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## Genetic variability, heritability and correlation coefficient analysis in rice (*Oryza sativa* L.) germplasm

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#### Abstract

The present investigation entitled "Assessment of genetic variability and qualitative traits of Rice (*Oryza sativa* L.) germplasm for yield and yield attributing characters" was undertaken to evaluate 72 germplasm accessions along with three local checks in rice for yield and yield attributing characters in rice with row to row and plant to plant spacing  $20 \times 15$  cm. The experiment was carried out to study the morphological characters, to access the genetic variability and to estimate the correlation coefficient among yield and ant its contributing traits in rice germplasm. The experiment was carried out at experimental area of rice in instructional farm, College of Agriculture, Rewa (M.P.) during kharif-2018. The experiment was laid out in Randomized Block Design with three replications.

The analysis of variance revealed that highly significant variations were recorded among all the germplasm accessions for all the traits under study. It indicated that adequate amount of genetic variability were present in all studied characters. High estimates of phenotypic coefficient of variations (PCV%), genotypic coefficient of variations (GCV%) and high heritability coupled with high genetic advance as percentage of mean was recorded for were recorded for number of tillers per plant, number of grains per panicle, biological yield per plant and grain yield per plant. These characters showed additive gene action in their expression.

The grain yield per plant had significant positive correlation with biological yield per plant followed by harvest index, panicle length, number of tillers per plant, number of productive tillers per plant, seed index and number of grains per panicle. The grain yield also showed negative correlation with plant height, days to 50 percent flowering and days to maturity.

Keywords: Rice, variability, heritability, genetic advance and correlation

#### Introduction

Rice (*Oryza sativa* L.) is an important member of family Poaceae (2n = 24), Oryza genus has 2 cultivated and 22 wild species. Three eco-geographic races of rice i.e. Indica, Japonica and Jawanica are widely cultivated in Asian country. Rice is primary food, usually consumed in less developed or developing country. It is predicted that up to 2025, the world's population may exceed beyond 8 billion which will require about 765 mt of rice which is expected 70 percent more than today's consumption. Hence, increase in rice productivity is the urgent need to feed over increasing world's population, which can be achieved through the application of hybrid varieties in commercial cultivation along with proper utilization of land, water, chemicals and other inputs. The crop improvement is the best solution of yield enhancement in rice.

The area, production and productivity of rice in India is 43.39 m ha, 108.32 mt and 2404 kg/ha, respectively. Similarly, in Madhya Pradesh it is also grown in an area of 1.93 m ha with a production of 2.74 mt and the productivity of 1768 kg/ha. (Anonymous 2016)<sup>[3]</sup>.

The genetic variability refers to presence of the differences among the different germplasm lines present in the population. Selection is effective when there is significant amount of genetic variability among the individuals of different germplasm lines. The presence of genetic variability along with high genetic advance for the characters which is significant positive correlated with grain yield per plant is basic requirements to formulate selection criteria for transgressive breeding programme in rice.

#### **Material and Methods**

The experiment was conducted in kharif-2018 at experimental area of rice in Instructional

Farm, College of Agriculture, Rewa (M.P.) to investigate the seventy-two germplasm accessions with three local checks in Randomized Block Design. The experimental field divided into nine blocks and three replications each block consisted twenty-four germplasm accessions and one check, respectively. Each genotype was grown in a plot which size 0.6x1.0 m and row to row spacing 20 cm and plant to plant spacing 15 cm, respectively. Checks are randomized within in the blocks twenty-four days old seedlings transplanted in the experimental field manually. Recommended dose of fertilizer 120N:60P:40K kg/ha was applied. The entire dose of K<sub>2</sub>O and P<sub>2</sub>O<sub>5</sub> was applied with half dose of N as basal dose at the time of field preparation and remaining dose of N was splited in two splits at twenty-five days interval in the crop field.

Ten randomly plants were a selection of from each genotype in each replication and observations were noted on these plants for the characters like, Plant height (cm), number of tillers per plant, number of productive tillers per plant, panicle length (cm), number of grains per panicle, 100 seed weight (g), biological yield per plant (g), harvest index (%) and grain yield per plant (g), while days to 50% flowering and days to maturity were recorded on plot basis.

#### **Experiment material**

The material consisted of seventy-two germplasm accessions collected from various areas of Rewa (M.P.) with three local checks that is LC-767, LG-964 and MTU-1010. The material used for investigation is given table 1.

Table 1: Source of germplasm

S. No.	Entry number	Name of Germplasm				
1	6	Badki Luchai				
2	10	Badal phool				
3	11	Baghmechha				
4	12	Bagari				
5	15	Banko				
6	24	Bela				
7	25	Berjali				
8	26	Bhata phool				
9	27	Bhejari				
10	33	Biranj				
11	38	Chinmauri				
12	50	Dhaniyadhan				
13	52	Dilbaxa				
14	55	Dubraj				
15	56	Doodhi				
16	58	Geeta				
10	61	Hardgudi				
18	63	Jeeraphool				
18	64	Jeerasar				
20	72	Kanga				
21	93	Karanphool				
22	104	Karmodhan				
23	106	Kerakhambh				
24	111	Khansari				
25	114	Kumhran				
26	115	Kuthalidhan				
27	120	Lamera				
28	135	Lohadhi				
29	141	Malati				
30	142	Masooriya				
31	143	Nadawal				
32	154	Rajgauhi				
33	155	Ramkajari				
34	162	Safari				
35	167	SAiri				
36	172	Samasar				
37	177	Samda				
38	181	Sauthi				
39	182	Sonkharchi				
40	187	Surja				
41	191	Hauhi				
42	199	Bhalshankar				
43	200	Pilkormera				
44	201	Shyamjeera				
45	203	Galari				
45	203	Bilailuchai				
47	205	Badshahbhog				
48	203	Hardigathi				
48	209	Shervani				
50	210	Badshahprasan				

51	211	Nevari
52	212	Kotava
53	215	Durgaprasad
54	217	Assamchidi
55	218	Koshamkhand
56	219	Senkursar
57	220	Keraphool
58	221	Bhaloodubraj
59	228	Kadamphool
60	229	Turailuchai
61	230	Phoolmechha
62	231	Hansraj
63	238	Ajan
64	243	Kannauji
65	244	Kerakhambh
66	250	Kansari
67	257	Karagi
68	261	Kosamsar
69	267	Kalajeera
70	290	Karahani
71	291	Katanga
72	292	Kudurlai
73	LC-767	
74	LC-964	
75	MTU-1010	

#### Statistical analysis

Different genetic parameters like, genotypic and phenotypic variance, GCV and PCV, heritability, genetic advance, genetic advance as percent of mean were estimated by using following formula:

#### Analysis of variance

The analysis of variance for twelve studied characters were estimated as per the model proposed by Panse and Sukhatme (1961)<sup>[11]</sup>.

The genotypic and phenotypic variance was calculated as per the formulae (Burton and Devane 1952).

Genotypic variance  $(\sigma^2 g) =$ 

(Mean sum of squares due to treatments – Mean sum of squares due to error) Number of replications

Phenotypic variance  $(\sigma^2 p) = (\sigma^2 g) + (\sigma^2 e)$ Where,  $(\sigma^2 e) =$  Error variance

#### Genotypic and phenotypic coefficients of variance

The genotypic and phenotypic coefficient of variance was calculated by the formulae given by Burton (1952).

$$\begin{array}{l} \mbox{Genotypic coefficient of variation (GCV \%) = - \frac{\mbox{Genotypic standard deviation}}{\mbox{Mean}} \times 100 \\ \end{array}$$

Categorization of the range of variation was affected as proposed by Siva Subramanian and Madhavamenon (1973) as low (<10%), moderate (10-20%) and high (>20%).

#### Heritability (Broad sense) h<sup>2</sup>

Heritability in broad sense  $h^2_{(b)}$  was calculated by the formula given by Lush (1940) <sup>[9]</sup>.

Broad sense Heritability = 
$$\frac{\sigma^2 g}{\sigma^2 p} \times 100$$

Where,  $\sigma^2 g$  = Genotypic variance and  $\sigma^2 p$  = Phenotypic variance.

As proposed by Johnson *et al.* (1955), heritability was categorized as: low (<30%), moderate (30 - 60%) and high (>60%).

#### Genetic advance

The genetic advance was calculated by the following formula given by Johnson *et al.* (1955).

 $GA = k \sigma_p H$ 

Where, GA = Genetic advance, k = Selection differential at 5% selection intensity.

 $\sigma_p$  = Phenotypic standard deviation and H = Heritability

Genetic advance as percent of mean (GA as percent mean) Genetic advance as percent of mean was calculated as per the formula

GA as percentage of mean = 
$$\frac{\text{Genetic advance}}{\text{General mean}} \times 100$$

The degree of genetic advance as percent of mean was classified as suggested by Johnson *et al.* (1955) as low (<10%), moderate (10-20%) and high (>20%).

#### **Correlation coefficient analysis**

Genotypic and phenotypic correlation coefficients were calculated using the method given by Johnson *et al.* (1955).

The significance of correlation coefficients was tested by comparing the genotypic and phenotypic correlation coefficients with table value [Fisher and Yates (1967)] at (n-2) degrees of freedom at 5% and 1% level where, 'n' denotes the number of treatments used in the calculations.

#### **Result and Discussion Analysis of variance**

The analysis of variance revealed that highly significant variations were recorded among all the germplasm accessions for all the traits under study. It indicated that adequate amount of genetic variability were present in all studied characters. Similar findings were also reported by Sameera *et al.* (2013)<sup>[15]</sup> and Sarawgi *et al.* (2013)<sup>[17]</sup>. The analysis of variance for yield and yield attributing traits are presented in Table 2.

Table 2: Analysis of variance for yield and yield attributing characters of rice germplas	asm accessions
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Source of verification	Mean sum of squares											
Source of variation	D.F.	DTF	DTM	PH	PL	NTPP	NPTPP	NGPP	S.I.	BYPP	HI	GYPP
Replication	2	4.80	1.24	0.64	0.51	3.28	3.58	237.9	0.00	20.18	0.12	0.94
Treatment	74	88.94 **	95.71 **	332.18 **	15.03 **	12.60 **	11.09 **	1818.92 **	0.36 **	204.93 **	93.70 **	51.05 **
Error	148	9.17	3.18	2.09	0.22	1.09	1.13	61.95	0.006	11.45	0.59	1.11

\*\*Significant at 1% level of probability.

#### Mean performance

The mean performance of seventy-two rice germplasm accessions along with three local checks for yield and yield attributing characters is presented in Table 3. The studied genotypes had large range of variation for all the characters.

The maximum grain yield per plant was observed 28.50 g by MTU-1010 followed by LC-964, while minimum grain yield per plant was recorded by Malati (3.16 g) with an overall mean value of 8.42 g. The higher grain per plant in this germplasm accession was attributed due to increase in number of tillers per plant, number of productive tillers per plant, panicle length, number of grain per panicle, seed index and harvest index. Similar kinds of results were also reported by Tariku *et al.* (2013) <sup>[20]</sup> and Rolando *et al.* (2016) <sup>[14]</sup>.

#### Estimation of parameters of genetic variability: The

parameters of genetic variability like mean, range, GCV (%), PCV (%), h<sup>2</sup>bs (%), GA as percentage of mean for all the characters under study were recorded and are given in table 4. High estimates of phenotypic coefficient of variations (PCV%) and genotypic coefficient of variations (GCV%) were recorded for number of tillers per plant, number of productive tillers per plant, number of grains per panicle, biological yield per plant and grain yield per plant. These characters showed additive gene action in their expression. Similar results were also reported by Rashid et al. (2017)<sup>[13]</sup> and Patel et al. (2014) <sup>[12]</sup> for number of grain per panicle. Prakash et al. (2018), Abebe et al. (2017) <sup>[1]</sup>, Gour et al. (2017)<sup>[6]</sup>, Veludandi et al. (2017)<sup>[23]</sup> and Patel et al. (2014) <sup>[12]</sup> for biological yield per plant, Singh et al. (2018) <sup>[18]</sup> for number of productive tillers per plant and Kishore et al. (2015)<sup>[8]</sup> for number of tillers per plant.

Table 3: Mean performance of different characters

I Badaki Luchai 98.00 126.000 126.100 7.433 7.100 83.200 1.367 21.367 25.933 4.933   2 Badal phool 94.667 125.333 116.133 22.833 9.700 9.067 82.533 2.400 33.867 29.800 10.300   3 Baghmechha 94.833 126.667 109.467 21.567 11.967 11.300 73.867 2.433 2.400 32.667 102.67   5 Banko 94.333 127.000 87.900 21.533 10.200 9.400 62.333 2.400 22.400 23.067 24.333 7.400   7 Berjail 78.667 111.000 90.100 22.567 13.967 12.467 23.33 3.4933 11.600 8.333 12.067 18.833 12.667 8.300 13.467 2.467 24.000 26.000 6.967   9 Bhejari 89.333 120.667 102.67 11.867 9.300 2.300 2.200 <th>S. No.</th> <th>Genotype</th> <th>DTF</th> <th>DTM</th> <th>PH</th> <th>PL</th> <th>TPP</th> <th>PTPP</th> <th>NGPP</th> <th>100-GW</th> <th>BYPP</th> <th>HI</th> <th>GYPP</th>	S. No.	Genotype	DTF	DTM	PH	PL	TPP	PTPP	NGPP	100-GW	BYPP	HI	GYPP
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1	Badaki Luchai	98.00	130.00	126.400	22.100	7.433	7.100	83.200	1.367	21.367	25.933	4.933
4 Bagari 86.667 118.667 109.467 21.567 11.967 11.300 73.867 2.433 29.400 32.667 10.267   5 Banko 94.333 127.000 87.900 21.533 10.200 9.400 62.333 2.407 22.367 28.333 7.400   7 Berjali 78.667 111.000 90.100 22.567 13.967 12.467 24.367 28.333 7.400   8 Bhata phool 87.333 120.667 91.067 7.833 7.200 65.767 2.467 24.000 26.900 6.967   9 Bhejari 89.333 120.667 110.267 21.867 9.300 8.367 31.467 2.467 28.000 31.300 8.433   10 Biranj 96.000 128.667 88.200 12.33 8.837 7.67 8.333 2.233 15.500 30.767 15.607 70.467 2.200 21.667 21.67 5.600 31.390 6.767 <t< td=""><td>2</td><td>Badal phool</td><td>94.667</td><td>125.333</td><td>116.133</td><td>22.833</td><td>9.700</td><td>9.067</td><td>82.533</td><td>2.400</td><td>33.867</td><td>29.800</td><td>10.300</td></t<>	2	Badal phool	94.667	125.333	116.133	22.833	9.700	9.067	82.533	2.400	33.867	29.800	10.300
5 Banko 94.333 127.000 87.900 21.533 10.200 9.400 62.333 2.400 22.000 39.300 9.067   6 Bela 85.000 118.667 96.867 22.800 9.767 9.333 59.533 2.467 24.367 28.333 7.400   7 Berjali 78.33 12.067 13.967 12.467 53.367 2.463 31.833 49.333 11.600   8 Bhata phool 87.333 120.667 110.267 21.867 9.300 8.367 31.467 2.467 28.200 31.300 8.433   10 Birarj 96.000 128.667 88.200 19.233 8.833 7.367 8.333 2.233 15.600 30.767 5.167   11 Chinmauri 87.167 13.300 12.330 20.767 10.567 9.867 9.300 2.200 21.567 2.567   14 Dubraj 92.667 12.4000 101.933 12.407 2.333<	3	Baghmechha	94.833	126.667	103.900	22.500	8.200	7.900	84.100	2.167	32.500	26.267	9.233
6 Bela 85.000 118.667 96.867 22.800 9.767 9.333 59.533 2.467 24.367 28.333 7.400   7 Berjali 78.667 111.000 90.100 22.567 13.967 12.467 53.367 2.633 31.833 34.933 11.600   8 Bhata phool 87.333 120.667 91.007 7.833 7.200 65.767 2.467 28.200 31.300 8.433   10 Biranj 96.000 128.667 88.200 19.233 8.833 7.767 83.333 2.233 15.600 30.767 5.167   11 Chinmauri 87.167 117.333 92.333 21.231 10.400 8.800 73.800 2.200 23.600 26.67 5.600   13 Dihaxa 91.667 123.067 10.577 9.867 9.800 2.200 23.600 24.00 5.670   14 Dubraj 92.667 124.000 101.933 20.767 6.5	4	Bagari	86.667	118.667	109.467	21.567	11.967	11.300	73.867	2.433	29.400	32.667	10.267
7 Berjali 78.667 111.000 90.100 22.567 13.967 12.467 53.367 2.633 31.833 34.933 11.600   8 Bhata phool 87.333 120.667 94.700 21.067 7.833 7.200 65.767 2.467 28.400 26.900 6.967   9 Bhejari 89.333 120.667 110.267 21.867 9.300 8.367 31.467 2.467 28.200 31.300 8.433   10 Biranj 96.000 128.667 88.200 19.233 8.833 7.767 83.333 2.300 25.267 30.100 6.767   12 Dhaniyadhan 98.000 130.000 112.300 20.167 6.087 70.467 2.200 21.567 25.67 30.100 6.567   14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 23.267 8.700   15 Doodhi 85.333 117.333	5	Banko	94.333	127.000	87.900	21.533	10.200	9.400	62.333	2.400	22.000	39.300	9.067
8 Bhata phool 87.333 120.667 94.700 21.067 7.833 7.200 65.767 2.467 24.000 26.900 6.967   9 Bhejari 89.333 120.667 110.267 21.867 9.300 8.367 31.467 2.467 28.200 31.300 8.433   10 Biranj 96.000 128.667 88.200 19.233 8.833 7.767 83.333 2.233 15.600 30.767 5.167   11 Chinmauri 87.167 117.333 22.333 21.233 10.400 8.800 2.200 21.567 27.567 5.600   13 Dibaxa 91.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.107 7.633 2.567 23.967 24.233 6.200   16 Geeta 88.000 118.667 121.067 24.133 <	6	Bela	85.000	118.667	96.867	22.800	9.767	9.333	59.533	2.467	24.367	28.333	7.400
9 Bhejari 89.333 120.667 110.267 21.867 9.300 8.367 31.467 2.467 28.200 31.300 8.433   10 Biranj 96.000 128.667 88.200 19.233 8.833 7.767 83.333 2.233 15.600 30.767 5.167   11 Chinmauri 87.167 117.333 92.333 21.233 10.400 8.800 2.300 25.267 30.100 6.767   12 Dhaniyadhan 98.000 130.000 112.300 20.167 6.807 6.067 70.467 2.200 21.567 25.600 5.567   13 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.400   16 Geeta 88.000 118.667 <	7	Berjali	78.667	111.000	90.100	22.567	13.967	12.467	53.367	2.633	31.833	34.933	11.600
10 Biranj 96.000 128.667 88.200 19.233 8.833 7.767 83.333 2.233 15.600 30.767 5.167   11 Chinmauri 87.167 117.333 92.333 21.233 10.400 8.800 73.800 2.300 25.267 30.100 6.767   12 Dhaniyadhan 98.067 123.667 105.700 20.867 6.387 5.867 99.800 2.200 23.600 26.100 5.567   14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 124.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   19 Jeerasar 91.000 124.000	8	Bhata phool	87.333	120.667	94.700	21.067	7.833	7.200	65.767	2.467	24.000	26.900	6.967
11 Chinmauri 87.167 117.333 92.333 21.233 10.400 8.800 73.800 2.300 25.267 30.100 6.767   12 Dhaniyadhan 98.000 130.000 112.300 20.167 6.800 6.067 70.467 2.200 21.567 27.567 5.600   13 Dilbaxa 91.667 123.667 105.700 20.867 6.387 5.867 99.800 2.200 23.600 26.100 5.567   14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 121.067 24.733 6.967 6.500 76.333 2.567 23.967 24.233 6.200   17 Hardgudi 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333	9	Bhejari	89.333	120.667	110.267	21.867	9.300	8.367	31.467	2.467	28.200	31.300	8.433
12 Dhaniyadhan 98.000 130.000 112.300 20.167 6.800 6.067 70.467 2.200 21.567 27.567 5.600   13 Dilbaxa 91.667 123.667 105.700 20.867 6.387 5.867 99.800 2.200 23.600 26.100 5.567   14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 121.067 24.733 6.967 76.333 2.567 23.967 24.233 6.200   18 Jeeraphool 77.333 109.667 102.637 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Kanga 88.667 122.333 128.300	10	Biranj	96.000	128.667	88.200	19.233	8.833	7.767	83.333	2.233	15.600	30.767	5.167
13 Dilbaxa 91.667 123.667 105.700 20.867 6.387 5.867 99.800 2.200 23.600 26.100 5.567   14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 121.067 24.733 6.967 71.033 2.567 23.967 24.233 6.200   17 Hardguli 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333 126.333 19.900 13.733 12.633 58.200 2.367 2.6400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067	11	Chinmauri	87.167	117.333	92.333	21.233	10.400	8.800	73.800	2.300	25.267	30.100	6.767
14 Dubraj 92.667 124.000 101.933 20.767 10.567 9.867 90.567 2.300 20.967 31.900 6.700   15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 121.067 24.733 6.967 6.500 76.333 2.567 23.967 24.233 6.200   17 Hardgudi 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333 109.667 105.633 19.900 13.733 12.633 58.200 2.367 26.400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067 22.367 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Karaphool 80.667	12	Dhaniyadhan	98.000	130.000	112.300	20.167	6.800	6.067	70.467	2.200	21.567	27.567	5.600
15 Doodhi 85.333 117.333 113.100 23.167 7.833 6.967 71.033 2.400 25.200 33.267 8.700   16 Geeta 88.000 118.667 121.067 24.733 6.967 6.500 76.333 2.567 23.967 24.233 6.200   17 Hardgudi 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333 109.667 105.633 19.900 13.733 12.633 58.200 2.367 26.400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067 22.367 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Karaga 88.667 122.333 128.300 22.900 15.700 14.533 76.800 2.333 40.600 31.907 13.067   21 Karanphool 80.667	13	Dilbaxa	91.667	123.667	105.700	20.867	6.387	5.867	99.800	2.200	23.600	26.100	5.567
16 Geeta 88.000 118.667 121.067 24.733 6.967 6.500 76.333 2.567 23.967 24.233 6.200   17 Hardgudi 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333 109.667 105.633 19.900 13.733 12.633 58.200 2.367 26.400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067 22.367 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Kanga 88.667 122.333 128.300 22.900 15.700 14.533 76.800 2.333 40.600 31.907 13.067   21 Karanphool 80.667 109.333 84.600 20.867 11.800 10.200 58.933 3.267 23.067 32.03 7.633   22 Karmodhan 89.333	14	Dubraj	92.667	124.000	101.933	20.767	10.567	9.867	90.567	2.300	20.967	31.900	6.700
17 Hardgudi 93.333 125.000 119.467 24.133 7.167 6.633 60.200 1.867 25.600 30.867 7.400   18 Jeeraphool 77.333 109.667 105.633 19.900 13.733 12.633 58.200 2.367 26.400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067 22.367 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Kanga 88.667 122.333 128.300 22.900 15.700 14.533 76.800 2.333 40.600 31.907 13.067   21 Karanphool 80.667 109.333 84.600 20.867 11.800 10.200 58.933 3.267 29.567 31.117 8.867   22 Karmodhan 89.333 123.333 101.967 21.200 8.100 7.100 77.367 2.367 23.067 32.203 7.633   23 Kerakhambh 85.66	15	Doodhi	85.333	117.333	113.100	23.167	7.833	6.967	71.033	2.400	25.200	33.267	8.700
18 Jeeraphool 77.333 109.667 105.633 19.900 13.733 12.633 58.200 2.367 26.400 29.133 7.400   19 Jeerasar 91.000 124.000 116.067 22.367 8.567 7.567 77.033 2.433 19.600 31.323 5.933   20 Kanga 88.667 122.333 128.300 22.900 15.700 14.533 76.800 2.333 40.600 31.907 13.067   21 Karanphool 80.667 109.333 84.600 20.867 11.800 10.200 58.933 3.267 29.567 31.117 8.867   22 Karanphool 89.333 123.333 101.967 21.200 8.100 7.100 77.367 2.367 23.067 32.203 7.633   23 Kerakhambh 85.667 118.667 104.300 21.450 8.467 7.600 80.533 1.900 19.600 29.833 6.467   24 Khansari 86.6	16	Geeta	88.000	118.667	121.067	24.733	6.967	6.500	76.333	2.567	23.967	24.233	6.200
19Jeerasar91.000124.000116.06722.3678.5677.56777.0332.43319.60031.3235.93320Kanga88.667122.333128.30022.90015.70014.53376.8002.33340.60031.90713.06721Karanphool80.667109.33384.60020.867118.80010.20058.9333.26729.56731.1178.86722Karmodhan89.333123.333101.96721.2008.1007.10077.3672.36723.06732.2037.63323Kerakhambh85.667118.667104.30021.4508.4677.60080.5331.90019.60029.8336.46724Khansari86.667118.333120.00023.9337.6006.46780.9002.30029.96730.6678.96725Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya <td>17</td> <td>Hardgudi</td> <td>93.333</td> <td>125.000</td> <td>119.467</td> <td>24.133</td> <td>7.167</td> <td>6.633</td> <td>60.200</td> <td>1.867</td> <td>25.600</td> <td>30.867</td> <td>7.400</td>	17	Hardgudi	93.333	125.000	119.467	24.133	7.167	6.633	60.200	1.867	25.600	30.867	7.400
20Kanga88.667122.333128.30022.90015.70014.53376.8002.33340.60031.90713.06721Karanphool80.667109.33384.60020.86711.80010.20058.9333.26729.56731.1178.86722Karmodhan89.333123.333101.96721.2008.1007.10077.3672.36723.06732.2037.63323Kerakhambh85.667118.667104.30021.4508.4677.60080.5331.90019.60029.8336.46724Khansari86.667118.333120.00023.9337.6006.46780.9002.30029.96730.6678.96725Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal	18	Jeeraphool	77.333	109.667	105.633	19.900	13.733	12.633	58.200	2.367	26.400	29.133	7.400
21Karanphool80.667109.33384.60020.86711.80010.20058.9333.26729.56731.1178.86722Karmodhan89.333123.333101.96721.2008.1007.10077.3672.36723.06732.2037.63323Kerakhambh85.667118.667104.30021.4508.4677.60080.5331.90019.60029.8336.46724Khansari86.667118.333120.00023.9337.6006.46780.9002.30029.96730.6678.96725Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal	19	Jeerasar	91.000	124.000	116.067	22.367	8.567	7.567	77.033	2.433	19.600	31.323	5.933
22 Karmodhan 89.333 123.333 101.967 21.200 8.100 7.100 77.367 2.367 23.067 32.203 7.633   23 Kerakhambh 85.667 118.667 104.300 21.450 8.467 7.600 80.533 1.900 19.600 29.833 6.467   24 Khansari 86.667 118.333 120.000 23.933 7.600 6.467 80.900 2.300 29.967 30.667 8.967   25 Kumhran 89.667 118.000 111.540 20.300 7.800 6.867 97.467 2.467 25.967 22.970 6.567   26 Kuthalidhan 82.667 115.333 111.033 21.600 11.500 9.700 71.333 2.467 26.100 23.557 6.933   27 Lamera 84.000 116.000 105.233 20.937 8.000 6.767 94.000 1.500 17.667 30.100 4.700   28 Lohandhi 84.000	20	Kanga	88.667	122.333	128.300	22.900	15.700	14.533	76.800	2.333	40.600	31.907	13.067
23Kerakhambh85.667118.667104.30021.4508.4677.60080.5331.90019.60029.8336.46724Khansari86.667118.333120.00023.9337.6006.46780.9002.30029.96730.6678.96725Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733		Karanphool	80.667	109.333	84.600	20.867	11.800	10.200	58.933	3.267	29.567	31.117	8.867
24Khansari86.667118.333120.00023.9337.6006.46780.9002.30029.96730.6678.96725Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	22		89.333	123.333	101.967	21.200	8.100	7.100	77.367	2.367	23.067	32.203	7.633
25Kumhran89.667118.000111.54020.3007.8006.86797.4672.46725.96722.9706.56726Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	23	Kerakhambh	85.667	118.667	104.300	21.450	8.467	7.600	80.533	1.900	19.600	29.833	6.467
26Kuthalidhan82.667115.333111.03321.60011.5009.70071.3332.46726.10023.5576.93327Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	24	Khansari	86.667	118.333	120.000	23.933	7.600	6.467	80.900	2.300	29.967	30.667	8.967
27Lamera84.000111.000105.16723.6677.4676.63392.1001.98329.63331.3679.50028Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	25	Kumhran	89.667	118.000	111.540	20.300	7.800	6.867	97.467	2.467	25.967	22.970	6.567
28Lohandhi84.000116.000105.23320.9378.0006.76794.0001.50017.66730.1004.70029Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	26	Kuthalidhan	82.667	115.333	111.033	21.600	11.500	9.700	71.333	2.467	26.100	23.557	6.933
29Malati88.000119.333118.00021.9675.4674.73375.5002.43312.40025.7333.16730Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	27	Lamera	84.000	111.000	105.167	23.667	7.467	6.633	92.100	1.983	29.633	31.367	9.500
30Mansooriya94.333123.000113.96718.0338.2007.36746.5002.33326.10722.0335.76731Nadawal86.667116.667104.20022.26710.2008.96742.9672.26723.50034.8008.00032Rajgauhi99.000126.667119.43321.7007.3336.40067.1002.13327.60025.0006.733	28	Lohandhi	84.000	116.000	105.233	20.937	8.000	6.767	94.000	1.500	17.667	30.100	4.700
31 Nadawal 86.667 116.667 104.200 22.267 10.200 8.967 42.967 2.267 23.500 34.800 8.000   32 Rajgauhi 99.000 126.667 119.433 21.700 7.333 6.400 67.100 2.133 27.600 25.000 6.733	29	Malati	88.000	119.333	118.000	21.967	5.467	4.733	75.500	2.433	12.400	25.733	3.167
32 Rajgauhi 99.000 126.667 119.433 21.700 7.333 6.400 67.100 2.133 27.600 25.000 6.733		Mansooriya	94.333	123.000	113.967	18.033	8.200	7.367	46.500	2.333	26.107	22.033	5.767
		Nadawal	86.667	116.667	104.200	22.267	10.200	8.967	42.967	2.267	23.500	34.800	8.000
33 Ramkajari 92.667 123.333 116.733 25.067 8.233 6.733 93.367 2.600 26.267 25.633 6.400	32	Rajgauhi	99.000	126.667	119.433	21.700	7.333	6.400	67.100	2.133	27.600	25.000	6.733
	33	Ramkajari	92.667	123.333	116.733	25.067	8.233	6.733	93.367	2.600	26.267	25.633	6.400

36 Sairi 87.267 118.667 98.967 24.967 11.933 10.233 57.500 2.167 28.900 35.367 12.133   36 Samakaar 82.333 114.333 102.300 24.400 10.167 9.633 81.400 1.567 29.400 35.367 17.967 9.500   37 Samaha 83.000 112.667 107.400 22.067 9.0767 18.33 63.667 2.367 5.900 40.33 2.267 5.900 44.33 2.267 5.900 44.33 7.337 112.067 12.300 9.633 8.300 81.367 2.567 2.433 2.573 5.133 9.167   42 Bhalshankar 80.833 112.33 80.400 20.300 11.600 10.133 51.367 2.167 31.933 37.133 10.400   43 Pilkormeva 96.900 12.1667 110.671 2.700 7.807 16.633 2.1007 2.333 2.2104 4.757   44	34	Safari	94.667	123.667	106.900	22.967	10.433	9.500	74.967	2.200	35.067	26.333	9.667
36 Samasar 82.33 114.33 102.300 24.400 10.167 9.633 81.400 1.567 29.400 85.467 9.633   37 Samuda 83.000 112.667 102.400 22.067 9.167 7.183 63.677 2.700 27.333 37.967 9.500   38 Saunthi 99.007 122.667 107.567 22.267 6.800 5.633 64.607 22.507 24.833 29.333 7.657   41 Hauhi 91.167 120.600 125.167 22.2067 8.167 6.967 39.267 2.533 21.567 25.733 6.133   42 Bhalshankar 80.833 112.333 80.400 20.300 11.600 10.133 51.367 2.1067 10.607 7.500 75.667 2.433 18.133 4.30   44 Shyamjeer 91.000 121.000 111.033 19.667 7.800 6.533 2.200 25.677 39.233 2.000 12.333 16.333													
37 Sanda 83000 112.667 102.400 22.067 9.167 7.183 63.67 2.700 27.333 37.967 9.500   38 Saunthi 91.333 122.333 122.867 31.633 9.300 8.067 7.4667 2.2.567 23.307 5.500   40 Surja 92.000 122.667 110.767 22.307 5.633 64.533 2.667 23.337 7.657   41 Hauhi 91.167 12.0600 125.167 2.0167 8.167 6.967 39.267 2.567 23.733 8.713 10.400   42 Bhalshankar 80.833 112.333 80.400 20.300 11.600 10.133 51.367 2.167 31.933 37.133 10.400   43 Nayamjeer 91.000 12.1000 11.11.01 18.300 9.167 7.500 7.5667 2.100 2.103 3.130 9.400 36.333 2.200 12.723 2.333 9.200 1.333 1.307													
Saunthi 91.333 122.333 122.867 31.633 9.300 8.067 74.467 2.650 21.333 8.333   39 Sonkharchi 92.907 122.667 107.567 22.267 6.800 5.633 2.667 23.967 22.367 5.900   40 Surja 92.000 124.667 112.067 22.067 8.167 6.967 39.267 2.533 21.567 127.333 6.133 17.133 37.133 13.10.40   41 Hauhi 91.167 122.000 110.733 19.967 7.800 6.633 60.767 2.167 33.303 10.433   43 Pilkormeva 96.900 121.000 111.167 18.300 9.077 7.500 75.667 2.000 2.3073 8.130   44 Shyanjeer 91.000 121.000 114.033 23.667 8.433 7.667 2.000 2.567 32.337 4.333   45 Galari 92.000 122.667 10.567 11.4.033 <td></td>													
39 Sonkharchi 92.967 122.667 107.567 22.300 9.633 8.4307 2.567 24.833 29.333 7.667   41 Hauhi 91.167 120.600 122.167 22.300 9.633 8.300 81.367 2.567 24.833 29.333 7.667   41 Hauhi 91.167 120.000 112.107 21.000 11.617 18.300 9.667 2.533 21.567 2.5733 18.13 4.33   42 Bhalshankar 80.833 112.3061 11.167 18.300 9.067 7.500 75.667 2.100 26.067 33.300 9.167   44 Shyamjeer 91.000 121.007 11.667 12.339 7.33 8.500 8.1700 1.400 21.067 7.500 75.667 2.100 25.67 39.233 9.203 35.67 5.200 7.567 2.200 27.167 25.033 6.333 7.200 25.567 39.233 9.203 9.200 1.233 3.2.333													
40 Surja 92.000 124.667 112.067 22.300 9.633 8.300 81.367 2.567 24.833 29.333 7.667   41 Hauhi 91.167 120.600 125.167 22.067 8.167 6.967 3.9267 2.533 21.567 25.733 61.333 10.400   42 Bhalshankar 80.833 112.333 80.400 20.300 11.607 18.300 9.667 7.500 75.667 2.167 13.933 7.133 13.33 13.300   44 Shyamjeer 91.000 121.000 111.167 18.300 9.067 7.500 75.667 2.100 2.100 4.767   45 Galari 96.333 123.667 114.033 23.667 8.433 7.367 162.033 2.000 12.67 12.33 9.607 8.633 6.700 1.830 2.001 1.633 10.757 8.33 9.667 8.633 6.700 1.833 1.167 14.00 9.25567 9.233													
41 Hauhi 91.167 120.600 125.167 22.067 8.167 6.967 39.267 2.533 21.567 25.733 6.133   42 Bhakshankar 80.833 112.333 80.400 20.300 11.600 10.133 51.367 2.167 31.933 37.133 10.400   43 Pilkorneva 96.900 121.000 111.167 18.300 9.067 7.800 6.633 60.767 2.100 22.673 38.300 9.167   45 Galari 96.333 123.667 110.667 22.733 9.733 8.500 15.033 2.000 19.267 2.2367 4.833   47 Badshabbog 84.333 116.333 105.467 12.007 7.833 6.337 7.3400 2.600 2.567 39.233 9.200   48 Hardigahi 92.000 121.667 109.067 25.300 7.633 6.333 67.00 8.833 63.133 2.200 2.7.167 25.033 6.200													
42 Bhalshankar 80.833 112.333 80.400 20.300 11.600 10.133 51.367 2.167 31.933 37.133 10.400   43 Pilkormeva 96.900 127.000 110.733 19.967 7.800 6.633 60.767 23.733 18.133 4.300   44 Shyanjeer 91.000 121.000 111.167 18.300 9.067 7.500 75.667 2.100 24.667 13.300 9.167   45 Galari 96.333 123.667 114.033 23.667 8.433 7.367 162.033 2.000 12.67 39.233 9.267 32.33 9.207 25.567 39.233 9.200 21.667 19.233 12.367 8.833 6.200 21.667 17.733 6.333 67.000 1.833 31.167 29.409 9.800 51.867 2.200 22.167 28.806 6.900 51 Nevari 83.667 114.000 106.273 25.333 10.600 8.833 6.31.33													
43 Pilkormeva 96 900 127.000 110.733 19.967 7.800 6.677 2.067 23.733 18.133 4.300   44 Shyanjeer 91.000 121.000 111.167 18.300 9.067 7.500 7.560 2.100 26.067 33.300 9.167   45 Galari 96.333 123.667 114.033 23.667 8.433 7.367 162.033 2.000 19.267 22.367 4.833   47 Badshahbag 84.333 116.333 105.467 22.000 11.300 9.400 36.333 2.200 21.567 39.233 9.200   48 Hardigathi 92.000 121.667 112.733 23.33 9.667 8.633 67.000 1.833 31.167 29.407 8.833 63.133 2.233 2.300 2.833 7.300 1.833 37.300 2.2667 2.8600 6.900   51 Nevari 83.667 112.033 12.550 9.200 7.133 5.0733 <td></td>													
44 Shyamjeer 91.000 121.000 111.167 18.300 9.067 7.500 7.500 7.500 2.100 2.6067 33.300 9.167   45 Galari 96.333 123.667 110.667 22.733 9.733 8.500 81.700 1.400 21.733 22.100 4.733   46 Bialiuchai 93.000 124.667 114.033 23.667 8.433 7.65.567 2.200 22.567 39.233 9.200   48 Hardigathi 92.000 121.667 1109.067 25.300 7.833 6.337 7.3400 2.600 25.67 39.233 6.833   50 Badshahparsan 82.000 112.667 112.733 23.333 9.667 8.633 63.133 2.233 23.833 37.300 9.167   52 Kotava 77.667 108.000 108.600 2.167 7.633 108.133 2.300 2.467 2.400 2.467 2.800 6.33 5.5 Kosamchidi 80.6													
45 Galari 96.333 123.667 110.667 22.733 9.733 8.500 81.700 1.400 21.733 22.100 4.767   46 Bilaluchai 93.000 124.667 114.033 23.667 8.433 7.367 162.033 2.000 12.367 4.833   47 Badshabbog 84.333 116.333 1105.467 20.001 11.300 9.400 36.333 2.000 25.677 39.233 9.200   48 Hardigathi 92.000 112.667 109.067 25.300 7.833 6.367 6.557 2.200 27.167 25.033 6.200   50 Badshabparsan 82.000 112.667 109.167 25.533 10.600 8.833 63.133 2.233 2.3667 8.032 2.267 2.460 2.860 6.900   51 Nevari 83.667 112.637 22.433 4.647 16.33 2.267 2.433 2.360 2.300 2.167 2.400 2.467 2.402 <td></td>													
46 Bilailuchai 93.000 124.667 114.033 23.667 8.433 7.367 162.033 2.000 19.267 22.367 4.833   47 Badshabhog 84.333 116.333 105.467 22.000 11.300 9.400 36.333 2.200 27.167 25.937 39.233 9.200   48 Hardigathi 92.000 121.667 109.067 25.300 7.833 6.333 7.3400 2.600 26.567 33.767 8.833   50 Badshabparsan 82.000 112.667 112.733 23.333 10.667 8.633 67.000 1.833 31.167 29.400 9.800   51 Nevari 83.667 114.000 106.273 25.533 10.600 8.833 63.313 2.233 23.333 37.300 9.167   52 Kotava 77.667 108.000 108.607 119.433 23.467 8.633 6.867 65.267 2.400 21.657 8.006 21.657 8.006													
47 Badshabbog 84.333 116.333 105.467 22.000 11.300 9.400 36.333 2.200 25.567 39.233 9.200   48 Hardigathi 92.000 121.667 109.067 25.300 7.833 6.367 65.567 2.200 27.167 25.033 6.203   49 Shervani 96.333 126.673 13.767 2.333 107.967 21.067 7.733 6.333 75.400 2.660 2.6567 33.730 9.400 51   Nevari 83.667 114.000 106.273 25.533 10.600 8.833 65.133 2.300 2.267 2.460 6.900 53 Durgaprasad 90.000 120.667 119.433 23.467 8.633 6.867 8.0267 2.400 2.400 2.467 2.400 3.867 9.133   56 Senkursar 93.667 124.67 109.167 22.500 9.200 7.133 50.733 2.600 21.433 10.30 10.333 10.													
48 Hardigathi 92.000 121.667 109.067 25.300 7.833 6.367 65.567 2.200 27.167 25.033 6.200   49 Shervani 96.333 126.333 107.967 21.067 7.733 6.333 73.400 2.600 26.567 33.767 8.833   50 Badshahparsan 82.000 112.637 25.533 9.667 8.633 67.103 1.833 31.167 29.400 9.800   51 Nevari 83.667 114.000 106.273 25.533 106.00 8.833 63.133 2.233 23.833 37.300 9.167   52 Kotava 77.667 108.000 108.600 21.967 9.207 7.133 50.733 2.000 21.533 2.000 21.533 2.000 7.133 5.003 5.000 27.467 20.333 5.300   54 Assamchidi 83.667 112.333 105.733 22.333 11.733 9.067 1.533 2.060 2.1503<													
49 Shervani 96.333 126.333 107.967 21.067 7.733 6.333 73.400 2.600 26.567 33.767 8.833   50 Badshaparsan 82.000 112.667 112.733 23.333 9.667 8.633 67.000 1.833 31.167 29.400 9.800   51 Nevari 83.667 114.000 106.273 25.533 10.600 8.833 63.133 2.233 23.833 37.300 9.167   52 Kotava 77.667 108.000 12.667 9.267 7.633 108.133 2.300 22.667 28.600 6.900   53 Durgaprasad 90.000 12.667 109.167 22.500 9.207 7.133 50.733 2.600 21.533 29.233 6.533 105.733 22.700 9.207 7.433 26.400 23.867 9.133 50   54 Assamchidi 83.667 112.633 112.671 18.00 126.507 128.607 128.507 15.		<b>U</b>											
50 Badshahparsan 82.000 112.667 112.733 23.333 9.667 8.633 67.000 1.833 31.167 29.400 9.800   51 Nevari 83.667 114.000 106.273 25.533 10.600 8.833 63.133 2.233 23.833 37.300 9.167   52 Kotava 77.667 108.000 120.667 19.433 23.467 8.633 68.87 65.267 2.400 27.467 20.333 5.300   54 Assamchidi 80.667 112.667 109.167 22.500 9.200 7.133 50.733 2.600 21.533 29.233 6.533   55 Kosamkhand 83.667 112.333 80.907 123.733 22.331 11.733 9.667 80.267 2.433 26.400 33.867 9.133   56 Senkursar 93.667 124.000 123.733 21.500 10.567 8.700 18.607 123.733 29.407 1.350 21.600 5.673													
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52 Kotava 77.667 108.000 108.600 21.967 9.267 7.633 108.133 2.300 22.667 28.600 6.900   53 Durgaprasad 90.000 120.667 119.433 23.467 8.633 6.867 65.267 2.400 27.467 20.333 5.300   54 Assamchidi 80.667 112.667 109.167 22.500 9.200 7.133 50.733 26.600 21.533 29.233 6.533   55 Kosamkhand 83.667 112.333 105.733 22.3700 9.400 7.367 128.767 1.600 24.733 18.700 5000   57 Keraphool 81.667 112.333 86.967 21.500 10.567 8.700 58.600 2.967 22.567 32.300 7.167   58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.600 6.600   60 Turailuchai <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>													
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54 Assamchidi 80.667 112.667 109.167 22.500 9.200 7.133 50.733 2.600 21.533 29.233 6.533   55 Kosamkhand 83.667 115.333 105.733 22.333 11.733 9.667 80.267 2.433 26.400 33.867 9.133   56 Senkursar 93.667 124.000 123.733 22.700 9.400 7.367 128.767 1.600 24.733 18.700 5000   58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.100 5.667   59 Kadamphool 91.333 123.333 88.900 18.733 7.233 5.800 133.667 2.267 26.100 36.933 9.767   61 Phoolmechha 90.667 119.667 91.500 19.700 8.050 6.433 89.367 1.567 15.400 29.067 4.567   62 hansraj 9													
55 Kosamkhand 83.667 115.333 105.733 22.333 11.733 9.667 80.267 2.433 26.400 33.867 9.133   56 Senkursar 93.667 124.000 123.733 22.700 9.400 7.367 128.767 1.600 24.733 18.700 5.000   57 Keraphool 81.667 112.333 86.967 21.500 10.567 8.700 58.600 2.967 22.567 32.300 7.167   58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.100 5.667   59 Kadamphool 91.333 123.333 88.900 18.733 7.233 5.800 133.667 2.267 26.100 36.933 9.767   61 Phoolmechha 90.667 118.667 87.733 19.867 7.233 5.800 133.867 2.500 35.500 8.333   64 Kannauji 92.333 <td< td=""><td></td><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>			1										
56 Senkursar 93.667 124.000 123.733 22.700 9.400 7.367 128.767 1.600 24.733 18.700 5.000   57 Keraphool 81.667 112.333 86.967 21.500 10.567 8.700 58.600 2.967 22.567 32.300 7.167   58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.100 5.667   59 Kadamphool 91.333 123.333 88.900 18.733 7.233 6.467 55.400 1.733 21.733 26.600 6.600   60 Turailuchai 87.000 118.667 87.733 19.867 7.233 5.800 13.667 2.267 26.100 36.933 9.767   61 Phoolmechha 90.667 128.667 104.000 22.167 8.067 6.667 54.300 1.833 24.800 28.833 7.100   63 Ajan 85.00													
57 Keraphool 81.667 112.333 86.967 21.500 10.567 8.700 58.600 2.967 22.567 32.300 7.167   58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.100 5.667   59 Kadamphool 91.333 123.333 88.900 18.733 7.233 6.467 55.400 1.733 21.733 26.600 6.600   60 Turailuchai 87.000 118.667 87.733 19.867 7.233 5.800 133.667 2.267 26.100 36.933 9.767   61 Phoolmechha 90.667 119.667 91.500 19.700 8.050 6.433 89.367 1.567 15.400 28.833 7.100   62 hansraj 94.667 128.667 104.000 22.167 8.067 6.667 54.300 1.833 24.803 2.167 25.500 35.500 8.333 7.00													
58 Bhaloodubraj 95.000 124.333 119.400 25.167 7.800 6.233 110.400 1.500 21.100 26.100 5.667   59 Kadamphool 91.333 123.333 88.900 18.733 7.233 6.467 55.400 1.733 21.733 26.600 6.600   60 Turailuchai 87.000 118.667 87.733 19.867 7.233 5.800 133.667 2.267 26.100 36.933 9.767   61 Phoolmechha 90.667 119.667 91.500 19.700 8.050 6.433 89.367 1.567 15.400 29.067 4.567   62 hansraj 94.667 128.667 104.000 22.167 8.067 6.667 54.300 1.833 24.800 28.833 7.100   63 Ajan 85.000 115.667 111.100 22.467 10.167 8.783 49.433 2.167 26.633 26.133 6.800   65 Kerakhambh 98.000													
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61Phoolmechha90.667119.66791.50019.7008.0506.43389.3671.56715.40029.0674.56762hansraj94.667128.667104.00022.1678.0676.66754.3001.83324.80028.8337.10063Ajan85.000115.667111.10022.76710.1678.78349.4332.16725.50035.5008.33364Kannauji92.333121.000114.06724.4677.8676.80767.2002.36726.63326.1336.80065Kerakhambh98.000128.33399.83320.5337.9006.50075.3672.43327.67336.0679.50066Kansari81.333107.000104.20021.16713.08311.16736.3672.46731.13337.03310.53367Karagi99.000131.667104.56719.8339.5337.70058.4002.36726.43327.8007.56768Kosamsar92.667125.333103.90021.0007.6676.23393.5002.20026.83333.1678.43369Kalajeera87.667121.00095.83321.03313.56712.26795.4002.66744.93331.00013.60070Karahani94.000125.667113.66720.3677.4006.23368.7002.26726.60028.7677.76771Katanga8	60												
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63Ajan85.000115.667111.10022.76710.1678.78349.4332.16725.50035.5008.33364Kannauji92.333121.000114.06724.4677.8676.80767.2002.36726.63326.1336.80065Kerakhambh98.000128.33399.83320.5337.9006.50075.3672.43327.67336.0679.50066Kansari81.333107.000104.20021.16713.08311.16736.3672.46731.13337.03310.53367Karagi99.000131.667104.56719.8339.5337.70058.4002.36726.43327.8007.56768Kosamsar92.667125.333103.90021.0007.6676.23393.5002.20026.83333.1678.43369Kalajeera87.667121.00095.83321.03313.56712.26795.4002.66744.93331.00013.60070Karahani94.000125.667113.66722.7006.8336.00064.5672.26726.60028.7677.76771Katanga82.167113.33109.76724.3676.7675.66771.4672.33333.60026.3009.36772Kudurlai92.667124.333115.66720.3677.4006.23368.7002.53325.16731.1107.80073MTU-101087.	62		94.667	128.667	104.000							28.833	7.100
64Kannauji92.333121.000114.06724.4677.8676.80767.2002.36726.63326.1336.80065Kerakhambh98.000128.33399.83320.5337.9006.50075.3672.43327.67336.0679.50066Kansari81.333107.000104.20021.16713.08311.16736.3672.46731.13337.03310.53367Karagi99.000131.667104.56719.8339.5337.70058.4002.36726.43327.8007.56768Kosamsar92.667125.333103.90021.0007.6676.23393.5002.20026.83333.1678.43369Kalajeera87.667121.00095.83321.03313.56712.26795.4002.66744.93331.00013.60070Karahani94.000125.667113.66722.7006.8336.00064.5672.26726.60028.7677.76771Katanga82.167113.33109.76724.3676.7675.66771.4672.33333.60026.3009.36772Kudurlai92.667124.333115.66720.3677.4006.23368.7002.53325.16731.1107.80073MTU-101087.667119.00089.06721.9007.6336.433159.2672.40055.93351.26728.50074LC-7679	63	Ajan	85.000	115.667	111.100	22.767	10.167	8.783	49.433		25.500	35.500	8.333
65Kerakhambh98.000128.33399.83320.5337.9006.50075.3672.43327.67336.0679.50066Kansari81.333107.000104.20021.16713.08311.16736.3672.46731.13337.03310.53367Karagi99.000131.667104.56719.8339.5337.70058.4002.36726.43327.8007.56768Kosamsar92.667125.333103.90021.0007.6676.23393.5002.20026.83333.1678.43369Kalajeera87.667121.00095.83321.03313.56712.26795.4002.66744.93331.00013.60070Karahani94.000125.667113.66722.7006.8336.00064.5672.26726.60028.7677.76771Katanga82.167113.333109.76724.3676.7675.66771.4672.33333.60026.3009.36772Kudurlai92.667124.333115.66720.3677.4006.23368.7002.53325.16731.1107.80073MTU-101087.667119.00089.06721.9007.6336.433159.2672.40055.93351.26728.50074LC-76795.000127.000106.30028.8677.1676.367132.9672.46769.40040.23327.80075LC-964		U	92.333		114.067	24.467	7.867						6.800
67Karagi99.000131.667104.56719.8339.5337.70058.4002.36726.43327.8007.56768Kosamsar92.667125.333103.90021.0007.6676.23393.5002.20026.83333.1678.43369Kalajeera87.667121.00095.83321.03313.56712.26795.4002.66744.93331.00013.60070Karahani94.000125.667113.66722.7006.8336.00064.5672.26726.60028.7677.76771Katanga82.167113.333109.76724.3676.7675.66771.4672.33333.60026.3009.36772Kudurlai92.667124.333115.66720.3677.4006.23368.7002.53325.16731.1107.80073MTU-101087.667119.00089.06721.9007.6336.433159.2672.40055.93351.26728.50074LC-76795.000127.000106.30028.8677.1676.367132.9672.53347.66738.36719.83375LC-96491.333122.000103.33328.20013.56711.96775.0672.46769.40040.23327.800	65												9.500
68 Kosamsar 92.667 125.333 103.900 21.000 7.667 6.233 93.500 2.200 26.833 33.167 8.433   69 Kalajeera 87.667 121.000 95.833 21.033 13.567 12.267 95.400 2.667 44.933 31.000 13.600   70 Karahani 94.000 125.667 113.667 22.700 6.833 6.000 64.567 2.267 26.600 28.767 7.767   71 Katanga 82.167 113.333 109.767 24.367 6.767 5.667 71.467 2.333 33.600 26.300 9.367   72 Kudurlai 92.667 124.333 115.667 20.367 7.400 6.233 68.700 2.533 25.167 31.110 7.800   73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000	66	Kansari	81.333	107.000	104.200	21.167	13.083	11.167	36.367	2.467	31.133	37.033	10.533
68 Kosamsar 92.667 125.333 103.900 21.000 7.667 6.233 93.500 2.200 26.833 33.167 8.433   69 Kalajeera 87.667 121.000 95.833 21.033 13.567 12.267 95.400 2.667 44.933 31.000 13.600   70 Karahani 94.000 125.667 113.667 22.700 6.833 6.000 64.567 2.267 26.600 28.767 7.767   71 Katanga 82.167 113.333 109.767 24.367 6.767 5.667 71.467 2.333 33.600 26.300 9.367   72 Kudurlai 92.667 124.333 115.667 20.367 7.400 6.233 68.700 2.533 25.167 31.110 7.800   73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000	67	Karagi	99.000	131.667	104.567	19.833	9.533	7.700	58.400	2.367	26.433	27.800	7.567
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71 Katanga 82.167 113.333 109.767 24.367 6.767 5.667 71.467 2.333 33.600 26.300 9.367   72 Kudurlai 92.667 124.333 115.667 20.367 7.400 6.233 68.700 2.533 25.167 31.110 7.800   73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000 127.000 106.300 28.867 7.167 6.367 132.967 2.533 47.667 38.367 19.833   75 LC-964 91.333 122.000 103.333 28.200 13.567 11.967 75.067 2.467 69.400 40.233 27.800	69	Kalajeera	87.667	121.000		21.033	13.567	12.267	95.400	2.667	44.933	31.000	13.600
72 Kudurlai 92.667 124.333 115.667 20.367 7.400 6.233 68.700 2.533 25.167 31.110 7.800   73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000 127.000 106.300 28.867 7.167 6.367 132.967 2.533 47.667 38.367 19.833   75 LC-964 91.333 122.000 103.333 28.200 13.567 11.967 75.067 2.467 69.400 40.233 27.800	70	Karahani	94.000	125.667	113.667	22.700	6.833	6.000	64.567	2.267	26.600	28.767	7.767
72 Kudurlai 92.667 124.333 115.667 20.367 7.400 6.233 68.700 2.533 25.167 31.110 7.800   73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000 127.000 106.300 28.867 7.167 6.367 132.967 2.533 47.667 38.367 19.833   75 LC-964 91.333 122.000 103.333 28.200 13.567 11.967 75.067 2.467 69.400 40.233 27.800			82.167										9.367
73 MTU-1010 87.667 119.000 89.067 21.900 7.633 6.433 159.267 2.400 55.933 51.267 28.500   74 LC-767 95.000 127.000 106.300 28.867 7.167 6.367 132.967 2.533 47.667 38.367 19.833   75 LC-964 91.333 122.000 103.333 28.200 13.567 11.967 75.067 2.467 69.400 40.233 27.800			92.667		115.667								7.800
74 LC-767 95.000 127.000 106.300 28.867 7.167 6.367 132.967 2.533 47.667 38.367 19.833   75 LC-964 91.333 122.000 103.333 28.200 13.567 11.967 75.067 2.467 69.400 40.233 27.800			87.667									51.267	28.500
	74		95.000	127.000	106.300	28.867	7.167	6.367	132.967		47.667	38.367	19.833
	75	LC-964	91.333	122.000	103.333	28.200	13.567	11.967	75.067	2.467	69.400	40.233	27.800
		Overall mean	89.297	120.368		22.313	9.162	7.962	75.580	2.270	27.053	30.168	8.421
C.V. 6.668 5.757 7.920 8.702 11.414 13.400 10.414 12.204 12.510 14.953 12.505		C.V.	6.668	5.757	7.920	8.702	11.414	13.400	10.414	12.204	12.510	14.953	12.505
S.E. 4.862 5.658 6.914 1.585 0.854 0.871 6.427 0.226 2.763 3.683 0.860		S.E.	4.862	5.658	6.914	1.585	0.854	0.871	6.427	0.226	2.763	3.683	0.860
		C.D. %	8.225	9.571		2.682	1.444	1.474	1.445	0.383	4.674	6.231	1.454
Range Lowest 77.333 107.000 80.400 18.033 5.467 4.733 31.467 1.367 12.400 18.133 3.1667		Range Lowest	77.333	107.000	80.400	18.033	5.467	4.733	31.467	1.367	12.400	18.133	3.1667
Range Highest 99.000 131.670 128.300 31.633 15.700 14.533 162.03 3.267 69.400 51.267 28.500		Range Highest	99.000	131.670	128.300	31.633	15.700	14.533	162.03	3.267	69.400	51.267	28.500

Table 4: Estimation of variability, heritability and genetic advance for yield and yield attributing traits of rice germplasms

Characters	Range		Mean	GCV%	PCV%	h <sup>2</sup> (bs)%	GA as % mean
Characters	Min	Max	Mean	GUV 70	PCV 70	II-(DS) %	GA as % mean
DTF	77.333	99.000	89.297	4.848	8.244	34.578	5.872
DTM	107.000	131.670	120.368	3.375	6.673	25.578	3.516
PH	80.400	128.300	106.923	8.820	11.854	55.358	13.518
PL	18.033	31.633	22.313	8.673	12.286	49.830	12.611
TPP	5.467	15.700	9.162	21.375	24.233	77.804	38.839
PTPP	4.733	14.533	7.962	22.885	26.520	74.468	40.682
NGPP	31.467	162.03	75.580	32.019	33.670	90.434	62.726
100-GW	1.367	3.267	2.270	13.643	18.304	55.551	20.947
BYPP	12.400	69.400	27.053	29.686	32.214	84.920	56.354
HI	18.133	51.267	30.168	16.393	22.189	54.583	24.949
GYPP	3.1667	28.500	8.421	48.449	50.037	93.754	96.638

High heritability coupled with high genetic advance as percentage of mean were recorded for number of tillers per plant, number of productive tillers per plant, number of grains per panicle, biological yield per plant and grain yield per plant. These characters showed additive gene action in their expression. Heritability refers the contribution of genetic variability to the phenotypic variability for traits under consideration and it is good indicator of the transmission of traits from parents to their progeny. The heritability estimate can be utilized for the forecasting of the genetic gain, which implies the genetic improvement that would result from the selection of best genotype. High heritability estimates were recorded for all studied characters; it indicated that all the characters inherited from generation to generation. Similar findings were also reported by Gour et al. (2017) [6] for biological yield per plant, Bandi *et al.* (2018) <sup>[4]</sup>, Abebe *et al.* (2017) <sup>[1]</sup> and Tejaswini *et al.* (2016) <sup>[21]</sup> for grain yield per plant, Akter et al. (2018)<sup>[2]</sup>, Singh et al. (2018)<sup>[18]</sup>, Rashid et al. (2018) and Tuwar et al. (2013) <sup>[22]</sup> for number of grains per panicle, Bandi et al. (2018)<sup>[4]</sup>, Gour et al. (2017)<sup>[6]</sup> and Sameera et al. (2016) <sup>[16]</sup> for number of tillers per plant, while Singh et al. (2018) <sup>[18]</sup>, Sameera et al. (2016) <sup>[16]</sup> for number of productive tillers per plant.

#### **Correlation analysis**

The correlation coefficient was partitioned into phenotypic and genotypic correlation coefficient. Genotypic correlation coefficients provide a measure of genetic association between characters and were generally used in selection of one character as a means of improving another. The magnitude of genotypic correlation was higher than phenotypic correlation. The grain yield per plant had significant positive correlation with biological yield per plant followed by harvest index, panicle length, number of tillers per plant, number of productive tillers per plant, seed index and number of grains per panicle. It indicated that improvement in these characters ultimately increased the grain yield, it means these characters may be included in selection criteria for rice improvement programme. However similar findings were also reported by Gour et al. (2017)<sup>[6]</sup> for number of tillers per plant, number of productive tillers per plant, biological yield per plant and harvest index, Panigrahi et al. (2018) [10] for number of tillers per plant, number of productive tillers per plant and number of grains per panicle, Singh et al. (2018)<sup>[18]</sup> for number of tillers per plant, number of productive tillers per plant, panicle length, number of grains per panicle, seed index, biological yield per plant and harvest index.

#### Conclusion

Analysis of variance exhibited that variance due to the correlation analysis was significant for all the traits, this suggested that adequate variability is available in germplasm accessions used for present investigation. Analysis of data exhibited highly significant differences among germplasm accessions for all the characters.

High estimates of phenotypic coefficient of variations (PCV%), genotypic coefficient of variations (GCV%) and high heritability coupled with high genetic advance as percentage of mean was recorded for were recorded for number of tillers per plant, number of productive tillers per plant, number of grains per panicle, biological yield per plant and grain yield per plant. These characters showed additive gene action in their expression.

The grain yield per plant had significant positive correlation with biological yield per plant followed by harvest index, panicle length, number of tillers per plant, number of productive tillers per plant, seed index and number of grains per panicle. The grain yield also showed negative correlation with plant height, days to 50 percent flowering and days to maturity. It indicated that improvement in these characters simultaneously increased the grain yield in rice. It showed that these characters may be included in selection criteria to enhance the grain yield in rice.

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