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Evaluation of biochemical traits of advanced wheat (*Triticum aestivum* L.) lines under restricted irrigation

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Abstract
An experiment was conducted in RBD design with three replication at Wheat improvement Project, Seed Breeding Farm, JNKVV, Jabalpur. The nineteen (19) genotypes showed marked variability in biochemical estimation. It was also concluded that restricted irrigated condition had an additive influence on biochemical estimations. Among genotypes G7, G3, G16, G17 and G18 showed promising seed yield and its attributes under restricted irrigated conditions. The high potassium and phosphorus content in G15 showed the good indicators for the heat tolerance capacity of these genotypes which can be further utilized for the development of temperature tolerant wheat varieties for restricted irrigation condition. G7 had maximum proline content, so it is suitable for drought conditions.

Keywords: Wheat, Variation, Drought, Biochemical traits

Introduction
Bread Wheat (*Triticum aestivum* L.) is an important agricultural crop, as it is able to adapt to a wide range of ecological conditions. Wheat is the world's second most important staple food crop for more than 35 percent of world's population next to the rice. In India, Madhya Pradesh is the third largest wheat producing state with 17.47 Million tons of production from 5.40 Mha of area with 2976 kg/ha of productivity (Anonymous 2014). Wheat is nutritionally valuable for human and animals containing 15.4 g of protein, 1.8 g of total fat, 67 g of carbohydrate, 12.2 g of dietary fiber and 3.6 mg of iron per 100 g. Restricted irrigation adversely affects yield performance of cereals. Restricted water availability and yield reductions derived from climate changes which have become a strong concern as regards fundamental crops i.e., wheat. In wheat breeding programmes, drought tolerance in plants increases improved yield. Plant drought tolerance is a highly complex trait that involves physiological and biochemical mechanisms (Erdei *et al.*, 2002) [4].

Material and methods
In the present investigation, 19 wheat varieties were used to estimate biochemical estimations under restricted irrigated condition. The experiment was conducted at Seed Breeding Farm, Department of Plant Breeding and Genetics, JNKVV, Jabalpur (MP) under Wheat Improvement Project in randomized complete block design with three replication. Free proline content in leaves was determined following the standred method of (Bates *et al*., 1973) [3]. The nitrogen content of seeds was estimated by Palican Equipment Kel-Plus which is based on the Microkjedhal digestion and distillation methods as given by (AOAC, 1980) [2]. The carbohydrates content in seed was estimated by "Anthrone Method" described by Hedge and Hofreiter, (1962) [5]. Estimation of fibre content (%) in seed followed by Sadasivam and Manickam (1992) [12]. The fat content in the seed was estimated by pelican equipment socs plus based on principle of soxhlets extraction method as described in AOAC (1980) [2]. The ash content in the sample was estimated according to AOAC method (1980) [2]. The protein percent in the sample was estimated multiplying nitrogen percent of sample by factor 6.25. For determination of phosphorus content, the ground grain and plant samples were digested with ternary acid mixture having nitrate, per colic and sulphuric acid in 10:4:1 ratio and was determined by vanadomolybdo phosphoric yellow colour method (Jackson, 1973) [6]. Potassium

Content in plant samples with ternary acid were determined separately by using flam photometer (Jackson, 1973) [6].

Result and discussion

Maximum Proline was estimated in G7 (MP3372/NAW1395) (30.46%) and minimum was estimated in G5 (MP3349/MP3269) (7.86%) as compared to all other varieties. Results of the current investigations are colaborated by the findings in *B. napus* by Nosrati *et al*. (2014) [9]. The highest protein content was obtained in G12 (401-136/JW17-2) (11.38%) while lowest content was estimated in G7 (MP3372/NAW1395) (8.13%). Our results are supported by the findings of Tohidi *et al*. (2011) [13] in *B. napus* where protein content decreased under water stress. The highest carbohydrates content was estimated in G14 (MP3324/MP403-2) (71.11%) while lowest value for the same was estimated in G10 (401- 136/ JW17-1) (67.23 %). An increased carbohydrate contents found in wheat (Naureen and Naqvi, 2010), while others have found to be reduced or remained constant (Morgan, 1992) during stress conditions. Maximum fiber content was estimated in G16 (PBW343/CDWR-9563-3) (1.54%) and minimum was estimated in G7 (MP3372/NAW1395) (1.31%). The highest fat content was estimated in G14 (MP3324/MP403-2) (1.41%) and lowest value was estimated in G6 (MP3368/MP4669) (1.23%) A wide range of fat content in wheat has been reported earlier ranging from 2.93 to 1.74, 1.2 and 1.35% (Rehman *et al*., 2007) [11]. Maximum ash was estimated in G10 (401- 136/ JW17-1) (1.71%) followed by G6 (MP3368/MP4669) (1.67%) minimum was estimated in G5 (MP3349/MP3269) (1.43%) as compared to all other varieties. Ash content in different wheat varieties under normal irrigation conditions was 0.80% (Rehman *et al*., 2007) [11].

The highest N content was noted in G12 (401-136/JW17-2) (1.82%) while lowest N content was noted in genotype by G7 (MP3324/MP-3319) (1.30%) as compared to all other varieties. The highest P content was found in G15 (PBW343/CDWR-9563-3) (0.80%) and lowest P content was noted in G14 (MP3324/MP403-2) (0.53%). Maximum potassium content was estimated in G15 (PBW343/CDWR-9563-3) (0.49%) and minimum was estimated in G9 (MP3336(C)) (0.31%) as compared to all other varieties. Similar results were also reported by Pampana *et al*. (2007) [10] while working with wheat genotypes to see the effect of genotype and environment on nitrogen, phosphorus and potassium content.

Table 1: Variations in biochemical parameters estimations of wheat under restricted irrigation condition

Genotypes		Proline (%)	Protein (%)	Carbohydrate (%)	Fiber (%)	Fat (%)	Ash (%)	Nitrogen (%)	Phosphorus (%)	Potassium (%)
G1	PBW343/CDWR9563-4	14.21	8.56	69.11	1.44	1.36	1.52	1.37	0.77	0.42
G2	GW173/MP-2498	26.59	8.97	67.94	1.36	1.26	1.46	1.44	0.66	0.33
G3	MP3324/MP-3319	8.80	11.16	69.27	1.37	1.25	1.46	1.78	0.80	0.45
G4	GW366(C)	12.37	9.34	67.42	1.50	1.35	1.64	1.50	0.60	0.50
G5	MP3349/MP3269	7.86	10.19	68.03	1.53	1.40	1.43	1.63	0.73	0.38
G6	MP3368/MP4669	8.72	9.03	70.31	1.32	1.23	1.67	1.45	0.69	0.41
G7	MP3372/NAW1395	30.46	8.13	67.83	1.31	1.29	1.60	1.30	0.77	0.48
G8	PBW343/CDWR9563-7	26.09	10.94	68.77	1.50	1.32	1.44	1.75	0.55	0.40
G9	MP3336(C)	30.55	10.41	68.13	1.47	1.37	1.53	1.67	0.77	0.31
G10	401- 136/ JW17-1	22.53	9.44	67.23	1.43	1.34	1.71	1.51	0.73	0.36
G11	PBW343/CDWR9563-6	16.86	11.16	68.15	1.37	1.28	1.66	1.79	0.59	0.48
G12	401-136/JW17-2	28.31	11.38	68.78	1.46	1.26	1.58	1.82	0.72	0.46
G13	HD2864(C)	16.34	8.63	68.91	1.43	1.32	1.44	1.38	0.67	0.35
G14	MP3324/MP403-2	23.75	10.84	71.11	1.37	1.41	1.51	1.74	0.53	0.41
G15	PBW343/CDWR-9563-3	18.28	9.00	68.39	1.35	1.35	1.54	1.44	0.80	0.49
G16	JW3288(C)	12.91	10.22	69.01	1.54	1.40	1.64	1.64	0.69	0.39
G17	MP3046/RAJ3777	23.52	10.78	67.71	1.51	1.30	1.48	1.73	0.64	0.34
G18	PBW343/CDWR9563-1	27.42	10.88	69.06	1.37	1.37	1.65	1.74	0.77	0.42
G19	PBW343/K9924	10.63	10.41	70.22	1.49	1.32	1.54	1.67	0.64	0.47
	Mean	19.27	9.97	68.70	1.42	1.32	1.55	1.60	0.69	0.41
	SEm±	1.223	0.103	0.518	0.013	0.009	0.007	0.017	0.010	0.016
	CD at 5%	3.633	0.307	1.538	0.039	0.028	0.021	0.049	0.031	0.047

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