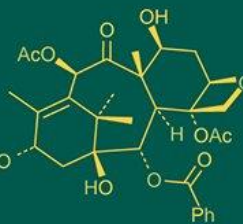
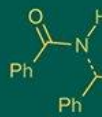


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Studies on most drought tolerance wheat genotype

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DOI: <https://doi.org/10.33545/26174693.2024.v8.i11c.2827>**Abstract**

The present experiment was carried out during *rabi* season of 2023-24 at experimental farm of B.T.C. College of Agriculture and Research Station Bilaspur, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, to study most drought tolerance wheat genotype. The experiment material considered, nine wheat genotypes for restricted irrigation drought condition with two checks CG1040 and CG1036, eight genotype for irrigated timely sown normal condition with one check GW-322 and eight genotype for irrigated late sown heat condition with two checks CG1029 and Chhattisgarh genhu-4. The objective of the study was to find out most drought tolerance wheat genotype in three condition viz., restricted irrigation drought condition, irrigated timely sown normal condition, irrigated late sown heat condition with two replications in randomized block design (RBD) yield attributing characters like 1000 grain weight, grains per spike, grain yield, biological yield per plant and harvest index. Result revealed that genotype CG2301, CG1047 and CG1036 recorded highly drought tolerant in restricted irrigation drought condition, GW-322 in irrigated timely sown normal condition and CG2311, CG1029 and Chhattisgarh genhu-4 recorded drought tolerance in irrigated late sown heat condition on the basis of DSI performance over all three condition.

Keywords: Drought tolerance, wheat genotype, restricted irrigation, drought susceptibility index, abiotic stress.

Introduction

Crop yield depends on potential of genotype and level of stress. Various factors such as biotic and abiotic stresses are responsible for the majority of wheat production losses. Biotic stress in wheat contains a number of pathogenic fungi and viruses that causes diseases like rust, karnal bunt, loose smut, powdery mildew and blast (recently identify).

Abiotic stresses in wheat refer to the nonliving environmental factors that can affect the growth and development of the plant such as heat, drought, salinity, frost, pre harvest sprouting, cyclone, high speed wind and ultra-violet radiation, are all detrimental posing a significant threat to agriculture and the environment and responsible for substantial crop yield loss (Wania *et al.* 2016) [8].

Drought stress: In agriculture, the term "drought" refers to a condition in which the amount of water available through rainfall and/or irrigation is insufficient to meet the transpiration needs of the crop (Tuberosa, 2012) [7]. Adverse environmental factors, of severe constraint to agriculture, account for about 70% of potential yield losses worldwide (Boyer, 1982) [5]. Developing crop cultivars with improved drought resistance is considered as a sustainable and an economically viable approach to enhance crop productivity and ensure food security for the growing human population (Blum *et al.* 1988; Bennett *et al.* 2012) [4, 3]. Therefore understanding the genetic nature abiotic stress (resistance/tolerance) is important to combat with upcoming problems of maintaining the crop productivity is changing environment.

Drought is the most detrimental environmental abiotic stress to wheat growth yield productivity. This effect is related to climate change specifically decreased rainfall as a result food security and sustainability suffered globally. Water scarcity in the region has become a paramount concern for agriculture production systems and crop productivity due to the uneven distribution of annual precipitation and accelerated depletion of ground water resources. Crop yield increases have been attained at the expense of great amounts of water used therefore the challenge is to reduce the rate of water use without a concomitant reduction in yield (Mei *et al.* 2013) [6]. Thus we must aim to balance the relationship between water consumption and crop production and seek to ensure the stability of water productivity

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in the area. Whether confounding other abiotic stresses (e.g. heat stress) drought challenges can be coping by the major breeding sustainable approach resilience wheat cultivar with drought tolerance.

Climate change and temperature fluctuations are affecting plant growth, yield, and distribution world wide. Drought stress has a massive effect on crop growth and productivity and is counteracting the 'zero hunger' goal with its strength and severity anticipated to increase in upcoming years. Increasing population and diverse dietary need to increase in total wheat production.

On the global context, India is the second largest producer of wheat with approximately 12 percent world's wheat production and it is also the second largest consumer of wheat after China, and has a huge and growing demand (Anonymous, 2022-23) ^[1, 2]. Wheat has occupied an area of 220.75 m ha, with a total production of 770.88 Mt and productivity 3.52 t per ha. in world (Anonymous, 2023) ^[1, 2]. In India, wheat has covered an area of 31.13 m ha with a total production of 109.59 million Mt and productivity 3.52 t per ha. In Chhattisgarh, wheat occupies an area about 0.22 m ha. with an average productivity of 1.6 t per ha. (Anonymous, 2023) ^[1, 2].

Materials and Methods

The present investigation was conducted during Rabi season of 2023-24 at the All-India Co-ordinated Wheat & Barley Improvement Project, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). The experimental materials consist of twenty-five advance up-coming promising genotypes (nine for restricted irrigation, eight for irrigated timely sown and eight for irrigated late sown conditions) checks CG1040, CG1036, GW-322, CG1029, Chhattisgarh genhu-4. The experiment was laid out in randomized block design (RBD) with two replications. Each genotype was grown in a plot size of 5.5 m² (5 rows 1cm apart) for each plot in each treatment in each replication sowing date 21th November 2023 restricted irrigation and timely sown 21th December 2023 irrigated late sown.

Various morphological and phenological observations were 1000 grain weight, grains per spike, grain yield, biological yield per plant and harvest index five competitive plants were randomly tagged for recording observations for each entry in each replication and water regimes for observing all quantitative characters. Few data were taken on plot basis, few on plant basis and other on seed basis. Mean of each character was used for statistical analysis. Drought susceptibility index was calculated according to the formula given by Fisher and Maurer (1978) ^[9].

$$DSI = (1 - Y_d/Y_p)/D$$

Where,

Y_d = mean yield of genotypes in stress environment

Y_p = mean yield of the genotypes under non- stress environments

$D = 1 - (\text{mean yield of all genotype under stress} / \text{mean yield of all genotype under non stress})$

Results and Discussion

Climate condition there was a winter rain of 51.2 mm at 15-17 DAS, which is sufficient for CRI stage of crop growth. There after 41 days of drought was created by non irrigating the field under restricted irrigation conditions. In between two irrigation were given to irrigated timely sown plot (Normal condition). Effective but in-sufficient winter rains (15.8 mm) received to experimental plot limiting the exposure of drought at heading period. Winter rains (54.0 mm) received at 83-84 DAS and 26.2 mm at 98 DAS is sufficient for milk/dough stage of crop. Total 147.2 mm rains received during the crop growth period against the requirement of 300 mm (Five irrigation of 60 mm) for optimum growth of wheat crop. More than half of the cropping period (67 days) was exposed to drought. This is sufficient for study of the wheat varieties for drought susceptibility Index (DSI). Drought susceptibility index (DSI), were estimated for each genotype as the reduction in the yield variable from normal to the stress environment relative to the respective mean reduction for all the genotypes. Genotypes are classified as highly tolerant (< 0.5), tolerant (0.5 to 1), susceptible (1 to 1.5) and highly susceptible (>1.5) to the abiotic stress. The restricted irrigation genotype CG2301, CG1047 and CG1036 is recorded highly drought tolerant for grain yield and CG2301 highly drought tolerant other three yield attributing characters like biological yield, grains per spike, and harvest index based on DSI values and CG2303, CG2304, CG2305 & CG1052 drought tolerant for grain yield CG2302 drought tolerant grain yield and 1000 grain weight CG1052 drought tolerant grain yield, biological yield and harvest index. Similarly irrigated timely sown genotype GW-322 is recorded highly drought tolerant for grain yield and other yield attributing characters like biological yield, grains per spike and harvest index based on DSI by five studied yield attributing character CG2306 highly drought tolerant for 1000 grain weight, grains per spike and biological yield CG2307, CG1050 and CG1045 highly drought tolerant for 1000 grain weight, biological yield, CG2309 highly drought tolerant grains per spike, biological yield and harvest index. Irrigated late sown condition genotype CG2314 highly drought tolerant for 1000 grain weight, grains per spike and biological yield, CG2313 highly drought tolerant grains per spike, biological yield, harvest index and CG2312, CG2315, Chhattisgarh genhu-4 highly drought tolerant for 1000 grain weight. Genotype CG2311, CG1029 and Chhattisgarh genhu-4 drought tolerant for grain yield under irrigated late sown. Mostly all genotypes show highly drought tolerant for biological yield under three condition restricted irrigation, irrigated timely sown and irrigated late sown conditions. The DSI analysis is represented in table 1.

Table 1: Estimates of heat and drought susceptible index of wheat genotypes.

	Sr. No.	Genotype	1000 grain weight(g)	Grain per spike	Grain yield (q/ha).	Biological yield (qt/ha)	Harvest index (%)
			DSI	DSI	DSI	DSI	DSI
RI	1	CG2301	1.13	-4.83	0.16	-0.59	-0.99
	2	CG2302	0.90	-1.38	0.98	-1.42	0.28
	3	CG2303	-3.38	1.11	0.81	-1.41	-0.39
	4	CG2304	2.18	3.33	0.83	-1.33	-0.14
	5	CG2305	-3.45	0.84	0.70	-0.65	0.86
	6	CG1047	4.64	4.16	0.29	-0.10	0.72
	7	CG1052	2.09	1.64	0.73	-0.64	1.00
	8	CG1040 ©	0.90	-0.26	1.27	-1.09	2.12
	9	CG1036 ©	0.85	4.71	0.41	0.16	1.77
TS	10	CG2306	-1.69	-0.96	1.26	-1.32	1.64
	11	CG2307	-1.62	0.58	0.76	-0.07	2.41
	12	CG2308	5.09	3.75	2.43	-4.93	1.74
	13	CG2309	1.63	-0.93	1.08	-1.58	0.36
	14	CG1044	1.76	1.20	1.71	-2.86	0.88
	15	CG1045	0.47	0.77	1.09	-1.26	1.09
	16	CG1050	-0.84	2.49	0.64	-0.48	1.04
	17	GW-322 ©	1.63	-1.37	0.12	0.00	0.40
LS	18	CG2311	11.11	-1.03	0.73	-0.69	0.89
	19	CG2312	-4.96	1.49	1.74	-2.79	1.11
	20	CG2313	8.98	-0.46	1.62	-3.06	0.04
	21	CG2314	-1.20	-0.43	1.10	-1.50	0.62
	22	CG2315	-8.03	2.53	1.71	-1.95	2.41
	23	CG1061	4.22	1.04	1.19	-1.09	1.84
	24	CG1029 ©	0.76	2.31	0.93	-1.30	0.32
	25	Chhattisgarh genhu-4 ©	0.43	3.02	0.97	-0.41	2.37

Conclusion

Highly drought tolerant genotypes identified in present investigation for two or more characters combination are. CG2301 for grains per spike, grain yield (qt/ha.), biological yield (qt/ha.) and harvest index (%). CG2313, CG2302 and CG2309 for grains per spike and harvest index (%) Most significant findings of present study. Considering two abiotic tolerance together, only CG2301 is characterised as highly drought tolerant genotype identified in present investigation. This genotype is nominated as CG1055 in national initial variety trial for restricted irrigation conditions of central and peninsular zone.

References

- Anonymous. AICRP on Wheat and Barley, Progress Report. Crop Improvement; 2022-2023.
- Anonymous. Ministry of Agriculture and Farmers Welfare, Government of India; 2022-2023.
- Bennett D, Reynolds M, Mullan D, Izanloo A, Kuchel H, Langridge P, *et al.* Detection of two major grain yield QTL in bread wheat (*Triticum aestivum* L.) under heat, drought, and high yield potential environments. Theoretical and Applied Genetics. 2012;125(7):1473-1485.
- Blum A, Mayer J, Golan G. The effect of grain number per ear (sink size) on source activity and its water-relations in wheat. Journal of Experimental Botany. 1988;39(1):106-114.
- Boyer JS. Plant productivity and environment. Science. 1982;218(4571):443-448.
- Mei XR, Zhong XL, Vadez V, Liu XY. Improving water use efficiency of wheat crop varieties in the North China Plain. Journal of Integrative Agriculture. 2013;12(7):1243-1250.
- Tuberosa R. Phenotyping for drought tolerance of crops in the genomics era. Frontiers in Physiology. 2012;3:347.
- Wania SH, Kumar V, Shriram V, Sah SK. Phytohormones and their metabolic engineering for abiotic stress tolerance in crop plants. The Crop Journal. 2016;4(3):162-176.
- Fischer RA, Maurer R. Drought resistance in spring wheat cultivar: I- Grain yield response. Aust. J. Agric. Res. 1978;29:897-912.