The Pharma Innovation Journal 2022; 11(7): 1675-1682

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(7): 1675-1682

www.thepharmajournal.com
Received: 17-05-2022
Accepted: 22-06-2022

Virendra Bahadur
Ph.D., Scholar, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Vinod Singh
Associate Professor, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Ravi Prakash Chaudhary
Ph.D., Scholar, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Lal Ji Bharti
M.Sc., Department of Plant Breeding and Genetics, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Shivam Dubey
Ph.D., Scholar, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Virendra Bahadur
Ph.D., Scholar, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

To study about genetic variability for yield and it's contributing traits of wheat in both conditions timely and late sown

Virendra Bahadur, Vinod Singh, Ravi Prakash Chaudhary, Lal Ji Bharti and Shivam Dubey

Abstract
The present investigation entitled "Combining ability and heterosis for yield and its contributing trait in wheat (*Triticum aestivum* L.) under sodic soil" will be conducted at Main Experiment Station of Genetics and plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during Rabi, 2019-20 and 2020-21. Eighty seven genotypes comprising 64 F_1, 16 parents and 3 checks (16 lines + 4 testers + 3 checks) will be evaluated in Randomized Complete Block Design with 3 replications in two conditions (E_1= Timely sown; E_2= Late sown). The mean sum of squares due to treatments of analysis of variance (ANOVA) were highly significant for all the characters studied except number of tillers per plant in both E_1 and E2 condition. Best five crosses that have higher grain yield per plant (g) - PBW-778 x NW-5054, PBW-780 x NW-5054, PBW-778 x HD-2967, PBW-780 x HD-2967 and HS-645 x NW-5054 in both E_1 and E_2 condition, these hybrids showed very high mean performance in grain yield per plant (g). The highest estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was observed in grain yield per plant (g) in both E_1 and E_2 condition, that's reason this characters have higher phenotypic variability and genetic variability. The highest estimated of heritability in broad sense was recorded for all the characters. The high estimate of heritability coupled with high genetic advance for plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), biological yield per plant (g), harvest index (%), chlorophyll content, and grain yield per plant (g) in both E_1 and E_2 condition, and also flag leaf area (cm^2) in E_2, conditions that's reason the selection of genotypes based on these characters are more useful for genetic improvement of genotypes.

Keywords: Genetic, variability, contributing, late, sown

Introduction
Wheat (*Triticum aestivum* L.) a hexaploid with 42 chromosomes number belongs to family Gramineae (Poaceae), autogamous (self-pollinated) crop. Wheat can be grown successfully in both tropical and subtropical areas. It is a primary staple food crop for South Asia; Wheat is the principal food crop in most areas of the world. It is also described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. Wheat is consumed in a variety of ways such as bread, chapatti, porridge, flour, suji etc. Wheat has been relatively high niacin and thiamin content which are principally concerned in providing the special protein called 'Gluten' (Bhushan *et al.* 2013) [3]. Wheat is classified into two major types: (1) the hexaploid bread wheat (2n = 6x = 42, AA BB DD) and (2) the tetraploid durum wheat (2n = 4x = 28, AA BB). Currently, at global level, it was cultivated over 221.18 million ha and production of 774.74 million tones with an average productivity of 35 quintals per hectare. In India, it is grown in area of 31.36 million hectares with a production of 107.86 million tones and productivity of 34.4 quintals per hectare (USDA, 2021; Bhushan *et al.* 2013) [15, 3]. In India, during 2019-20 Rabi season the production of wheat 107.18 million tonnes and average productivity was 33.18 q/ha, with the area of 31.450 million ha. The major wheat producing states are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, etc. During the year 2019-20 in Uttar Pradesh, the total wheat production was 31.98 million tonnes and average productivity was 32.69 q/ha., with the area of 9.786 million ha. Wheat is also a major source of energy, protein and dietary fiber in human nutrition (Dutamo, *et al.*, 2015). It has good nutrition profile with 12.1 per cent protein, 1.8 per cent lipids, 1.8 per cent ash, 2.0 per cent reducing sugars, 6.7 per cent pentose's, 59.2 per cent starch, 70 per cent total carbohydrates and provides 314K cal/100g of food (Ibrahim 2019).

Depending on the population and income growth, poverty alleviation and the rate of urbanization, a demand-supply gap may open at a rate of about 1 to 2 per cent per year which is equivalent to 0.7 to 1.4 million tons of wheat, growing larger over the years. Promoting rapid economic development and income growth in India which embraces the poor and particularly the rural poor, may lead to considerable growth in demand for wheat and thus an expansion in trade opportunities. (Singh *et al.*, 2012) [8].

Material and Methods

The present investigation entitled "Combining ability and heterosis for yield and its contributing trait in wheat (*Triticum aestivum* L.) under sodic soil" will be conducted at Main Experiment Station of Genetics and plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during Rabi, 2019-20 and 2020-21. Eighty seven genotypes comprising 64 F_1, 16 parents and 3 checks (16 lines + 4 testers + 3 checks) will be evaluated in Randomized Complete Block Design with 3 replications in two conditions (E_1= Timely sown; E_2= Late sown). Recommended cultural practices will be followed to raise a good crop. Ten competitative plants from each plot were randomly selected for recording observation for all the quantitative character except day to 50% flowering and days to maturity which were recorded on plot basis. Geographical, this place is located between 24.47^0 and 26.56^0 N latitude, 82.12^0 and 83.98^0 E longitudes and at an altitude of 113 m above from mean sea level in the gangetic plains of eastern U.P. this area falls in sub-tropical climatic zone. The soil type is sandy loam. The annual rainfall is about 1270 mm. The climate of district Ayodhya is semi-arid with hot summer and cold winter. Analysis of variance for design of experiment was carried out for each character separately following Panse and Sukhatme (1967). Variability for different characters was estimated as suggested by Burton and de Vane (1953). Heritability in broad sense (h^2 b) was suggested by Burton and de Vane (1953). Genetic advance ($\overline{Ga}$) was estimated by the method suggested by Johnson *et al*. (1955).

Result and Discussion

The result of analysis of the variance for Randomized Block Design in **r**espect to fourteen characters in wheat has been presented in Table1.

Table 1: Analysis of variance for 14 characters in wheat

	Characters	Replications		Treatments		Error	
S. No.	DF	E1	E2	E1	E2	E1	E2
		2		86		172	
1	Days to 50% flowering	307.41	182.51	44.94**	44.16**	0.49	0.83
2	Days to maturity	314.56	194.52	45.10**	45.66 **	0.52	0.92
3	Plant height (cm)	100.77	24.34	579.42**	541.27**	0.88	1.10
4	Flag leaf area (cm2)	234.99	453.88	15.26**	13.83 **	0.31	0.08
5	Number of tillers per plant	62.33	67.11	2.24	1.45	0.02	0.01
6	Spike length (cm)	68.35	184.82	15.04**	11.18**	0.22	0.58
7	Number of spikelets per spike	264.29	387.54	16.07**	11.28**	0.18	0.89
8	Grain per spike	649.64	207.42	89.41**	73.50**	0.94	1.38
9	Peduncle length (cm)	144.66	168.79	28.89**	28.40**	0.19	1.51
10	1000-grain weight (g)	548.47	274.09	30.52**	27.41**	0.13	1.15
11	Biological yield per plant (g)	602.48	480.45	220.93**	206.76 **	0.36	0.56
12	Harvest index (%)	1121.59	1481.16	58.59**	64.90**	0.97	3.10
13	Chlorophyll content	482.18	267.68	51.01**	48.10**	0.28	0.83
14	Grain yield per plant (g)	259.42	245.19	50.17**	47.03**	0.19	0.73

Note: *, ** significant at 5 and 1 per cent probability levels, respectively E_1= Timely sown, E_2= Late sow

The mean squares due to treatments were highly significant for all the characters studied except Number of tillers per plant 2.24 in E_1 and 1.45 in E_2.

The mean performance of all 87 genotypes including checks in Table 2 and Table 3. Among parents it ranged from 8.09 g (KRL-1-4) to 23.49 g (PBW-780) in E_1 and from 7.02 g (KRL-1-4) to 21.36 g (PBW-780) in E_2. Among the crosses, it ranged from 10.38 g (HI-1612 x KRL-99) to 24.32 g (PBW-778 x NW-5054) in E_1 and from 9.23 g (HI-1612 x KRL-99) to 22.20 g (PBW-778 x NW-5054) in E_2. The grand mean (17.15±0.26) was more than the parents (15.80) and less than crosses (17.45) in E_1. Whereas, the grand mean (15.56±0.50) was more than the parents (14.15) and less than crosses (15.88) in E_2. Best five crosses that have higher grain yield per plant (g) - PBW-778 x NW-5054, PBW-780 x NW-5054, PBW-778 x HD-2967, PBW-780 x HD-2967 and HS-645 x NW-5054 in both E_1 and E2 condition.

In this regard, the most desirable five crosses that have early days to 50 per cent flowering - VL3014 x KRL-99, WAPD-1530 x KRL-99, WAPD-1516 x KRL-99, WAPD-1519 x KRL-99 and DBW-251 x KRL-99 in E_1. And in E_2 condition, VL3014 x KRL-99, DBW-251 x KRL-99, PBW-778 x KRL-99, DBW-179 x HD-2967, and WAPD-1516 x KRL-99; for early days to maturity - WAPD-1519 x KRL-99, VL3014 x KRL-99, DBW-251 x KRL-99, HS-645 x KRL-99 and DBW-251 x HD-2967 in E_1. And in E_2 condition, HS-645 x HD-2967, WAPD-1519 x KRL-99, VL3014 x KRL-99, HS-645 x KRL-99, and WAPD-1524 x KRL-99; for short plant height - WAPD-1516 x KRL-99, WAPD-1519 x KRL-1-4, WAPD-1516 x NW-5054, WAPD-1516 x KRL-1-4 and WAPD-1524 x KRL-99 in both E_1 and E_2 condition; for higher flag leaf area - PBW-780 x HD-2967, PBW-780 x KRL-99, HS-646 x KRL-1-4, PBW-778 x NW-5054 and PBW-778 x KRL-1-4 in E_1. And in E_2 condition, PBW-780 x HD-2967, HS-646 x KRL-1-4, PBW-778 x KRL-1-4, DBW-251 x KRL-1-4, and PBW-778 x NW-5054; for higher number of tillers per plant - PBW-778 x KRL-99, WAPD-1524 x KRL-99, PBW-778 x NW-5054, HS-644 x KRL-99 and PBW-780 x HD-2967 in E_1. And in E_2 condition, PBW-778 x KRL-99, PBW-778 x NW-5054, PBW-780 x HD-2967, HS-644 x KRL-99, and PBW-780 x KRL-1-4; for longer spike length - PBW-778 x NW-5054, PBW-780 x NW-5054, PBW-780 x KRL-1-4,

PBW-780 x KRL-99 and HS-644 x NW-5054 in both E_1 and E_2 condition; for higher number of spikelets per spike - PBW-780 x NW-5054, PBW-780 x KRL-1-4, PBW-780 x HD-2967, HS-644 x HD-2967and HS-644 x KRL-1-4 in E1. And in E2 condition, PBW-780 x NW-5054, HS-644 x KRL-1-4, PBW-780 x KRL-99, PBW-778 x NW-5054, and HS-644 x KRL-99. for higher grain per spike - PBW-780 x KRL-1-4, PBW-780 x NW-5054, PBW-778 x KRL-99, PBW-780 x KRL-99 and PBW-780 x HD-2967 in both E1 and E2 condition; for short peduncle length (cm) - WAPD-1524 x KRL-99, WAPD-1516 x KRL-99, WAPD-1519 x KRL-99, WAPD-1524 x KRL-1-4 and WAPD-1530 x KRL-99 in in both E_1 and E_2 condition; for higher 1000-grain weight (g) - HS-646 x NW-5054, PBW-780 x NW-5054, HS-646 x HD-2967, PBW-780 x HD-2967 and WH-1127 x NW-5054 in E_1. And in E_2 condition, HS-646 x NW-5054, HS-646 x HD-2967, PBW-780 x NW-5054, PBW-780 x HD-2967, and PBW-778 x NW-5054; for higher biological yield per plant (g)- PBW-778 x KRL-1-4, HPW-439 x HD-2967, HPW-439 x NW-5054, PBW-780 x KRL-99 and WAPD-1530 x HD-2967 in E_1. And in E_2 condition, PBW-778 x KRL-1-4, HPW-439 x HD-2967, HPW-439 x NW-5054, PBW-778 x HD-2967, and WAPD-1530 x HD-2967; for higher harvest index (%)- HS-645 x NW-5054, PBW-780 x NW-5054, PBW-780 x KRL-1-4, HS-645 x HD-2967 and PBW-780 x KRL-99 in E_1. And in E_2 condition, HS-645 x NW-5054, HS-645 x HD-2967, PBW-780 x NW-5054, HS-646 x NW-5054, and PBW-780 x KRL-1-4; for higher chlorophyll content - WAPD-1530 x KRL-99, PBW-780 x HD-2967, PBW-778 x NW-5054, WAPD-1530 x KRL-1-4 and WAPD-1519 x HD-2967 in E_1. And in E_2 condition, PBW-780 x HD-2967, WAPD-1530 x KRL-99, PBW-780 x KRL-99, WAPD-1524 x HD-2967, and PBW-778 x NW-5054.

Table 2: Mean performance of timely sown

Genotype	DFF	DM	PH	FLA	NTP	SL	NSS	GS	PL	TGW	BYP	HI	CC	GYP
HS-645 x KRL-99	80.33	118.33	66.22	25.76	7.47	10.22	19.54	58.46	21.68	38.56	59.45	34.32	42.25	20.37
HS-645 x KRL-1-4	77.00	126.67	73.07	25.16	6.72	11.26	18.75	48.81	22.38	35.66	68.71	29.83	41.62	20.46
HS-645 x HD-2967	89.33	125.67	79.29	25.56	7.35	11.62	18.96	57.19	23.80	39.51	64.87	34.69	44.84	22.45
HS-645 x NW-5054	86.00	128.33	77.47	25.07	7.36	12.97	19.77	58.98	24.93	39.71	65.01	35.94	42.69	23.10
PBW-778 x KRL-99	76.33	120.33	82.21	26.57	7.88	13.44	20.26	59.92	22.75	39.80	68.66	33.04	44.02	22.64
PBW-778 x KRL-1-4	81.33	129.33	82.91	26.75	7.06	14.99	19.80	55.44	23.48	37.58	78.72	28.81	42.32	22.64
PBW-778 x HD-2967	82.33	129.33	82.82	26.57	7.47	15.44	21.64	55.56	25.02	40.82	73.46	32.23	43.33	23.65
PBW-778 x NW-5054	81.33	130.00	84.56	26.81	7.73	17.59	23.37	57.26	26.16	41.03	72.96	33.40	44.96	24.32
VL3014 x KRL-99	74.67	117.33	62.03	22.65	5.56	9.17	18.26	48.48	21.83	31.45	49.29	24.82	38.76	12.16
VL3014 x KRL-1-4	78.00	120.33	68.42	20.91	5.05	8.35	16.57	47.19	22.45	29.47	66.64	21.28	37.23	14.16
VL3014 x HD-2967	80.33	119.33	74.24	22.69	5.06	8.69	17.63	49.81	24.00	32.27	67.15	21.41	41.48	14.35
VL3014 x NW-5054	79.33	121.67	87.87	22.89	5.51	13.31	18.55	48.05	25.15	32.42	66.69	22.27	38.34	14.81
DBW-251 x KRL-99	76.00	118.00	85.25	25.33	6.86	10.96	22.46	46.70	24.58	35.87	47.45	24.09	36.64	11.35
DBW-251 x KRL-1-4	85.00	119.33	95.13	26.58	5.94	11.11	22.81	45.54	25.32	35.57	63.36	20.17	35.19	12.73
DBW-251 x HD-2967	84.33	118.33	96.10	25.58	6.56	11.57	21.76	45.64	27.03	36.78	57.37	23.38	38.14	13.35
DBW-251 x NW-5054	84.33	120.00	91.80	23.55	6.75	14.97	22.81	46.98	28.31	36.96	56.98	24.26	36.44	13.78
HI-1612 x KRL-99	82.00	121.00	99.22	20.21	5.28	9.32	18.53	48.62	27.45	30.32	42.72	24.44	34.99	10.38
HI-1612 x KRL-1-4	76.33	124.33	99.92	21.52	5.39	9.88	17.68	48.67	26.53	30.23	58.03	20.49	33.44	11.85
HI-1612 x HD-2967	78.67	123.00	98.10	21.62	6.11	10.17	18.02	48.58	25.24	31.08	53.98	23.54	34.35	13.64
HI-1612 x NW-5054	78.33	125.00	99.76	20.50	5.18	9.50	18.54	48.14	29.52	31.18	53.62	23.35	34.67	13.08
HI-1619 x KRL-99	87.33	124.33	95.27	19.57	6.36	12.06	20.88	48.06	23.21	30.62	47.98	26.19	31.26	12.53
HI-1619 x KRL-1-4	84.67	122.00	89.66	20.87	6.37	12.01	20.37	46.70	23.89	34.71	58.11	21.34	29.99	12.36
HI-1619 x HD-2967	85.00	121.33	93.13	22.46	6.57	12.42	20.33	52.99	25.51	38.56	70.07	24.16	31.65	16.88
HI-1619 x NW-5054	85.67	123.00	94.26	19.79	6.20	10.84	21.45	53.63	26.67	38.76	69.59	25.04	30.37	17.41
HPW-439 x KRL-99	83.00	126.00	75.68	19.81	6.66	11.37	20.08	45.23	29.57	37.97	59.63	29.36	36.28	17.46
HPW-439 x KRL-1-4	87.00	123.33	80.12	20.35	7.40	11.69	18.52	43.97	30.42	34.63	50.61	26.74	34.82	13.47
HPW-439 x HD-2967	84.33	123.33	84.53	21.59	6.63	12.04	19.49	44.57	29.99	38.96	78.53	26.72	37.69	20.95
HPW-439 x NW-5054	83.00	124.00	84.56	20.09	6.56	10.84	20.44	46.06	29.21	39.11	77.99	27.69	33.38	21.57
PBW-780 x KRL-99	84.67	132.33	63.87	26.94	7.35	16.20	23.52	59.64	21.82	40.56	65.16	34.58	44.63	22.46
PBW-780 x KRL-1-4	83.00	128.00	71.56	25.79	7.50	16.32	23.88	60.59	22.49	38.48	65.46	34.70	43.96	22.64
PBW-780 x HD-2967	87.00	127.33	73.67	28.91	7.62	15.58	23.81	59.59	20.25	41.58	69.61	33.56	46.35	23.31
PBW-780 x NW-5054	84.33	129.00	73.09	25.28	7.25	16.54	24.15	60.56	25.15	41.79	69.14	34.82	41.80	24.01
DBW-179 x KRL-99	79.67	130.33	89.69	22.68	6.58	9.86	18.64	56.22	21.72	38.39	50.01	25.44	40.14	12.67
DBW-179 x KRL-1-4	79.00	126.33	82.89	22.68	6.10	9.65	19.57	47.59	22.08	32.55	64.99	21.08	39.57	13.68
DBW-179 x HD-2967	76.33	125.33	85.32	23.32	6.55	9.96	18.11	52.63	21.43	39.34	63.70	25.82	42.44	16.37
DBW-179 x NW-5054	77.00	127.00	89.07	22.86	6.46	9.52	17.63	52.50	24.99	39.54	63.26	26.70	38.13	16.88
HS-644 x KRL-99	86.00	123.67	68.44	25.14	7.69	11.51	23.31	53.66	22.03	39.45	67.09	30.39	41.88	20.34
HS-644 x KRL-1-4	81.00	124.67	72.51	25.55	7.07	11.22	23.56	50.99	22.71	40.55	73.02	28.03	42.23	20.39
HS-644 x HD-2967	88.33	124.33	76.95	25.98	7.57	11.53	23.62	53.58	24.29	40.48	68.07	30.66	44.68	20.82
HS-644 x NW-5054	88.00	126.00	75.91	24.45	7.47	15.83	22.77	55.30	25.34	40.68	67.60	31.87	40.34	21.52
HS-646 x KRL-99	83.67	124.33	75.57	25.66	7.43	8.76	19.63	52.55	23.06	40.71	64.52	30.66	42.38	19.72
HS-646 x KRL-1-4	82.33	129.00	78.34	26.87	6.69	9.88	17.56	57.50	23.74	37.61	69.39	29.80	40.75	20.61
HS-646 x HD-2967	84.67	129.33	81.48	26.38	6.90	10.22	19.10	57.40	25.39	41.75	66.19	31.97	42.48	21.13
HS-646 x NW-5054	86.33	130.00	84.39	25.91	7.37	9.94	18.26	59.20	26.56	41.95	65.75	33.27	42.22	21.83
WH-1127 x KRL-99	80.67	125.33	90.53	20.89	7.04	10.99	18.52	56.32	27.52	39.80	50.57	26.56	39.37	13.38

WH-1127 x KRL-1-4	78.67	124.00	86.88	21.37	6.61	12.40	17.51	51.17	28.40	36.19	56.53	24.41	37.81	13.74
WH-1127 x HD-2967	82.33	123.33	89.40	22.34	6.96	12.78	17.95	51.99	27.80	40.79	62.12	24.93	39.26	15.45
WH-1127 x NW-5054	80.33	125.00	93.21	21.03	6.94	12.11	18.76	53.62	29.20	41.04	61.70	25.75	39.77	15.84
WAPD-1516 x KRL-99	75.33	120.00	51.76	22.48	5.74	12.36	18.30	48.47	19.32	36.96	53.49	28.23	41.99	15.05
WAPD-1516 x KRL-1-4	80.33	121.33	51.97	22.54	4.86	12.54	17.63	42.56	19.99	35.31	54.40	26.72	40.37	14.48
WAPD-1516 x HD-2967	84.33	120.33	59.80	23.60	5.94	12.80	17.77	47.57	21.51	37.89	73.35	27.10	41.86	19.85
WAPD-1516 x NW-5054	82.00	122.00	51.95	22.62	5.67	13.12	19.55	49.04	20.16	38.04	72.85	28.08	39.57	20.43
WAPD-1519 x KRL-99	76.00	116.33	54.25	21.79	6.45	12.45	17.83	50.98	19.54	37.79	53.35	26.25	43.48	13.94
WAPD-1519 x KRL-1-4	77.67	120.33	51.87	22.35	6.09	12.31	15.57	43.47	20.26	36.80	61.17	24.53	41.81	14.95
WAPD-1519 x HD-2967	82.33	119.67	58.80	22.55	6.55	12.60	17.31	53.16	21.79	38.79	70.40	25.10	44.87	17.64
WAPD-1519 x NW-5054	80.33	121.00	55.08	21.92	6.23	12.89	17.69	54.80	22.95	38.93	69.92	26.05	37.54	18.19
WAPD-1524 x KRL-99	77.33	118.33	53.27	23.39	7.73	11.95	17.63	49.72	19.00	37.63	60.56	24.25	44.30	14.67
WAPD-1524 x KRL-1-4	83.33	121.00	54.58	21.57	5.69	11.89	16.29	39.79	19.60	33.55	60.21	22.62	42.60	13.59
WAPD-1524 x HD-2967	83.00	120.33	61.90	23.57	5.50	12.15	17.13	50.62	21.16	38.58	64.83	28.37	44.84	18.35
WAPD-1524 x NW-5054	81.00	122.00	56.78	23.50	5.65	12.48	17.73	48.94	21.04	38.78	64.39	29.50	41.47	18.91
WAPD-1530 x KRL-99	75.00	121.33	66.66	24.77	6.13	12.61	19.21	47.59	19.97	38.42	60.55	27.44	46.71	16.56
WAPD-1530 x KRL-1-4	78.33	120.33	77.54	25.59	5.94	13.74	17.75	43.93	23.65	37.43	67.36	23.54	44.92	15.83
WAPD-1530 x HD-2967	81.00	119.00	70.81	24.74	6.48	14.06	18.65	51.75	22.30	39.15	73.41	26.42	44.56	19.38
WAPD-1530 x NW-5054	80.33	121.00	73.46	24.92	6.01	13.41	19.56	53.07	23.43	39.56	72.91	27.41	44.20	19.96
Hybrid Mean	81.60	123.47	77.14	23.57	6.54	12.06	19.57	51.30	24.03	37.44	63.51	27.34	40.10	17.45
Line														
HS-645	88.00	128.67	79.84	24.44	6.93	8.23	15.02	53.01	20.24	37.35	53.30	36.72	41.90	19.51
PBW-778	82.00	129.33	84.89	25.17	7.12	11.91	17.52	55.71	22.48	38.25	71.53	30.62	42.73	21.85
VL3014	80.33	121.33	73.53	19.72	4.88	6.66	15.96	40.15	20.61	28.77	65.44	19.50	38.33	12.72
DBW-251	86.67	121.00	97.88	24.59	5.46	10.67	21.54	41.76	25.04	35.23	54.95	23.04	36.11	12.59
HI-1612	77.00	123.33	99.40	19.79	4.86	7.82	17.27	44.63	26.36	29.50	47.97	24.73	34.19	11.79
HI-1619	86.00	123.67	96.29	20.47	5.23	11.00	18.92	49.05	24.74	34.63	55.91	20.47	29.35	11.42
HPW-439	88.33	125.33	82.26	19.48	6.85	9.20	17.76	43.80	24.34	36.91	53.47	28.71	33.81	15.33
PBW-780	88.67	131.33	71.27	24.69	7.27	13.13	21.31	55.72	18.57	37.90	61.17	38.51	45.04	23.49
DBW-179	78.67	131.00	87.21	21.84	6.10	8.32	15.99	48.13	20.97	37.23	47.84	24.21	40.26	11.50
HS-644	88.67	126.00	75.86	24.22	7.19	9.25	20.80	51.30	21.20	38.85	67.20	32.48	42.74	21.78
HS-646	87.67	129.33	80.96	25.41	6.83	7.65	17.42	53.71	21.64	39.92	63.13	33.52	40.51	21.11
WH-1127	81.33	127.33	89.69	20.38	6.69	9.66	16.36	58.28	25.82	38.22	49.21	24.94	38.15	12.22
WAPD-1516	81.67	125.33	50.21	22.39	5.67	10.84	15.71	41.45	17.56	35.10	61.55	23.97	40.09	14.71
WAPD-1519	80.67	124.00	52.17	21.24	5.85	10.48	15.37	48.16	18.54	35.43	59.68	22.83	42.70	13.59
WAPD-1524	82.33	123.67	52.14	21.74	5.17	10.24	15.42	47.14	17.66	35.64	60.74	22.92	42.70	13.88
WAPD-1530	80.67	122.67	68.60	24.60	5.47	10.73	16.33	48.22	18.71	37.46	62.57	24.03	43.89	15.03
Tester														
KRL-99	74.00	114.67	69.60	20.55	5.29	8.74	19.61	43.94	21.39	36.34	43.32	29.85	38.00	12.87
KRL-1-4	78.33	121.00	75.90	20.10	4.11	9.82	15.98	38.82	23.05	32.95	43.25	18.86	36.14	8.09
HD-2967	83.33	121.33	82.21	25.37	5.99	10.24	18.67	50.76	26.69	37.31	77.07	28.51	44.27	21.93
NW-5054	80.33	121.33	81.79	22.47	5.15	14.96	23.10	54.23	28.03	37.51	71.22	29.08	33.86	20.66
Parent Mean	82.73	124.58	77.58	22.43	5.91	9.98	17.80	48.40	22.18	36.02	58.53	26.87	39.24	15.80
Checks														
K-65	80.00	120.33	94.33	22.12	5.50	13.85	17.72	55.29	26.33	38.72	70.59	32.42	39.99	22.84
KRL-210	76.00	119.00	70.55	20.95	4.81	7.58	18.03	37.10	26.50	36.43	60.11	27.82	34.25	16.67
NW-1067	76.33	119.00	70.72	24.10	7.01	12.45	19.91	48.53	26.25	36.12	67.29	30.03	38.13	20.16
Total mean	81.72	123.59	77.29	23.27	6.37	11.56	19.13	50.49	23.68	37.11	62.45	27.33	39.81	17.15
Fratio	90.77	86.63	651.64	48.84	93.99	65.73	87.99	94.66	149.95	227.57	609.92	60.26	179.91	254.63
S.E.	0.41	0.42	0.54	0.32	0.09	0.28	0.25	0.56	0.25	0.21	0.35	0.57	0.31	0.26
C.D.(5%)	1.13	1.15	1.51	0.89	0.25	0.77	0.68	1.56	0.70	0.59	0.96	1.58	0.85	0.71
CV(%)	0.86	0.58	1.22	2.40	2.43	4.14	2.23	1.93	1.85	0.99	0.96	3.61	1.34	2.59

Table 3: Mean performance of late sown

Genotype	DFF	DM	PH	FLA	NTP	SL	NSS	GS	PL	TGW	BYP	HI	CC	GYP
HS-645 x KRL-99	77.00	114.00	63.72	21.65	5.93	9.64	16.25	52.04	20.78	35.36	54.60	34.14	39.35	18.57
HS-645 x KRL-1-4	74.00	123.00	70.72	20.71	5.40	10.47	15.53	43.98	21.12	32.48	63.57	29.43	38.58	18.61
HS-645 x HD-2967	86.00	112.00	76.80	21.79	5.91	10.71	15.71	50.96	22.59	36.54	59.70	34.38	41.80	20.46
HS-645 x NW-5054	83.00	124.00	74.75	20.82	5.84	14.37	16.34	52.96	23.11	36.80	58.41	36.15	39.71	21.07
PBW-778 x KRL-99	73.00	117.00	78.72	22.71	6.24	12.32	16.74	53.89	21.44	36.06	63.52	32.61	40.73	20.63
PBW-778 x KRL-1-4	79.00	125.00	79.92	22.89	5.61	13.61	16.45	49.90	22.49	34.56	73.26	28.21	39.29	20.64
PBW-778 x HD-2967	80.00	125.00	79.72	22.68	5.97	14.03	17.92	50.21	23.64	37.93	68.16	31.68	40.74	21.57
PBW-778 x NW-5054	79.00	126.00	81.76	22.86	6.16	15.85	19.52	51.92	24.58	38.27	67.68	32.87	41.90	22.20
VL3014 x KRL-99	72.00	113.00	59.81	18.31	4.45	7.71	15.13	43.87	20.44	28.65	44.75	24.50	35.73	10.87
VL3014 x KRL-1-4	76.00	116.00	65.91	16.74	4.03	7.99	13.71	42.85	21.06	27.31	61.49	20.89	34.57	12.78
VL3014 x HD-2967	77.00	115.00	71.79	18.80	4.01	8.28	14.60	44.85	22.58	29.77	62.05	20.95	38.50	12.92

VL3014 x NW-5054	77.00	117.00	84.98	18.76	4.40	12.25	15.40	42.85	24.63	29.27	61.61	21.72	35.37	13.35
DBW-251 x KRL-99	72.00	115.00	82.75	20.87	5.51	10.29	18.61	41.95	23.61	33.87	42.96	23.69	33.86	10.12
DBW-251 x KRL-1-4	82.00	116.00	91.89	22.87	4.72	10.34	18.95	40.99	24.52	32.57	58.49	19.68	32.60	11.46
DBW-251 x HD-2967	82.00	115.00	92.96	21.81	5.22	10.72	18.09	40.95	25.62	34.53	52.59	22.93	35.30	11.99
DBW-251 x NW-5054	81.00	116.00	91.78	19.87	5.41	13.61	18.90	41.97	26.50	33.79	52.20	25.83	33.79	13.41
HI-1612 x KRL-99	79.00	117.00	95.72	16.92	4.25	8.87	15.42	43.15	26.58	27.51	38.39	24.30	32.38	9.23
HI-1612 x KRL-1-4	74.00	120.00	95.68	17.81	4.30	9.22	14.62	43.01	24.93	27.37	53.23	20.07	30.96	10.63
HI-1612 x HD-2967	76.00	119.00	94.87	17.78	4.92	9.57	14.92	43.73	23.45	28.57	49.30	22.50	31.73	11.00
HI-1612 x NW-5054	75.00	121.00	95.79	16.90	4.14	8.95	15.41	42.96	28.55	28.76	48.94	24.19	31.67	11.73
HI-1619 x KRL-99	85.00	120.00	92.87	15.97	5.02	11.12	17.35	44.95	22.46	34.50	43.48	26.07	28.46	11.22
HI-1619 x KRL-1-4	82.00	118.00	86.79	16.69	5.04	11.10	16.83	41.96	22.52	31.93	52.30	21.29	27.75	11.09
HI-1619 x HD-2967	82.00	117.00	89.51	18.80	5.23	11.43	16.83	47.87	24.65	35.60	64.88	23.62	28.64	15.27
HI-1619 x NW-5054	83.00	119.00	90.79	15.95	4.95	10.00	17.80	47.92	25.50	35.82	64.42	24.50	27.77	15.76
HPW-439 x KRL-99	80.00	123.00	72.69	15.83	5.30	10.57	16.64	40.97	28.37	35.75	54.78	29.10	33.13	15.88
HPW-439 x KRL-1-4	84.00	119.00	77.95	16.67	5.90	10.86	15.37	40.00	28.63	31.41	46.03	26.40	32.03	12.10
HPW-439 x HD-2967	81.00	118.00	81.92	17.77	5.26	11.11	16.12	39.93	28.51	35.87	73.06	26.15	34.91	19.06
HPW-439 x NW-5054	80.00	120.00	81.75	16.82	5.22	10.05	16.90	41.99	27.51	35.73	72.55	27.14	30.56	19.64
PBW-780 x KRL-99	82.00	128.00	62.91	22.77	5.91	14.62	19.52	53.98	20.41	37.40	60.12	34.16	42.23	20.46
PBW-780 x KRL-1-4	81.00	124.00	68.75	21.87	6.04	14.76	19.75	53.95	21.59	35.30	60.43	34.18	41.07	20.64
PBW-780 x HD-2967	85.00	123.00	70.84	24.80	6.12	14.11	19.80	53.87	19.52	38.58	64.44	32.74	43.58	21.06
PBW-780 x NW-5054	82.00	125.00	71.03	20.80	5.80	14.96	20.01	53.98	23.56	38.83	63.97	34.30	38.68	21.91
DBW-179 x KRL-99	76.00	127.00	86.75	18.73	5.21	9.28	15.56	43.94	20.59	35.27	45.44	25.21	37.24	11.36
DBW-179 x KRL-1-4	77.00	122.00	79.75	18.81	4.91	9.02	16.22	42.91	21.59	29.79	59.96	20.56	36.84	12.30
DBW-179 x HD-2967	73.00	121.00	81.98	19.64	5.33	9.39	15.01	46.89	20.64	36.27	60.71	24.57	39.69	14.80
DBW-179 x NW-5054	75.00	123.00	85.51	18.91	5.16	9.01	14.62	46.97	23.68	36.79	58.29	26.36	35.69	15.28
HS-644 x KRL-99	84.00	120.00	65.70	20.88	6.11	10.72	19.35	47.94	20.94	36.33	62.00	31.13	38.62	19.25
HS-644 x KRL-1-4	79.00	121.00	69.75	21.71	5.66	10.44	19.58	45.93	21.72	37.56	67.75	28.61	39.25	19.33
HS-644 x HD-2967	85.00	120.00	73.76	21.77	6.03	10.72	19.61	47.86	23.46	37.26	62.95	31.47	41.69	19.73
HS-644 x NW-5054	85.00	122.00	72.75	20.78	5.97	14.31	18.81	49.92	24.49	37.69	62.50	32.70	37.43	20.37
HS-646 x KRL-99	80.00	120.67	72.85	21.69	5.92	8.36	16.33	46.95	21.07	37.56	59.52	31.67	39.47	18.76
HS-646 x KRL-1-4	80.00	125.00	75.87	22.99	5.34	9.25	14.54	51.96	22.39	34.60	64.22	30.49	38.06	19.54
HS-646 x HD-2967	82.00	125.00	78.78	21.69	5.52	9.55	15.83	51.92	24.44	38.91	61.12	32.86	39.95	20.02
HS-646 x NW-5054	84.00	126.00	81.77	21.97	5.88	9.37	15.19	52.96	25.51	39.40	60.69	34.22	39.44	20.67
WH-1127 x KRL-99	77.00	121.00	86.75	16.85	5.62	10.27	15.31	50.04	26.03	36.68	45.99	26.30	36.93	12.04
WH-1127 x KRL-1-4	76.00	120.00	83.76	17.84	5.28	11.48	14.56	45.94	26.65	33.27	51.76	21.39	34.43	11.02
WH-1127 x HD-2967	80.00	119.00	85.67	18.74	5.53	11.72	14.92	46.83	26.62	37.95	57.18	24.48	36.42	13.95
WH-1127 x NW-5054	78.00	121.00	89.85	16.91	5.54	11.10	15.55	47.91	27.46	37.68	56.78	25.55	36.63	14.45
WAPD-1516 x KRL-99	73.00	116.00	50.72	18.75	4.60	10.92	15.22	43.94	18.09	33.74	48.82	27.84	38.95	13.52
WAPD-1516 x KRL-1-4	77.00	117.00	50.05	18.70	3.85	11.12	14.65	38.91	18.90	32.20	50.71	25.92	37.67	13.05
WAPD-1516 x HD-2967	82.00	116.00	57.15	19.70	4.75	11.43	14.75	42.89	20.49	34.65	68.05	26.91	38.73	18.28
WAPD-1516 x NW-5054	80.00	118.00	50.85	18.83	4.53	11.66	16.21	43.99	18.76	35.52	67.58	27.63	36.65	18.58
WAPD-1519 x KRL-99	74.00	112.00	52.14	17.75	5.04	11.07	14.84	45.99	18.09	34.90	48.68	25.99	40.26	12.57
WAPD-1519 x KRL-1-4	75.00	116.00	50.82	18.77	4.83	10.96	14.62	38.98	19.63	33.79	56.26	24.04	38.19	13.46
WAPD-1519 x HD-2967	80.00	115.00	56.75	18.56	5.28	11.28	14.31	47.95	20.58	35.58	65.21	24.58	41.84	15.99
WAPD-1519 x NW-5054	77.00	117.00	53.88	17.86	4.96	11.45	14.62	48.89	21.52	35.90	64.75	25.56	34.49	16.49
WAPD-1524 x KRL-99	74.00	114.00	51.79	19.72	4.55	10.61	14.62	44.89	17.61	34.49	55.67	23.93	41.26	13.28
WAPD-1524 x KRL-1-4	81.00	117.00	52.93	17.81	4.52	10.57	13.52	36.00	18.73	30.55	55.33	22.15	39.79	12.21
WAPD-1524 x HD-2967	81.00	116.00	59.88	19.69	4.36	10.82	14.30	45.87	19.60	35.72	59.80	27.90	42.17	16.65
WAPD-1524 x NW-5054	79.00	118.00	54.91	19.69	4.49	11.01	14.75	43.92	19.80	35.81	59.38	28.96	38.71	17.17
WAPD-1530 x KRL-99	73.00	118.00	64.62	20.74	4.91	11.22	15.91	42.95	18.10	35.47	55.40	27.14	43.14	14.99
WAPD-1530 x KRL-1-4	76.00	116.00	73.65	21.89	4.72	12.12	14.70	39.98	19.70	34.26	62.25	23.04	41.75	14.30
WAPD-1530 x HD-2967	79.00	115.00	67.95	20.93	5.18	12.45	15.46	46.93	21.61	36.56	68.11	25.88	41.61	17.59
WAPD-1530 x NW-5054	77.00	117.00	70.79	20.85	4.81	11.95	16.22	47.87	22.50	36.90	67.63	26.92	41.07	18.14
Hybrid Mean	78.91	119.24	74.50	19.66	5.20	11.06	16.26	46.05	22.76	34.62	58.53	27.07	37.21	15.88
Line														
HS-645	84.67	124.00	76.63	20.09	5.44	7.70	12.25	47.11	19.17	34.08	49.82	35.30	38.82	17.43
PBW-778	79.00	125.00	81.34	20.66	5.60	10.86	14.34	49.38	21.35	34.71	66.32	29.97	39.47	19.80
VL3014	77.33	117.00	70.75	16.12	3.80	6.41	12.95	35.47	19.09	26.20	60.35	18.91	34.99	11.38
DBW-251	83.00	117.33	93.75	20.18	4.22	9.80	17.69	36.43	23.07	32.15	50.28	21.10	33.13	10.53
HI-1612	74.33	119.00	95.72	16.42	3.77	7.40	14.05	39.46	24.07	26.98	43.34	20.09	31.08	8.64
HI-1619	83.00	120.33	92.75	16.36	4.76	10.12	15.40	43.45	23.09	32.10	51.45	19.72	26.99	10.11
HPW-439	85.00	121.00	78.72	15.29	5.34	8.59	14.58	38.96	21.50	33.76	48.78	28.01	31.01	13.57
PBW-780	85.00	127.00	68.72	20.29	5.66	11.86	17.40	49.55	17.01	34.88	56.27	38.08	41.01	21.36
DBW-179	76.33	127.00	83.82	18.33	4.71	7.85	12.93	42.10	19.18	34.35	43.38	23.67	36.91	10.20
HS-644	86.33	122.00	72.92	20.24	5.64	8.63	17.08	45.92	20.05	35.50	62.27	33.09	39.22	20.54
HS-646	84.33	125.00	77.72	20.51	5.32	7.22	14.22	47.56	20.07	36.76	58.07	34.38	37.17	19.93
WH-1127	79.00	123.00	86.72	16.31	5.13	8.98	13.35	51.48	24.02	34.57	44.60	24.36	35.18	10.81

WAPD-1516	81.00	121.00	48.75	18.32	4.50	9.51	12.74	36.02	16.20	31.93	56.55	23.43	36.16	13.19
WAPD-1519	78.00	120.00	50.92	17.32	4.51	9.29	12.52	42.16	17.05	32.19	54.73	22.30	39.49	12.15
WAPD-1524	79.33	120.00	51.89	18.39	3.91	10.07	12.55	41.83	16.05	32.71	55.75	22.38	39.26	12.44
WAPD-1530	78.00	119.00	65.72	20.34	4.20	9.44	13.31	42.03	17.08	34.14	57.52	23.58	40.72	13.49
Tester														
KRL-99	72.00	111.00	66.85	16.36	4.01	8.15	16.02	38.07	20.07	32.81	38.88	30.27	35.05	11.67
KRL-1-4	75.00	118.00	72.99	16.33	3.27	9.13	13.05	34.04	21.91	29.77	38.80	18.42	33.10	7.02
HD-2967	80.00	117.00	78.77	21.29	4.59	9.50	15.25	44.90	25.63	33.70	71.57	27.97	40.98	19.95
NW-5054	77.00	118.00	89.85	18.40	4.00	13.41	18.96	47.03	26.49	34.33	65.90	28.57	30.94	18.78
Parent Mean	79.88	120.58	75.27	18.38	4.62	9.20	14.53	42.65	20.61	32.88	53.73	26.18	36.03	14.15
Checks														
KH-65	77.00	116.00	90.88	18.27	4.20	12.56	14.42	48.11	24.64	35.40	65.31	31.81	36.91	20.76
KRL-210	73.00	115.00	67.92	18.32	3.72	8.12	14.77	32.06	25.32	32.83	55.14	27.52	31.34	15.11
NW-1067	73.33	116.67	62.95	18.39	5.45	11.13	16.26	42.84	24.55	32.67	62.11	29.58	35.10	18.27
Total mean	78.98	119.44	74.66	19.32	5.04	10.62	15.83	45.09	22.33	34.19	57.51	26.95	36.84	15.56
Fratio	52.65	49.21	491.37	171.16	101.33	19.24	12.68	52.90	18.74	23.75	366.73	20.92	57.42	63.76
S.E.	0.53	0.56	0.61	0.16	0.07	0.44	0.54	0.68	0.71	0.62	0.43	1.02	0.53	0.50
C.D.(5%)	1.47	1.54	1.68	0.45	0.19	1.22	1.51	1.89	1.97	1.72	1.20	2.82	1.46	1.37
CV(%)	1.16	0.81	1.41	1.47	2.38	7.18	5.96	2.61	5.51	3.14	1.31	6.53	2.48	5.52

Similarly, the genotypes showing very high mean performance in desirable direction for various characters may also be used for improving the characters for which they have high mean performance.

Table 4: Estimates of range, coefficient of variation (PCV and GCV), heritability, genetic advance and genetic advance in per cent of mean for 14 characters in wheat

Traits		General Mean	Variance			Coefficient of variation (%)		h^2 (Broad Sense)	Genetic advance 5%	Genetic Advance as% of Mean 5%
			PV	GV	EV	GCV	PCV			
Days to 50% flowering	E1	81.72	15.31	13.28	2.03	3.71	4.78	86.76	7.80	9.54
	E2	78.97	15.28	12.92	2.37	3.81	4.95	84.51	7.61	9.63
Days to maturity	E1	123.59	15.38	13.32	2.06	2.12	3.17	86.61	7.80	6.31
	E2	119.43	15.84	13.33	2.51	2.23	3.33	84.14	7.71	6.46
Plant height (cm)	E1	77.29	193.73	173.47	20.26	16.97	18.00	89.54	28.54	36.92
	E2	74.65	181.16	161.94	19.22	16.97	18.02	89.39	27.55	36.91
Flag leaf area (cm2)	E1	23.27	5.30	4.45	0.84	8.59	9.88	84.09	4.46	19.17
	E2	19.32	4.66	4.12	0.55	10.08	11.17	88.26	4.37	22.62
Number of tillers per plant	E1	6.37	0.76	0.66	0.10	12.51	13.72	86.87	1.74	27.38
	E2	5.04	0.49	0.43	0.06	12.76	13.96	87.10	1.41	27.93
Spike length (cm)	E1	11.56	5.17	4.42	0.75	18.23	19.67	85.57	4.47	38.73
	E2	10.62	4.12	3.12	0.99	16.70	19.10	75.87	3.59	33.79
Number of spikelets per spike	E1	19.13	5.48	4.75	0.73	11.03	12.23	86.66	4.66	24.36
	E2	15.83	4.36	3.03	1.33	10.76	13.19	69.57	3.42	21.62
Grain per spike	E1	50.49	30.43	26.44	3.99	9.76	10.92	86.89	11.01	21.81
	E2	45.09	25.43	21.50	3.93	9.87	11.18	84.54	9.82	21.78
Peduncle length (cm)	E1	23.68	9.76	8.59	1.17	12.06	13.19	88.02	6.30	26.63
	E2	22.34	10.48	7.92	2.56	12.40	14.49	75.54	5.70	25.54
1000-grain weight (g)	E1	37.11	10.26	9.10	1.16	7.58	8.63	88.69	6.51	17.55
	E2	34.19	9.91	7.76	2.14	7.65	9.21	78.35	5.73	16.76
Biological yield per plant (g)	E1	62.45	73.89	66.14	7.75	12.73	13.76	89.51	17.62	28.21
	E2	57.51	69.30	61.81	7.49	13.42	14.48	89.19	17.01	29.58
Harvest index (%)	E1	27.33	20.18	17.19	2.99	15.04	16.44	85.18	8.80	32.23
	E2	26.95	23.70	18.23	5.47	15.84	18.06	76.91	8.72	32.34
Chlorophyll content	E1	39.81	17.19	15.19	2.00	9.33	10.41	88.35	8.40	21.10
	E2	36.84	16.59	14.10	2.50	9.77	11.06	84.95	7.97	21.63
Grain yield per plant (g)	E1	17.15	16.86	14.97	1.88	22.80	23.93	88.83	8.35	48.73
	E2	15.56	16.17	13.82	2.35	24.25	25.85	85.44	7.91	50.81

NOTE: E_1= Timely sown, E_2= Late sown

The PCV and GCV was found that are mention in Table 4. The high estimates of phenotypic coefficient of variation (>20%) were found both environment grain yield per plant (g) in both E_1 and E_2 condition. The moderate estimates (10 - 20%) of PCV recorded for the characters, plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), biological yield per plant (g), harvest index (%), and chlorophyll content in both E_1 and E_2 condition, also Flag leaf area (cm^2) in E_2, conditions; And the low estimates of PCV were recorded in days to 50% flowering, days to maturity, & 1000-grain weight (g) in both E_1 and E_2 condition, also Flag leaf area (cm2) in E_1, conditions. The high estimates of genotypic coefficient of variation (>20%) were found in both environment grain yield per plant (g) in E_1 and E_2 condition. The moderate estimates (10 - 20%) of GCV recorded for the characters, plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, peduncle length (cm), biological yield per plant (g) and harvest index (%) in both E_1 and E_2 condition, also flag leaf area (cm^2) in E_2,

conditions; And the low estimates of GCV were recorded in days to 50% flowering, days to maturity, grain per spike, 1000-grain weight (g) & chlorophyll content in both E_1 and E_2 condition, also flag leaf area (cm^2) in E_1, conditions.

Hence, knowledge of nature and magnitude of genetic variability present in genotypes and the degree of transmission of the economic traits is of greater help in identifying the parents with novelty and diversity for planning a suitable breeding strategy. The existence of genetic variation is a basic necessity for evolution of any species. The variability for yield, its components that we can see, measure and study is the ultimate result of the variability in the genetic constitution of the individuals. To develop high productive genotypes for qualitative and quantitative traits by genetic improvement through breeding programmes, the presence of genetic variability are most essential requirement of genotypes. The information on the amount of genetic variability present in the genotype with respect to important traits is considered a priority for directed improvement in the concerned species. The fundamental principle involved in plant breeding is the application of the genetic variability available in the breeding material for various characters to change the genetic architecture of plant in order to develop improved genotype possessing higher economic yield and value than existing one. The phenotypic and genotypic coefficients of variation were computed to assess the nature and magnitude of existing variability in the genotype. The PCV and GCV were higher for grain yield per plant (g) in both E_1 and E_2 condition. Similar results were observed by Kumar *et al*. (2022) [8], Chegdali *et al*. (2022) [4], Porte *et al*. (2021) [13], Kumar *et al*. (2021) [9], Bayisa *et al*. (2020) [1], Mishra *et al*. (2019) [10], Bhardwaj (2018) [2], Pachauri *et al*. (2018) [12], Mohanty *et al*. (2016) [11], Sathisha *et al*. (2016) [14], Jat *et al*. (2015) [6], and Kumar *et al*. (2014) [7].

In the present investigation, heritability in broad sense and genetic advance as per cent of mean are found that are mention in Table 4. the high estimate of heritability in broad sense (>60%) was recorded for all characters like- days to 50% flowering, days to maturity, plant height (cm), flag leaf area (cm^2), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), 1000-grain weight (g), biological yield per plant (g), harvest index (%), chlorophyll content and grain yield per plant (g) in both E1 and E2 condition. The high estimates of genetic advance as per cent of mean (>20%) were found in these characters- plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), biological yield per plant (g), harvest index (%), chlorophyll content, and grain yield per plant (g) in both E_1 and E_2 condition, also flag leaf area (cm^2) in E_2, conditions; The moderate estimates (10 - 20%) of genetic advance as per cent of mean recorded for the characters, flag leaf area (cm2), and 1000-grain weight (g) in E_1 and in E_2, 1000-grain weight (g). And the low estimates (<10) of genetic advance as per cent of mean were recorded in days to 50% flowering, & days to maturity in both E_1 and E_2 condition.

In any selection programme, for the dependent character yield and its component characters lies solely on their heritability and genetic advance. Heritability estimation provides information on transmission of character from the parent to the progeny. High value of heritability indicates that it may be due to higher contribution of genotypic components. High heritability alone is not enough to make efficient selection, unless the information is accompanied by substantial amount of genetic variation (Johnson *et al.*, 1955). Heritability ($h^2_{(bs)}$) and genetic advance in per cent of mean as direct selection parameters provide index of transmissibility of traits which gives indication about the effectiveness of selection in improving the characters. Success in recombination breeding depends on suitable selection of best parents, exploitation of high heterotic crosses and selection of transgressive segregants. The choice of selection and breeding procedures for genetic improvement of any crop is largely dependent on the knowledge of type and relative amount of genetic component and the presence of non-allelic inter-action for different characters in the plant materials under investigations. The high estimate of heritability coupled with high genetic advance for plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), biological yield per plant (g), harvest index (%), chlorophyll content, and grain yield per plant (g) in both E_1 and E_2 condition and also flag leaf area (cm^2) in E_2, conditions that's reason the selection of genotypes based on these characters are more useful for genetic improvement of genotypes and similar results were observed by Chegdali *et al*. (2022) [4], Porte *et al*. (2021) [13], Kumar *et al*. (2021) [9], Bayisa *et al*. (2020) [1], Jaiswal *et al*. (2020) [5] Mishra *et al*. (2019) [10] and Bhardwaj (2018) [2].

Conclusion

The mean squares due to treatments were highly significant for all the characters studied except Number of tillers per plant in both E_1 and E_2 condition. Best five crosses that have higher grain yield per plant (g)- PBW-778 x NW-5054, PBW-780 x NW-5054, PBW-778 x HD-2967, PBW-780 x HD-2967 and HS-645 x NW-5054 in both E_1 and E_2 condition these hybrids showed very high mean performance in grain yield per plant (g). The highest estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was observed in grain yield per plant (g) in both E_1 and E_2 condition, that's reason these characters have higher phenotypic variability and genetic variability. The highest estimated of heritability in broad sense was recorded for all the characters. The high estimate of heritability coupled with high genetic advance for plant height (cm), number of tillers per plant, spike length (cm), number of spikelets per spike, grain per spike, peduncle length (cm), biological yield per plant (g), harvest index (%), chlorophyll content and grain yield per plant (g) in both E_1 and E_2 condition, and also flag leaf area (cm2) in E_2, conditions that's reason the selection of genotypes based on these characters are more useful for genetic improvement of genotypes.

References

1. Bayisa T, Tefera H, Letta T. Genetic variability, heritability and genetic advance among bread wheat genotypes at Southeastern Ethiopia. Agriculture, Forestry and Fisheries. 2020;9(4):128.
2. Bhardwaj SL. Genetic Variability and Heritability Studies in Wheat Genotypes under Late Sown Condition in Chh2attisgarh Plains. Int. J Pure App. Bios. 2018;6(3):513-517.
3. Bhushan B, Bharti S, Ojha A, Pandey M, Gourav SS, Tyagi BS. Genetic variability, correlation coefficient and path analysis of some quantitative traits in bread wheat.

Journal of Wheat Research. 2013;5(1):21-26.
4. Chegdali Y, Ouabbou H, Essamadi A. Assessment of Agro-Morphological Variability in a Durum Wheat Collection Maintained in the Moroccan Gene Bank. Food Science and Engineering, 2022, 31-42.
5. Jaiswal R, Gaur SC, Jaiswal SK, Kumar A. An estimate of variability, heritability and genetic advance for grain yield and yield components in bread wheat (*Triticum aestivum* L.). Curr. J Appl. 2020;39(12):2457-1024.
6. Jat A, Prasad SS, Ambati D, Singh J, Gautam A, Dubey VG. Genetic variability, heritability and diversity for yield contributing traits in reference varieties of wheat. Indian Journal of Plant Genetic Resources. 2015;31(1):11-16.
7. Kumar N, Markar S, Kumar V. Studies on heritability and genetic advance estimates in timely sown bread wheat (Triticum aestivum L.). Bioscience Discovery. 2014;5(1):64-69.
8. Kumar R, Singh SK, Singh M, Singh SV, Singh L, Kumar S. Analysis of genetic variation based on quantitative as well as quality traits in bread wheat (Triticum aestivum L.). 2022.
9. Kumar V, Mishra PC, Babbar A, Khande D. Genetic variability analysis of yield and its attributes in F1 and their parent of bread wheat (Triticum aestivum L.) over environment. The Pharma Innovation Journal. 2021;11(2):817-820
10. Mishra U, Sharma AK, Chauhan S. Genetic variability, heritability and genetic advance in bread wheat (*Triticum aestivum* L.). Int. J Curr. Microbiol. App. Sci. 2019;8(7):2311-2315.
11. Mohanty S, Mukherjee S, Mukhopadhyaya SK, Dash AP. Genetic Variability, Correlation and Path Analysis of Bread Wheat (Triticum aestivum L.) Genotypes under Terminal Heat Stress. International Journal of Bio-resource and Stress Management. 2016;7(6):1232-1238.
12. Pachauri P, Kandalkar VS, Satankar N. Analysis of genetic variability and path coefficient for yield and yield contributing traits in cultivated and synthetic wheat and their interspecific crosses. Journal of Pharmacognosy and Phytochemistry. 2018;7:83-87.
13. Porte B, Agrawal AP, Gupta VK. Genetic variability parameters studies under normal and stress conditions of wheat (Triticum aestivum L.). Journal of Pharmacognosy and Phytochemistry. 2021;10(1):598-601.
14. Sathisha TN, Desai SA. Genetic Variability for Nitrogen Use Efficiency (NUE) and Yield Attributing Traits in Wheat. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107. 2016;8(48):2010-2014.
15. USDA. United States Department of Agriculture. 2021. https:// ipad.fas.usda.gov