Research Article

Assessment of Yield Attributes of Durum Wheat (*Triticum Durum* L.) Genotypes under Irrigated Conditions

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Abstract

In present study, grains of 36 durum wheat genotypes from including four checks (two bread and two durum wheat) were evaluated for different yield attribute *viz.* number of grains per spike, grain weight per spike, number of spikelets per spike, grain yield per sq. meter, biomass per sq. meter, number of productive tillers per sq. meter and 1000-grain weight. Genotype UAS 448 was found to be superior in retaining maximum grain number per spike (79). Grain weight per spike was observed highest in PDW 337 (2.60 g) followed by PBND 1625 (1.95 g). Number of spikelets per spike was found maximum in PDW 337 (28) followed by UAS 448 (24). Biomass per sq. meter was observed highest in HD 4730 with a value of 1909.91 g/m^2. Genotype HD 4730 (641.31 g/m^2) had higher grain yield followed by PDW 337(639.5 g/m^2). Number of productive tillers was observed maximum in PDW 337 (504.11). 1000-grain weight was observed highest in PDW 337 (75.77 g) followed by PBND 1624 (73.70 g). The genotypes HD 4730, WHD 954 and PBND1625 showed better performance for most of the yield related traits and may be used in crossing programme in order to improve grain quality along with yield.

Keywords: Biomass, durum wheat, grains, genotypes, grain yield, productive tillers, quality, spikelets, yield attributes, yield

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Introduction

Wheat is nature's unique gift to mankind as it produces excellent source of nutrition in terms of carbohydrate, minerals and proteins. It is the most widely grown crop and an essential component of the global food security mosaic, providing one-fifth of the total calories of the world's population. It is the staple food for most of the countries in the world. At present in India, wheat is the second most important cereal crop after rice grown under diverse agro-climatic conditions and occupies around 29.90 million hectare area with a production of about 93.90 million tons [1]. Durum or macaroni wheat (*Triticum durum* L.) is a tetraploid species and is the second most important cultivated species of the genus *Triticum* and falls next to bread wheat (*Triticum aestivum* L.) in respect of area and production. It is cultivated about 10 to 11 per cent of the world wheat areas and accounting about 8 per cent of the total wheat production [2]. Quality is an important aspect of durum wheat and it demands specific quality traits as well as functionality. Knowledge of the genetic association between grain yield and its components can help the breeders to improve the efficiency of selection of superior genotypes. Wheat grain yield is the major end product of the interaction of a large number of physiological and biochemical processes occurring throughout the growing cycle. Grain yield is a complex multi component character and is greatly influenced by various environmental conditions [3]. It is a quantitative trait entailing several contributing factors and is an important tool in crop improvement [4]. Quality improvement has been a great challenge in wheat research. Constant efforts are being made all over the world to improve/combine quality with yield along with biotic and abiotic stresses so that the developed material could be released as a variety. Quality differences among wheat cultivars have gained even more importance in grain trading due to important global economic and social trends. The development of product specific varieties depends on the knowledge of quality requirements of different end use products and the genetic components controlling different quality traits. In current research study, thirty six durum wheat genotypes were used to evaluate the association for yield and its related traits and their uses for selection of superior genotypes of wheat.

Materials and Methods

The present study was conducted at Department of Chemistry and Biochemistry and Wheat Quality Laboratory of Wheat and Barley Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. The experimental material was comprised of thirty six durum wheat genotypes, which were planted in randomized complete block design with three replications. Plot size was 6×1.20 sq. meter. The data was recorded number of grains per spike, grains weight per spike (g), number of spikelets per spike, biomass per sq. meter (g/m^2), grain yield per sq. meter (g/m^2), number of productive tillers per sq. meter and 1000-grain weight (g). Ten plants were selected randomly from each treatment in each replication to record the data. All agronomic and cultural practices were carried out uniformly for all genotypes throughout cropping season.

Statistical Analysis

The experimental data were analyzed using analysis of variance for the complete randomized design (CRD) where each observation was replicated thrice. To compare the treatments, critical difference (P= 0.05) was calculated. The correlation coefficient was calculated according to the formula suggested by Pearson.

Results and Discussion

Grain yield of a crop depends on the source-sink relationship, which is the cumulative function of various growth parameters and yield components. Enhancement of grain yield in most cases is effectively fulfilled on the basis of performance of yield components which are in turn closely associated with grain yield [5]. The number of grains per spike is an important yield formation factor and has a direct contribution towards the final grain yield [6]. Further, this trait was known to be positively correlated with yield and yield components [7] hence the number of grains per spike were estimated among different genotypes and found to be ranged from 30-79 (**Figure 1**) with an overall mean value of 56. UAS 448 (79) was found to be superior in retaining maximum grain number per spike followed by PBND 1625 (73.0) and minimum value was observed in RKD 255 (30.0). Similar results had also been reported by [8] where the number of grains per spike ranged from 28.0-51.0 in bread wheat. Grain weight is the best single index of potential semolina yield and should be considered an important factor in assessing durum wheat quality. Grain weight is a major component contributing to yield variation [9]. The genotypes possessing higher grain weight would present better potential for grinding and flour extraction, hence wide variation in grain weight could be used for improvement of traits for creation of genotypes with maximum flour outputs [10]. In the present study, grain weight of various genotypes ranged from 0.74-2.60 g (**Figure 2**) with an overall mean value of 1.25 g. Highest grain weight per spike was observed in PDW 337 (2.60 g) followed by PBND 1625 (1.95 g) and lowest was observed in HD 4729 (0.74 g).

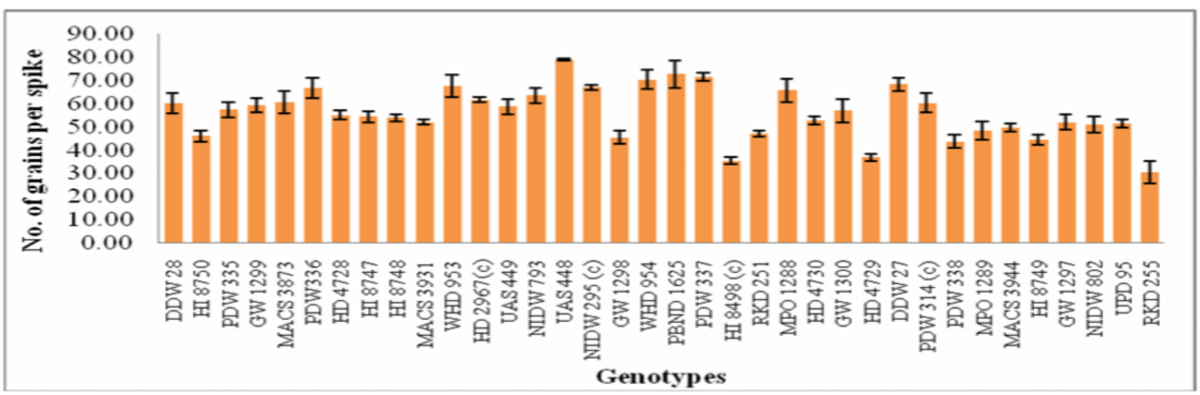

Figure 1 No. of grains per spike in durum wheat genotypes, C.D. at 5 per cent = 9.144

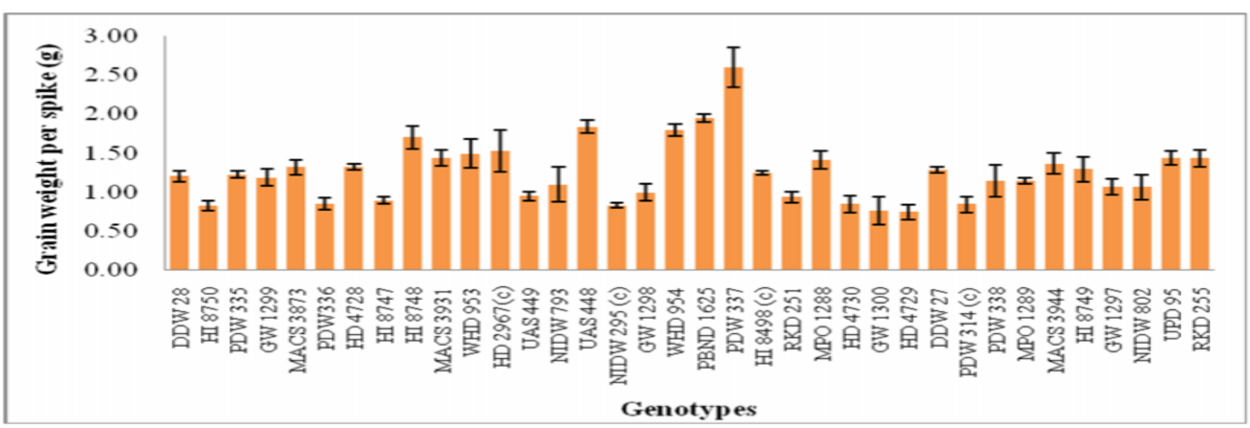

Figure 2 Grain weight per spike (g) in durum wheat genotypes, C.D. at 5 per cent = 0.348

Consequently another factor that contributes to final yield is 'number of spikelets per spike' [11, 12] hence their values were also estimated and found to be ranged from 17-28 with an overall mean value of 20.0. **Figure 3** depicts number of spikelets per spike in durum wheat genotypes. The superior genotypes found for this trait were PDW 337 (28) followed by UAS 448 (24) and RKD 255 (17) retained minimum number of spikelets per spike.

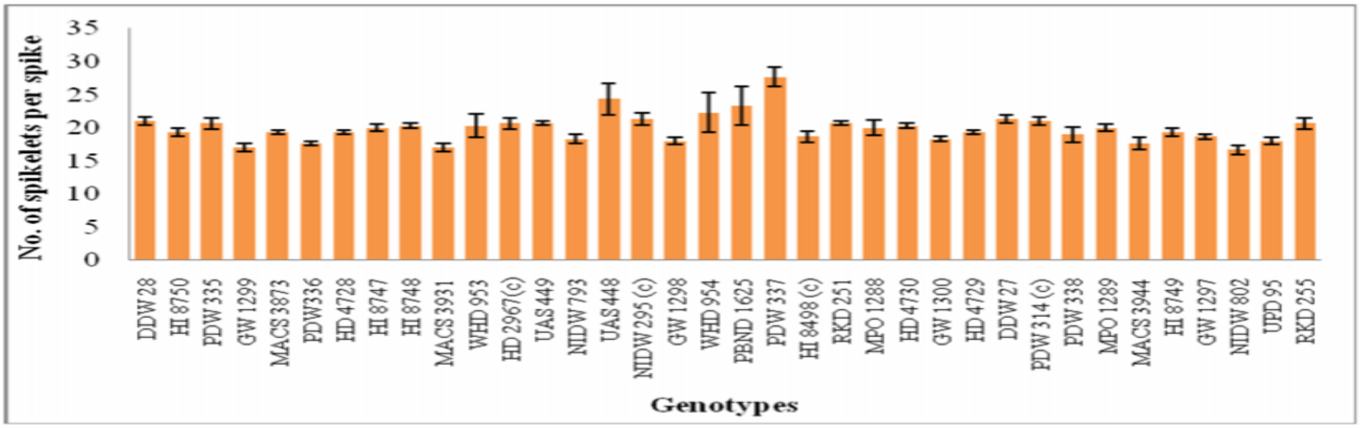

Figure 3 No. of spikelets per spike in durum wheat genotypes, C.D. at 5 per cent = 3.023

A product of an organized interplay for its components which is highly susceptible to environmental fluctuations is biomass and grain yield [13]. Therefore, both biomass and grain yield were estimated among various genotypes and found to be ranged from 111.34- 1909.91 g/m^2 and 430.56-649.31 g/m^2 (**Figures 4** and **5**) respectively. Highest value of biomass was recorded in HD 4730 (1909.91 g/m^2) followed by PDW 337 (1736.11 g/m^2) and lowest was recorded in MPO 1288 (1134.94 g/m^2). Figure 5 depicts number of grain yield per sq. meter in durum wheat genotypes. It ranged from 649.31 to 430.56 g/m^2 with an overall mean value of 516.09 g/m^2. HD 4730 (649.31 g/m^2) had highest grain yield per sq. meter followed by PDW 337 (639.5 g/m^2) while the genotype DDW 28 (430.56 g/m^2) had lowest grain yield.

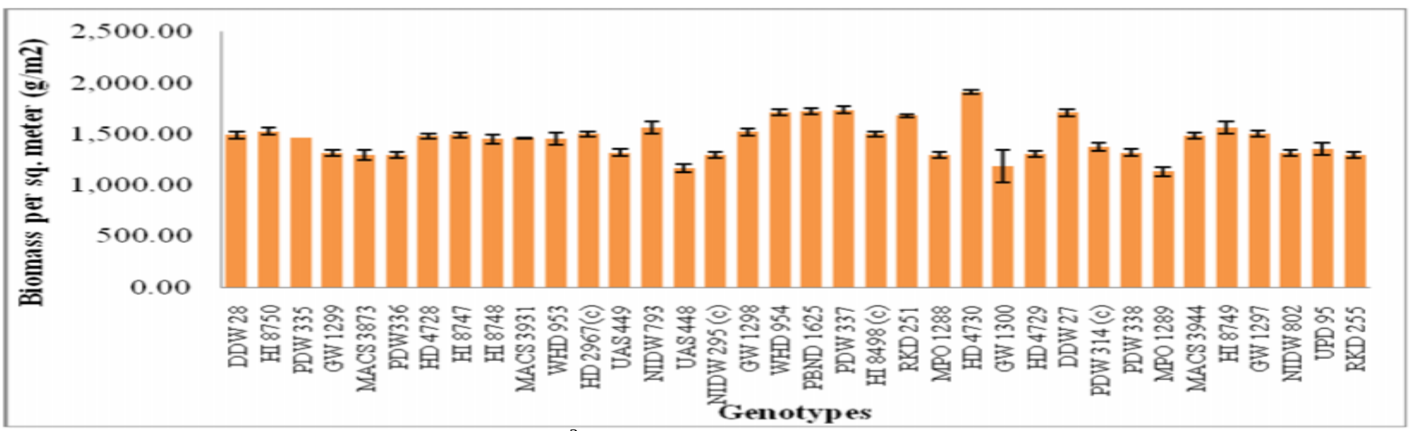

Figure 4 Biomass per sq. meter (g/m^2) in durum wheat genotypes, C.D. at 5 per cent = 124.624

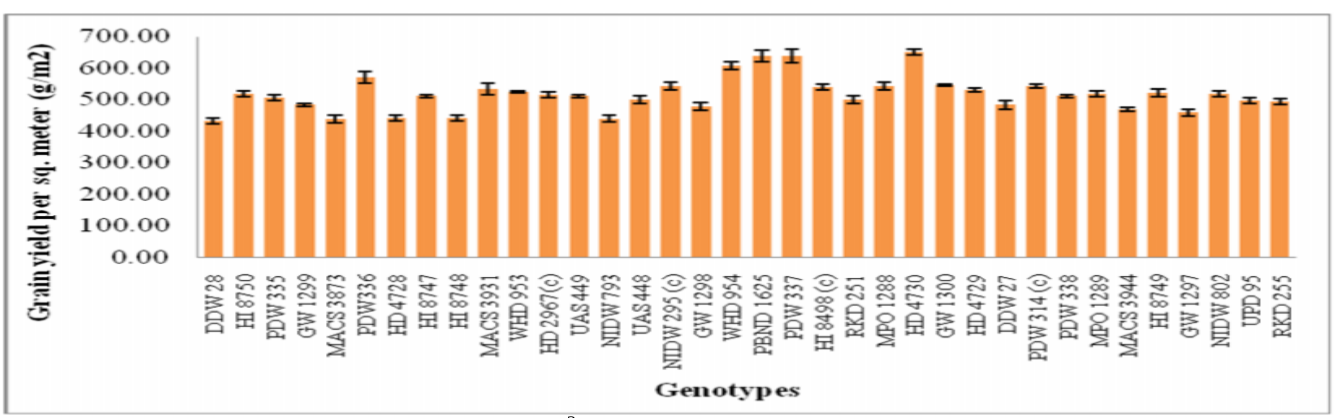

Figure 5 Grain yield per sq. meter (g/m^2) in durum wheat genotypes, C.D. at 5 per cent = 31.056

The number of fertile tillers is another important factor due to their direct contribution to final yield. [6, 14]. **Figure 6** depicts number of productive tillers per sq. meter in durum wheat genotypes. It ranged from 264.10 to 504.11 with an overall mean value of 373.68. The genotypes showed highest value of productive tillers were PDW 337 (504.11) followed by PBND 1625 (492.99) while lowest was in DDW 28 (264.10). A useful tool for the assessment of potential milling yield is 1000- kernel weight. A higher milling yield can be expected with large sized kernels where the ratio of endosperm to bran is more. **Figure 7** depicts number of 1000-grain weight in durum wheat genotypes. It ranged from 45.0 to 75.77 g with an overall mean value of 57.90 g. 1000-grain weight was found maximum in PDW 337 (75.77 g) followed by PBND 1625 (73.70 g) and minimum was in DDW 28 (45.0 g). [15] studied 13 wheat varieties for physical characteristics and observed that 1000-kernel weight ranged from 40.3 to 53.2 g, grain hardness ranged from 9.36 to 13.25 kg/grain. The grain colour varied from light yellow to light golden yellow. [16] indicated that the lower kernel weight was associated with increased number of kernels per meter square. It is not only due to a lower amount of assimilates per kernel, but it is the result of an increased number of kernels with a lower weight potential coming from more distal florets. Sharma (2000) [17] evaluated four wheat varieties namely WH 542, Sonak, WH 553 and UP 2338 and reported that 1000-grain weight and grain hardness of wheat ranged from 33.0 to 41.8 g and 8.5 to 10.7 kg/grain, respectively. Test weight and thousand kernel weight are among the most imperative parameter in determining the physical characteristics of wheat [18, 19]. [20] reported that 1000-grain weight of wheat ranges from 31.90 to 53.03 g and grain hardness from 9.36 to 13.9 kg/grain.

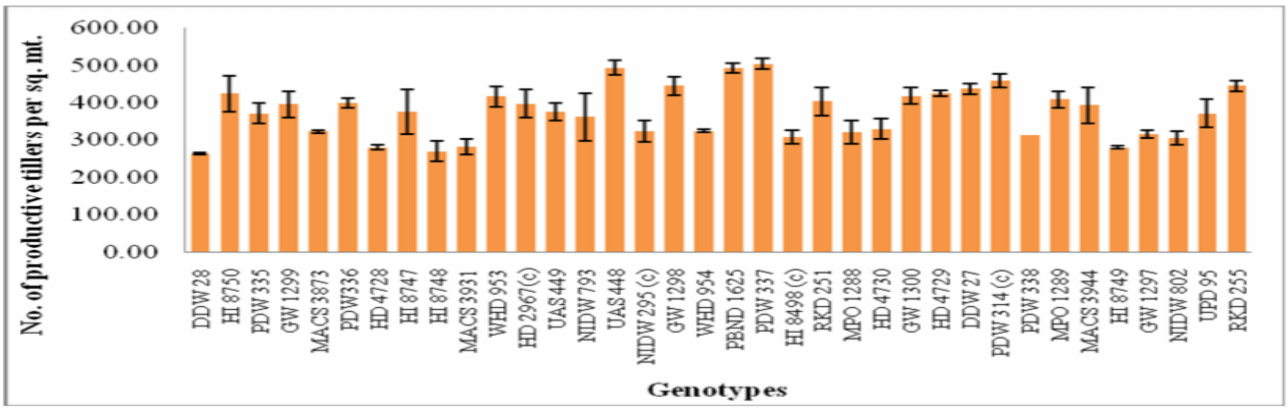

Figure 6 No. of productive tillers per sq. meter in durum wheat genotypes, C.D. at 5 per cent = 28.190

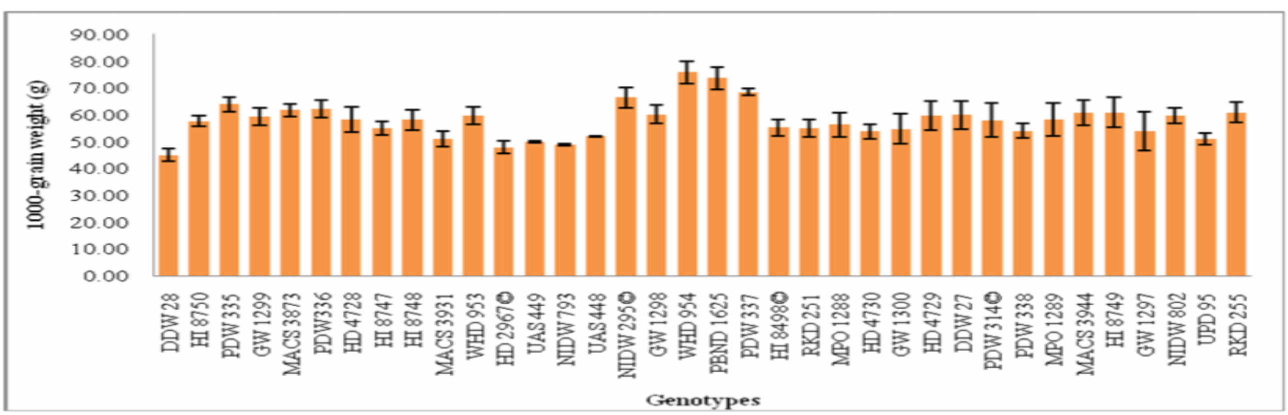

Figure 7 1000-grain weight (g) in durum wheat genotypes, C.D. at 5 per cent = 10.804

Abinasa et al (2010) [21] studied the genetic variability, heritability and trait associations in durum wheat (*Triticum turgidum* L. var. *durum*) genotypes and observed considerable variations for all agronomically important traits which give an opportunity to plant breeders for the improvement of these traits. [22] studied the correlation between different yield attributes and found that significant and positive correlation among different yield traits was present. [23] studied the role of genotype, environment and genotype-by-environment interactions in determining the metabolite profile of durum wheat grain. Four durum wheat cultivars were grown under conventional and organic farming system over three consecutive years. Statistical analysis of the data showed a small impact of genotype and large effects of both year and genotype-by-environment interaction on the metabolic composition and quality of the grains. Overall the data from this study highlight the potential role of metabolic profiling in the analysis of durum wheat quality and production.

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