034		
Var Genotypical		1.7939	GCV	14.1635		
Var Phenotypical		1.9519	PCV	14.7741		
h^2 (Broad Sense)		0.9191	S.E. of h^2	0.7624		
Genetic Advancement		2.6451	3.3898			
Gen.Adv as % of Mean		27.9711	35.8465	(selection intensity at 5% & 1%)		

VITA

The author of this thesis Mr. Ravindra Patidar S/O Shri Premchandra Patidar was born on 20th January 1990 at Khargone, M.P. He completed his primary and middle school education from Khargone H.S.C. (10th) from Bal Siksha Niketan H.S.Khargone and H.S.S.C. (12th) from Govt. D.A.Boys H.S.School Khargone, District Khargone(M.P.) in 2007

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