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Evolution and genetic variability, heritability and genetic advance of hexaploidy Wheat (Triticum Aestivum L.) genotypes under irrigated condition

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Abstract

A field experiment was conducted in a randomized block design with three replications at the Agricultural Research farm, R.B.S. College, Bichpuri, Agra, (Uttar Pradesh) during 2018-19 . Evaluated the protection potential of 27 genotypes namely K-1317, K-307, K-9423, DBW-39, K-402, WH-147, DBW-17, K-1007, K-9107, HUW-234, K-7903, LOK-1, WH-711, Raj-3765, PBW-550, PBW-343, Raj-1482, Raj-4037, HUW-213, HD-3086, PBW-154, HD-2967, WH-1105, PBW-502, PBW-373, PBW-226 and UP-2338 under irrigated with canal water condition. The observations were recorded on five randomly selected plants in each replication for each genotypes and the mean data for grain yield and its attributes. Initiation of spike, days to maturity, plant height at maturity, number of tillers per plant, number of spikes per plant, number of spikelets per plant, spike length , number of grains per spike, weight of 1000-grains, grain yield per plant and grain yield per plot were subjected to an analysis of variance the results revealed that significant differences among 27 triticum aestivum genotypes for grain yield and its attributes among 27 triticum aestivum varieties WH-147 and K-7903 for grain yield. These genotypes may be process the for stresses as evidence by performance in predominantly soil and water use they should be included in direct cultivation in such environment as hybridization program to develop recombinants position high grain yield.

Introduction

Wheat (Triticum aestivum L.) is the world's leading cereal grain and most important food crop, occupying commanding position in Indian agriculture, which occupy 28% area under the cereal

and contributing 33% of the total food grain production in the country. Wheat offer a great wealth of material for genetical studies due to its wide ecological distribution and enormous variation encountered for various morphological and physiological characters. (Rangare et. al. 2009).

In Indian wheat is mainly grown under the three production conditions viz. timely sown; medium to good fertility, irrigated; late sown, medium fertility; irrigated and timely sown; low fertility and in rained condition. (Datta et. al., 2009)

The ultimate aim of any plant breeding programme is to develop cultivars with high potential and consistent performance over diverse environments. Hybridization is an important source of creation of variation. The study of genetic variability is the pre-requisite for any crop improvement programme. Success in recombination breeding depends on suitable exploitation of genotypes as parent of obtaining high heterotic crosses and transgressive sergeants or the presence of genetic variability in base population is essential. (Allarad, 1960)

The modern wheat breeding programmes focus on the improvement of agronomic and grain quality traits. The manipulation of wheat genetics has led to ever-increasing grain in yield and grains quality, while decreasing the ability of wheat to survive in the wild or in varying climate especially with the adverse conditions. In self pollinated crops the assessment of quantitative variable for genotypic variance, estimates of heritability and genetic advance of yield contributing characters are important for successful hybridization programme to evaluate new cultivars. (Amin et. al. 1992)

Selection on the basis of phenotypic variation is not efficient and selection therefore, based on evolution and utilization of genetic variability in a desired direction is extremely important in wheat improvement programme. The present study was is conducted in Upper Gangetic Plain with timely sown wheat lines with objective to find out the extent of variability, heritability and genetic advance with environmental effect on timely sown advance lines developed at our center for eleven quantitative characters.

Materials and Methods

An experimental was conducted in completely randomized block design with three replications at The Agricultural Research Farm, R.B.S. College Bichpuri, Agra, (Uttar Pradesh) during 2018-19. The experimental material consisted Twenty-seven wheat genotypes. The sowing was done by hand dibbling method in rows with 25 cm spacing apart and 4cm within row on 2nd December 2018 (timely sown environment 2018-19).

The recommended economical practices and plant protection measures were followed for the successful raising of the crop.

Observation were recorded on the randomly selected five plants for grain yield and different yield contributing traits viz. Initiation of spike, days to maturity, plant height at maturity, number of tillers per plant, number of spikes per plant, number of spikelets per plant, spike length , number of grains per spike, weight of 1000-grains, grain yield per plant and grain yield per plot. Their averages were used in the statistical analysis. The analysis of variance for R.B.D. was carried out by linear model suggested by Panse and Sukhatme (1985). The phenotypic and genotypic coefficient of variance which measure the magnitude of phenotypic and genotypic variation present in a particular character were computed by the formula given by Burton and De vane (1953).

The heritability in per cent in broad sense was estimated by Hanson, et. al. (1956) . Heritability values are characterized as low moderate and high by Robinson et. al. (1949).

The estimation of expected genetic advance from selection G(s), was obtained by the formula suggested by Robinson, Camstock and Harvey (1949) and genetic advance as percent of mean was classified as low, moderate and high by Johnson et. al. (1955).

Result and Discussion

Analysis of variation revealed that genotype genotypes were significant for all eleven characters viz. Initiation of spike, days to maturity, plant height at maturity, number of tillers per plant, number of spikes per plant, number of spikelets per plant, spike length , number of grains per

spike, weight of 1000-grains, grain yield per plant and grain yield per plot. Present findings are similar with earlier report at Kumar et. al. (2014) and Saini and shewta (2017).

Table- 1. Mean Sum Squares Genotypes

Source of Variation	d.f.	Initiation of spike (in days)	Days to Maturity	Plant Height at Maturity (c.m.)	Number of Effective Tillers per Plant	Number of Spikes per Plant	Number of spikelets per Spike	Spike Length (c.m.)	Number of grains per spike	Weight of 1000-Grains (gm.)	Grain yield per plant (gm.)	Grain yield per plot (gm.)
Replication	2	0.11	0.01	19.67	0.78	0.79	0.90	0.47	3.20	0.04	1.08	402.26
Treatment	26	44.74**	8.50**	118.39**	7.69**	8.71**	5.01**	1.74**	15.84**	11.99**	28.01**	85010.43**
Error	52	0.47	0.61	7.12	1.20	1.06	0.98	0.39	2.31	0.27	1.28	8530.36
Total	80	14.85	3.16	43.60	3.30	3.54	2.29	0.83	6.73	4.07	9.96	33183.18
$SE_{(d)}$		0.56	0.64	2.18	0.90	0.84	0.81	0.51	1.24	0.43	0.92	75.41
C.D. at 5%		1.13	1.29	4.39	1.80	1.69	1.63	1.02	2.50	0.86	1.86	151.76
C.V. (%)		0.79	0.64	2.65	12.33	11.56	4.67	5.40	2.46	1.28	6.00	9.02

*, ** significant at 5% and 1% level, respectively

The phenotypic and genotypic coefficient of variability were computed to access the nature and magnitude to existing variability in the germplasm the present in Table __

Indicates that the magnitude of PCV was variably higher than the GCV for all the traits under study. The highest magnitude of GCV was observed for number of Spikes for plant and number of tillers per plant this indicate greater scope of obtaining high selection response for these traits owning the presence of high genetic variability. The existence of high variability. grain yield per plant in wheat is conformity with the finding of earlier workers. Bhushan et. al. (2013) Saini and Shewta (2017).

The moderate estimate of coefficient of variation at genotypic and phenotypic level were found for spike length, plant height at maturity, number of spikelets per spike, weight of 1000-grains, grain yield per plant and grain yield per plot. The six character exhibiting moderate PCV and GCV values as mentioned above, are likely to allow reasonable scope for improvement through selection due to the moderate genetic variability available in wheat genotypes evaluated. similar were finding Mecha et. al. (2016).

Low estimate of PCV and GCV parameters were observed for days to maturity, number of grains per spike, initiation of spike, which suggested that selection directly based on these traits would

not be much rewarding. The estimate of phenotypic coefficient of variation was slightly higher than the genotypic coefficient of variation for all the characters. similar were finding Deoraj et. al.(2000).

Genotypes	Mean	Range	Variance			Coefficient of Variance		$[h^2_{(b)}]$%	G.A.	G.A. as % mean
			σ^2_g	σ^2_p	σ^2_e	G.C.V (%)	P.C.V (%)			
Initiation of spike (in days)	86.78	77.67 - 93.33	14.76	15.23	0.47	4.43	4.5	96.91	7.79	8.98
Days to Maturity	123.16	120.0 -125.33	2.63	3.24	0.61	1.32	1.46	81.03	3.01	2.44
Plant Height at Maturity (c.m.)	100.89	90.83 -117.62	37.09	44.21	7.12	6.04	6.59	83.88	11.49	11.39
Number of Effective Tillers/ Plant	8.89	7.00 - 13.00	2.16	3.36	1.2	16.55	20.64	64.31	2.43	27.34
Number of Spikes per Plant	8.9	7.00 - 13.00	2.55	3.61	1.06	17.94	21.35	70.66	2.77	31.07
Number of spikelets per Spike	21.16	19.00 - 24.00	1.34	2.32	0.98	5.48	7.2	57.87	1.82	8.59
Spike Length (c.m.)	11.51	10.16 - 14.10	0.45	0.84	0.39	5.84	7.96	53.94	1.02	8.84
Number of grains per spike	61.77	54.00 - 66.00	4.51	6.82	2.31	3.44	4.23	66.1	3.56	5.76
Weight of 1000-Grains (gm.)	40.81	36.56 - 45.46	3.91	4.18	0.27	4.84	5.01	93.52	3.94	9.65
Grain yield per plant (gm.)	18.82	13.09 - 25.77	8.91	10.19	1.28	15.86	16.96	87.48	5.75	30.56
Grain yield per plot (gm.)	1023.64	717.6 -1372.7	25493.36	34023.72	8530.36	15.6	18.02	74.93	284.71	27.81

Table – 3. Genetic Variability

Heritability and Genetic Advance :-

The fundamental principle of plant breeding is the application of selection on the genetic variability available in germplasm for various character to change the genetic architecture of the plant character and consequently of the plant in order to develop improve genotypic genotypes possessing higher economic yield value than existing ones. Obviously, genetic material is the raw material on which the selection acts to bring improvement in genetic architecture of plants. Heritability in broad sense and genetic advance in as percent of mean as direct selection parameter provides in the transmissibility of traits which give indication about the effectiveness of selection in improving the characters.

The higher estimates of heritability in broad sense was found for initiation of spike followed by weight of 1000-grains, grain yield per plant, plant height, days to maturity, grain yield per plot while low estimates of the heritability was found for spike length followed by number of spikelets per spike, number of tillers per plant and number of grains per spike similar were finding Mohsin et. al. (2009) and Khokhar et. al. (2010).

The highest genetic advance has been recorded for grain yield per plot followed by plant height, initiation of spike, grain yield per plant, weight of 1000-grains, while lowest genetic advance has been recorded for spike length followed by number of spikelets per spike, number of tillers per plant, number of spikes per plant and days to maturity. similar were finding Khokhar et. al. (2010) and Kumar et. al.(2017).

Conclusion

The results showed that significant variation existing among 27 wheat genotypes. WH-147 showed high mean performance for grain yield per plot(1372.70gm).High heritability along with high genetic advance was observed for initiation of spike, weight of 1000-grains, grain yield per plant and plant height at maturity. Genotype WH-147(1372.70gm), K-7903(1364.90gm), PBW-343(1303.50gm), LOK-1(1268.37gm), PBW-226(1160.23gm) attributed high grain yield per plot and should be material selected as high yielding genotypes for future experimentation to obtain a better yielding varieties under Agra Uttar Pradesh condition.

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