Screening of Wheat Genotypes for Morphological, Physiological and Phenological Traits Under Climatic Condition

A. L. Siyal, A. G. Chang, N. Shaikh, J. K. Sootaher, T. Jatt, F. K. Siyal, and M. S. Chang

ABSTRACT

Climate change is a major threat to most of crops grown globally in subtropics and tropics. One of the consequences of climate change is drought, which has a negative effect on crop growth and productivity. However, present research drought affected breed wheat was tested to examine the quality of wheat selection for different stage using morphological and phenological traits. Ten genotypes along with two local check varieties were tested in randomize complete block design were used for this experiment. The experiment was conducted in the field of Southern Wheat Research Station, Agriculture Research Institute, Tandojam, in winter season to determine the different levels of tillers per plant, growth vigor, early growth habit, plant type, Leaf type, content of proline in (μ mol. g⁻¹ fresh wt), osmotic potential in (-Mpa) and relative water content in (%) analyzed for significance. The genotypes showed positive significantly differ in response to studied traits. Ten genotypes were sown in three replications, in two blocks. The genotypes were significantly different in response to the moisture stress. There were highly significant differences for all traits. The positive association for studied the parameters between the field trials demonstrated that greater seedling vigor of root and shoot is key factor influencing in wheat. Therefore, our finding suggested that these genotypes had potential to grow well and perform better than other genotypes and check varieties.

Keywords: Evaluation, Early growth, Moisture stress, Osmotic potential, Relative water content.

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I. INTRODUCTION

Wheat (*Triticum aestivum* L.) is grown in more than 85 countries with approximately 2.1 million total hand-picked area, and it subsidizes about 20% of the world's dietary calories and protein subsidies [1]. In arid areas, there is a severe shortage of water resources, where annual transportation is less than 1500 mm and rainfall are less than 200 mm [2]. Abiotic stresses curtailing wheat production, climatic conditions (biotic and Abiotic) factors have the most detrimental effects in rain-fed environments [3]. Its status is imperative among cereal crops, as of its nutritional value and highly consumption. The rapid increasing population and better lifestyle reduce new challenges for wheat scientists to

breed new varieties with improved yield, quality, and resistance in contradiction of biotic and abiotic stresses [4]. It is used as a staple food for half of the world's populace, consequently considered as a strategic crop [5]. The global warming and climate change are changing the weather's pattern worldwide. These climatic conditions and hot weather generally affect not only the total amount of rainfall in a particular season, but also the frequency, duration, and harshness of water stress in the crops at different growth stages [6].

In wheat development programs, testing and identification of lines is the first and important step in crop improvement from the introduction of improved plant material. The promise of the genotypes for commercial production can be

reliably brought about by high productivity, good adaptation and agricultural characteristics required. Nevertheless, an effective and high hybridization programs in the place, and maintains a promise for the success of such hybridization programs, evaluating important bacterial variations and current germ pod pattern [7]. The wheat breeders are focusing on the improvement for yield potential of wheat crop by evolving new cultivars having promising genetic composition in order to cope with the consumption pressure of ever-increasing world population [8]. Another strategy, Identification of genomic regions linkage with breeder's interest's traits, including yield of the grain under minimal water can help breeders and scientists in different ways. These improve the enhancement of breeding germplasm pools with significant and positive alleles as well as direct introgression through the selection of the marker assisted parameters.

Hence, wheat breeders strive to gain a comprehensive information on the extent and genetic basis of the variability regarding vital parameters in wheat genotypes. Thus, present studies were designed to determine performance of wheat morphophysiological attributes to obtain the information on the nature and magnitude of genetic components of variation controlling the expression of yield and its components attributes in hexaploid wheat.

II. MATERIALS AND METHODS

Current research was conducted to examine mean performance of early growth characterization of ten inbreed lines along with two local check varieties of bread wheat (*Triticum aestivum* L.) genotypes. Ten genotypes along with two local check varieties were used for this experiment, sown in Randomized Complete Block Design. These genotypes are of different in characters from each other. Each replicate is randomized separately. Each treatment has the same probability of being assigned to a given experimental unit within a replicate. Each treatment must appear at least once per replicate. A field trial was conducted in the growing seasons, to determine the mean performance on early stage of wheat genotypes at Southern Wheat Research Station, Agriculture Research Institute, Tandojam. The experiment was laid out under split plot design with three replications arranged in a plot of size 3×1.2 m (3.6 m²) having four rows each of three meter long.

A. Statistical Analysis

For the research experimental the ANOVA was used to evaluate the mean performance of wheat genotypes on early growth stages of wheat genotypes. The collected data were subjected to the statistical analysis of variance according to the statistical methods developed by Gomez and Gomez [9], DMRT (Duncan's Multiple Range Test) was calculated for the comparison of means according to Duncan [10].

III. RESULTS

Data recorded on various early growth components were analyzed statistically and mean squares obtained from examination of variance.

A. Analysis of Variance

Reasonable differences for morphological and phenological traits. Tillers per plant, growth vigor, early growth habit, plant type, Leaf type, content of proline in $\mu\text{mol. g}^{-1}$ fresh wt), osmotic potential in (-Mpa) and relative water content in (%) performed significantly different for studied traits. It indicated a large amount of genetic variability present in genotypes wheat which could be put into practice for the upcoming breeding programmes for the improvement and development and of wheat genotypes.

B. Tillers Plant⁻¹

The overall mean for tillers plant⁻¹ of all wheat genotypes showed significant differences ($P<0.05$). Highly significant differences ($P<0.05$) for the trait tillers plant⁻¹ were recorded in wheat genotypes at (Table III, Fig. 1). Highly significant differences ranged from 20.6 in V12 to 28 in V4.

C. Early Growth Vigour

The overall mean for early growth vigour of all wheat genotypes showed significant differences ($P<0.001$). V12 (38.26 cm) showed significant increase in early growth vigour as compared to V7 (30.66 cm). Highly significant differences ($P<0.05$) for the trait early growth vigour were recorded in all wheat genotypes (Table III, Fig. 1).

D. Early Ground Cover

The overall mean for early ground cover of wheat genotypes showed significant differences ($P<0.05$). V12 (6.33) showed significant increase in early ground cover as compared to V7 (3.85) which indicated significant decrease (Table III, Fig. 2).

E. Proline Content

The overall mean for the proline content in wheat genotypes observed that all the genotypes contained accretion and exhibited proline in the leaf. V12 (10.2) showed significant increase in Proline content as compared to V2 (3.72). Highly significant differences ($P<0.05$) for the trait proline content were recorded in all wheat genotypes (Table III, Fig. 2).

F. Osmotic Potential

The overall mean for the Osmotic potential in wheat genotypes observed that all the genotypes contained accretion and exhibited osmotic potential in the leaf. V9 (0.801) showed significant increase in osmotic potential as compared to V7 (0.55). Highly significant differences ($P<0.05$) for the trait osmotic potential were recorded in all wheat genotypes (Table III, Fig. 2).

G. Relative Water Content

The overall mean for the relative water content in wheat genotypes observed that all the genotypes contained accretion and exhibited osmotic potential in the leaf. V8 (84.5) showed significant increase in osmotic potential as compared to V12 (73.77). Highly significant differences ($P<0.05$) for the trait relative water content were recorded in all wheat genotypes (Table III, Fig. 1).

Fig. 1. Comparative mean performance of tillers plant⁻¹, early growth vigour and relative water content of wheat genotypes.

Fig. 2. Comparative mean performance of osmotic potential, early ground cover and proline content of wheat genotypes.

TABLE I: MEAN SQUARES FROM ANOVA OF DIFFERENT TRAITS OF WHEAT

Source of variation	D.F.	Mean Squares (M.S)						
		No. T	E. G. V	E. G. C	P. T	L.T	Proline	O. P
Replications	2	1.64	14.77	0.58	7.57	5.87	71.2	9543.94
Genotypes	11	3.64**	9.62**	1.90**	12.50**	9.75*	30276.60**	9252.07**
Error	22	1.30	16.20	1.67	10.50	12.25	9	9552.7
Total	35	--	--	--	--	--	--	--

* Significant at 0.05 level of probability, ** significant at 0.01 level of probability.

TABLE II: MEAN PERFORMANCE FOR PLANT TYPE AND LEAF TYPE IN TWO BLOCKS

S. No.	Block 1		Block 2	
	Plant type	Leaf type	Plant type	Leaf type
01	S. Prostrate	Broad Leaf	Prostrate	Broad Leaf
02	S. Erect	Narrow Leaf	Erect	Narrow Leaf
03	Prostrate	Broad Leaf	Erect	Narrow Leaf
04	S. Prostrate	Broad Leaf	Erect	Narrow Leaf
05	Erect	Narrow Leaf	S. Prostrate	Broad Leaf

TABLE III: MEAN PERFORMANCE OF DIFFERENT TRAITS OF WHEAT GENOTYPES

Genotypes	Tillers/plant	Early Growth Vigour	Early Growth Cover	Proline Content	Osmotic Potential	Relative Water Content
1	26.2	33.13	5.66	8.41	0.537	81.14
2	25.8	32.4	4.33	8.44	0.587	76.95
3	26.6	33.2	4.33	3.72	0.791	70.71
4	28	35.3	4.33	8.3	0.692	78.32
5	24.8	35.3	4.33	9.35	0.707	83.27
6	26	32.66	4.33	6.38	0.718	78.99
7	25	30.66	3.85	8.52	0.55	74.28
8	26.4	35.86	4.33	7.86	0.593	84.5
9	25.8	34.53	4.25	4.65	0.801	75.31
10	26	36.53	4.66	8.01	0.699	79.72
11	27.4	34.25	4.66	9.35	0.715	74.53
12	20.6	38.26	6.33	10.2	0.725	73.77

Fig. 3. Early growth vigour.

Fig. 4. Early seedling color.

IV. DISCUSSION

Trait improvements such as higher yields have remained important objectives of wheat breeders for many decades. For the improvement of any character, plant breeders mostly

count on the combining ability of parents determined by various mating designs [11]. Therefore, nowadays, the wheat varieties are improved through different conventional and nonconventional procedures by incorporating single or multiple traits into the wheat genome and expression of these

traits is also regulated for the wheat hybrid development [12]. Significant differences for morphological and phenological traits. All characters performed significantly different for studied traits. It indicated a large amount of genetic variability present in genotypes wheat which could be put into practice for the upcoming breeding programmes for the improvement and development and of wheat genotypes. Previous workers like [13] found the same results for such characters in wheat genotypes. Our results were also in agreement of Sootaher et al. [14] who worked on wheat. These results were also observed by [15], [6]. These results were also articulated by [17], [18], and suggested that the genotypes having genetic variability for different characters must be chosen for future breeding.

Highly significant and positive differences were revealed among accessions for all studied parameters, identify the dissimilarity in germplasm. Moderate variability of properties showed ropes that an achievable variability in performance compared to the genotype tested for the study, those with the best performance were considered on early growth characterization. The results indicated that ten genotypes along with two local check varieties produced significantly the highest tillers per plant, significant increase in early growth vigor, highly increase in early ground cover and semi-erect nature of growth habit whereas; all other genotypes showed the erect nature including two check varieties in early growth habit. The overall mean for tillers plant⁻¹ of all wheat genotypes showed significant decrease in tillers plant⁻¹. It was observed that all the cultivars contained accretion and exhibited proline in the leaf. Comparing the proline content among the cultivars, it was a great variation. In our research trail, the osmotic potential (-MPa) of wheat cultivars were extremely notable ($p \leq 0.05$). Escalating of water paucity in wheat cultivars were significantly affected on the leaf's osmotic potential. In terminal drought mean value of OP (1.20 -MPa) was superior. Variance analysis results revealed that relative water content (%) in the wheat cultivars become thoroughly significant ($p < 0.05$). The relative percentage of water contents become increased with terminal drought for all studied traits. Akbar et al. [19] also reported good results for this trait in wheat. Kalhor et al. [20] and Kumbhar et al. [21] who articulated the same results as the present results for determining number of tillers in a single plant and other different characters of wheat. Similar results were also found by [22]. On the other hand, Baloch et al. [23] and Kachi et al. [24] added that success in the enlargement of high yielding and widely adapted hybrids nevertheless is governed by good contribution of good genotypes for hybridization and selection programmes to develop breeding material with medium taller plant height for hybrid wheat development. Sharma and Jaiswal [25] also observed better results for such valuable characters of wheat. Such results had also been confirmed by Padhar et al. [26] and Hijam et al. [27] in his experiment working with the crop of wheat on different morphophysiological characters.

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