# PERFORMANCE OF WHEAT GENOTYPES AT AEZ 28

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**PERFORMANCE OF WHEAT GENOTYPES AT AEZ 28**

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**CERTIFICATE**

This is to certify that the thesis entitled, "Performance of some wheat genotypes at AEZ 28 submitted to the Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **MASTER OF SCIENC**E in **AGRONOM**Y embodies the result of a piece of bonafide research work carried out by **Foysal Ahmed, Registration No. 05-1742** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by him.

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Dated:
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**Dedicated to**

**My**

**Beloved Parents**

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***The Author***

**PERFORMANCE OF WHEAT GENOTYPES AT AEZ 28**

**Abstract**

The experiment was conducted at the Agronomy field, Sher-e-Bangla Agricultural University (SAU), Dhaka, during the period from November 2010 to March 2011 to study the “Performance of some wheat genotypes at AEZ 28”. The experiment consisted of 15 treatments (genotypes of wheat). The experiment was laid out in a Randomized Complete Block design with 3 replications. The 15 genotypes of wheat were BAW1059; BAW1064; CVD5 (BAW1111); CVD6 (BAW1114); AYT5 (BAW1135); AYT7 (BAW1137); AYT9 (BAW1139); AYT10 (BAW1140); AYT11 (BAW1141); BL3503; Bijoy; Prodip; Sourav; Shatabdi and Sufi. Manures and fertilizers were applied at recommended doses of wheat. Results showed that the highest plant height (103.40 cm) and maximum number of tillers plant$^{-1}$ (9.00) were obtained with AYT9, BAW1139 and Sourav at harvest respectively. The highest dry weight plant$^{-1}$ (35.72 g), number of spike plant$^{-1}$ (9.04), spike length (17.68 cm), number of spikelet spike$^{-1}$ (19.91) and number of grains spike$^{-1}$ (56.83), 1000- grain weight (46.49 g), grain yield (4.29 t ha$^{-1}$), stover yield (6.64 t ha$^{-1}$) and biological yield (10.90 t ha$^{-1}$) were obtained from Shatabdi. But the highest harvest index (43.64) was observed in BL3503.

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# LIST OF ABBRIVIATIONS

| | | |
|---|---|---|
| BARI | = | Bangladesh Agricultural Research Institute |
| cm | = | Centimeter |
| $^0C$ | = | Degree Centigrade |
| DAS | = | Days after sowing |
| *et al.* | = | and others *(at elli)* |
| Kg | = | Kilogram |
| t $ha^{-1}$ | = | Tone per hectare |
| g | = | gram (s) |
| LSD | = | Least Significant Difference |
| MP | = | Muriate of Potash |
| m | = | Meter |
| $P^H$ | = | Hydrogen ion conc. |
| RCBD | = | Randomized Complete Block Design |
| TSP | = | Triple Super Phosphate |
| t/ha | = | ton/hectare |
| WRC | = | Wheat Research Center |
| % | = | Percent |

# Chapter 1

# INTRODUCTION

Wheat (*Triticum aestivum*) is one of the major leading cereals in the world, which ranks first in terms of acreage and production. About one third of the world's population lives on wheat grain for their subsistence (Hanson *et al*., 1982). It is the second important cereal crop in Bangladesh after rice and from nutritional point of view, wheat is preferable to rice for its higher protein content. Wheat covered 0.40 million hectare having a total production of 1.00 million tons of grain in 2009-2010 (BBS, 2010).

The average yield of wheat in Bangladesh is 1.9 t $ha^{-1}$, which is very low in compared to other wheat growing countries like the Netherland, UK, France and Norway where average yield is 7.1, 5.9, 5.6 and 4.1 t $ha^{-1}$ respectively (FAO, 1987). The low yield of wheat in Bangladesh may be attributed to number of reasons like cultivation practices, poor knowledge about spacing, lack of improved varieties, improper fertilizer application, seed rate, water management, cultural method, time of sowing etc.

Increasing food production of the country in the next 20 years to much population growth is a big challenge in Bangladesh. It is more difficult because, land area devoted to agriculture will decline and better quality land and water resources will be divided to the other sector of national economy. In order to grow more food from marginal and good quality lands, the quality of natural resources like seed, water, varieties and fuel must be improved and sustained. Variety plays an important role in producing high yield of wheat because different varieties responded differently for their genotypic characters, input requirement, growth process and the prevailing environment during growing season.

Bangladesh is a highly populated country and its population density is increasing day by day. Scarcity of food has become a chronic problem of this country. To mitigate the food shortage, measures should be taken to increase total food production. So, the cereal crop production like wheat should be increased to meet the demand of the escalating population, where an individual requires 454 g cereal food (BARI, 2004). It is a future challenge for Bangladesh to better exploit the potential of the production of wheat crop to meet the country's grain food requirement without endangering the environment.

The wheat yield in this country is low (2.16 t $ha^{-1}$). There are several reasons that can explain the yield variation, which cover both biotic and abiotic factors. Among the biotic factors, unavailability of high yielding varieties (Rerkasem *et al.,* 1993), incidence of diseases and pests (Hossain *et al.,* 1995) and abiotic factors such as high temperature (Orakwue, 1984), moisture stress (Bingham, 1966) and nutrient deficiency (Rerkasem *et al.,* 1991, Jahiruddin *et al.,* 1992) are responsible for lower productivity of wheat in the tropics and sub-tropics.

According to the researchers, variety is an important factor affecting farmers' yields and is also among the factors given the highest priority for immediate technology transfer. The speed with which new varieties are released and diffused to the farming population is an important factor influencing the benefits realized from plant breeding. Diffusion of new varieties ensures continuing increase in productivity through the increased yield potential of new varieties; it reduces the time lapse from the investment in research to the time the benefits are realized, thereby increasing the returns to research; and it helps to maintain genetic resistance to diseases and pests (Heisey, 1990).

The increasing intensity of land use has resulted in a marked exhaustion of nutrient from soils. With the improved variety of wheat and also proper nutrition in the soil yield can be maximized, because use of high yield variety make increased yield. Considering the reviews mentioned above the present experiment was undertaken to evaluate some wheat genotype in AEZ 28 with the following objectives:

**Objectives**

i. to compare the performance out the effect of 15 wheat genotypes, and
ii. to evaluate effective genotype for cultivation at AEZ 28.

## Chapter 2

## REVIEW OF LITERATURE

This chapter presents a comprehensive review of the works which have been done in Bangladesh and many other countries of the world with regards to the effect of different level of nitrogen application on different varieties of wheat. An emphasis has been given to the literature that has been published in the last two decades.

Maikstenience *et al.* (2006) carried out a field experiment at the Lithuanian Institute of Agriculrue's Joniskelis Experimental Station in 2004-2005 to estimate the changes in productivity and quality indicators of winter wheat (*Triticum aestivum*) varieties differing in genetic characteristics as affected by various nitrogen rates applied in the form of urea solution at different ripening stages of cereals. The tests involved the following winter wheat varieties: Ada and Bussard (with very good food qualities), Lars and Tauras (with good food qualities) and Seda (with satisfactory food qualities). In that experiment it was found that higher grain yield (11.0 t $ha^{-1}$) was produced by the varieties Lars, Tauras and Seda compared with Ada and Bussard.

Jalleta (2004) conducted an experiment in farmers' level with a number of improved bread wheat varieties for production in the different climatic zones. Farmers identified earliness, yield and quality as the main criteria for adaptation of wheat varieties and they also found that the variety HAR-710 gave 2.56 t $ha^{-1}$ and PAVON-76 gave 2.49 t $ha^{-1}$.

Sulewska (2004) carried out an experiment with 22 wheat genotypes for comparing vegetation period, plant height, number of stems and spikes, yield per spike and plant, resistance to powdery mildew and brown rust. He found a greater variability of plant and spike productively and of other morphological characters and he also reported that the variety Waggershauser Hohenh Weisser Kolben gave the highest economic value among the tested genotypes.

BARI (2003) tested performance of varieties of wheat and found Shatabdi produced the highest yield (2.72 t $ha^{-1}$) followed by Gourab (2.66 t $ha^{-1}$) and the lowest yield was produced by Kanchan (2.52 t $ha^{-1}$).

BARI (2003) conducted an experiment in Wheat Research Centre at Nashipur, Dinajpur, tested some varietal performance in Rajshahi and found that Shatabdi produced highest (3.2 t $ha^{-1}$) followed by Gourab (3.13 t $ha^{-1}$) and lowest yield produced by Kanchan (2.96 t $ha^{-1}$).

WRC (2003) conducted an experiment in Heat Tolerant Screening Nursery in Barisal region with 50 advance lines/varieties. From following by E50-(3.94 t $ha^{-1}$), BAW 1048 (3.85 t $ha^{-1}$, BAW 1021 3.64 t $ha^{-1}$), BAW 1024 (3.6 t $ha^{-1}$), E45 (3.58 t $ha^{-1}$). Among the varieties produced by BARI (WRC) Protiva produced highest yield (2.97 t $ha^{-1}$).

WRC (2003) conducted an experiment in the Wheat Research Centre Nashipur, Dinapur to see the performance of genotypes among various tillage operations and to understand the effects of interaction between genotypes and tillage operations. Two cultivation methods bed and conventionally tilled flat were in the main plot and 10 wheat genotypes (Kanchan, Gourab, Shatabdi, Shourav, BAW 1008, BAW 1006, BAW 1004, BAW 969, BAW 968 and BAW 96) were tested in sub plots. The genotypes showed a wide range of variation for yield and related characters. Under bed condition, all the genotypes significantly produced higher grain yield except Gourab and Shourav. Variety Shatabdi produced maximum grain $spike^{-1}$ and 1000-grain weight under both tillage operations. Among the varieties Shatabdi showed good stability for grain yields (5.40 t $ha^{-1}$ in bed 5.0 t $ha^{-1}$ in conventional methods).

Gwal *et al*. (1999) worked with four varieties of wheat sown in December at Sehore, Madhyha Pradesh, fertilized with 0-0-0, 60-30-30, 120-60-60 or 180-90-90 kg $N\text{-}P_2O_5\text{-}K_2O_5$ $ha^{-1}$, respectively. Averaged from the varieties, plant height, number of tillers $plant^{-1}$, spike length, grain protein content, grain yield and straw yield increased with NPK rate. Grain yield averaged 6.79, 9.98, 9.99 and 5.47 t $ha^{-1}$ in cv. Lok-1, HD-2236, WH-147 and Raj-1555 respectively.

Zhu-Guorong *et al.* (1999) conducted an experiment with 100 varieties of wheat in Zhejianf since 1954 and 27 of these have been grown over 34000 ha. Yields have increased greatly as a result of selective breeding. In 1990 mean production was 1.6 t $ha^{-1}$, 1.4 times higher than in 1959. In 1994 production was 2.52 t $ha^{-1}$, 57% higher than in 1970, while in 1997 it reached 2.94 t $ha^{-1}$. Varieties have also been selected for quality as well as yield improvement.

Srivastava *et al*. (1998) conducted an experiment in India with nine wheat varieties, promising for rainfed conditions, together with their 36 $F_1$, hybrids using a randomized block design with four replications. Observations were recorded on vegetative growth period, grain development period, flag leaf area ($cm^2$), spikelets spike$^{-1}$ and grain yield plant$^{-1}$. The genotypes were grouped into 10 clusters. Promising crosses for rainfed conditions were WL 2265 X P20302, CPAN 1992 X P20302, WL 2265 X HDR 87 and WL 2265 X CPAN 1992.

Litvinckho, *et al.* (1997) reported that winter wheat with high grain quality for bread making is produced in Southern Ukraine. Wheat breeding began more than 80 years ago. Over this time, seven wheat varieties were selected where yield potential increased from 2.73 to 6.74 t ha$^{-1}$. This increase was due to a decrease in photoperiodic sensitivity and the introduction of semi dwarf genes. Genes for photoperiodic sensitivity and vernalization requirement were combined and the effect of these genes on grain yield, frost and drought resistance and growth and development rate of plant in autumn and early spring were studied.

Srinivas *et al.* (1997) studied with 3 levels of nitrogen (80, 120 and 160 kg ha$^{-1}$) and three wheat cultivars (HD-4502, HD-2189 and HD-2281) to study the response of wheat to dry matter production and noticed that HD 2189 gave the highest dry matter.

Arabinda *et al.* (1994) observed that the grain yield was significantly affected by different varieties in Bangladesh. The genotypes CB-15 produced higher grain yield (3.7 ha$^{-1}$) due to more number of spikes m$^{-2}$ and grains spike$^{-1}$.

Samson *et al*. (1995) reported that among the different varieties the significant highest grain yield 3.5 ha$^{-1}$ was produced by the variety Sawghat which was closely followed by the variety BAW-748. Other four varieties namely, Sonalika, CB-84, Kanchan and Seri-82 yielded 2.70, 2.83, 3.08 and 3.15 t ha$^{-1}$ respectively.

Jahiruddin and Hossain (1994) observed that 1000-grain weight varied among the three varieties Sonalika, Kanchan and Aghrani.

Bakshi *et al.* (1992) conducted field experiments at Ludhiana, Punjab with eight bread wheat and seven durum wheat varieties sown on 1 or 15 Nov. or 15 Dec., and given 0, 40, 80 or 120 kg N ha$^{-1}$ with one or two irrigation. Seed yield was highest when wheat was sown on 1 Nov. with 120 kg N $ha^{-1}$ and two irrigations. Varieties Raj 3037, HD-4594, WL-711 and WH-841 gave the highest seed yield.

Sikder *et al*. (2001) exposed an experiment with ten recommended wheat (*Triticum aestivum* L.) varieties and of two sowing conditions i.e. optimum sowing (November 30) and late sowing (December 30). By late sowing, the varieties were given high temperature stress during reproductive growth phase. The experiment was conducted to determine the relative heat tolerance of the wheat varieties and to evaluate the relative yield performance of heat tolerant and heat sensitive wheat varieties under late seeded conditions. Based on membrane thermostability (MT) test, four varieties (Ananda, Pavon, Aghrani, and Barkat) took maximum heat killing time and were classified as relative heat tolerant, three varieties (Akbar, Kanchan and Protiva) as moderately tolerant and the rest three varieties (Balaka, Sawgat and Sonora) took the shortest heat killing time and considered as heat sensitive. The grain number per ear, 1000 grain weight and main shoot grain weight of tolerant and moderately tolerant varieties showed higher relative performance compared to senitive varieties, But the relative ear number per plant and relative grain yield were found to range low to high in heat tolerant and moderately tolerant varieties. In heat sensitive varieties the relative ear number per plant and relative grain yield were moderate to high. Thus the results suggest in addition to membrane thermostability test, the high relative grain number per ear, 1000 grain weight and main shoot grain weight can be used to determine the heat tolerance of wheat varieties under late seeded warmer conditions.

Khakwani *et al*. (2012 ) conducted an experiment of 6 bread wheat varieties (Damani, Hashim-8, Gomal-8, DN-73, Zam-04 and Dera-98) were subjected to 2 treatments i.e., control treatment (100% field capacity) and stressed treatment (20 days water stress was given during booting stage and 20 days water stress after anthesis). The findings revealed highly significant differences among means of wheat varieties in all physiological and yield traits. Almost all varieties showed their best adaptation under stressed environment however Hashim-8 and Zam-04 behaved exclusively and indicated higher relative water content (RWC), mean productivity (MP), geometric mean productivity (GMP) and stress tolerance index (STI) whereas stress susceptibility index (SSI) and tolerance (TOL) was estimated at its lowest, as these traits are recognised beneficial drought tolerance indicators for selection of a stress tolerant variety. Similarly, total grain yield per plant, biological yield per plant and harvest index was also higher in the same wheat varieties that put them as good candidates for selection criteria in wheat breeding program for drought resistant.

Hussain *et al*. (2010) investigated to assess the growth and yield response of three wheat varieties (Inqalab-91, Kharchia and Parwaz-94) to different seeding densities i.e. 100, 125 and 150 kg ha-1 were carried out on a sandy loam soil. The results indicated that seeding densities significantly affected various growth and yield parameters like germination count, total number of tillers $m^{-2}$, number of grains $spike^{-1}$ and grain yield, but total leaf area $plant^{-1}$, straw yield and harvest index were not affected significantly. The varieties differed significantly from one another with respect to the yield and yield contributing parameters. Wheat variety Inqalab-91 when sown @ 150 kg ha-1 gave the highest yield.

Rahman *et al*. (2009) conducted a field experiment in research farm of Wheat Research Centre, Dinajpur (25°38´ N, 88°41´ E and 38.20 m above sea level), Bangladesh, during wheat season of 2003-04 with 10 wheat genotypes (Gen/3/Gov, PB 81/PVN, Fang 60, Kanchan, Sari 82, HI 977, HAR 424, PF 70354, Opata and Fyn/Pvn) sown on optimum (November 17) and late (December 21) condition in a randomized complete block design with three replications to evaluate the performance of these genotypes under optimum and late sown condition and to find out the suitable time of sowing for a specific genotypes. Under optimum sown condition, differences among the genotypes were found to be significant in respect of grain yield, biomass at anthesis, ground cover at 4-5 leaf stage, days to anthesis, maturity and flag leaf emergence, plant height, grain filling duration and 1000-grain weight, and insignificant for biomass at final harvest, ground cover at anthesis, chlorophyll content of the flag leaf and differences in temperature (DT) between canopy and ambient. While for the late sown condition, grain yield, biomass at anthesis, ground cover at 4-5 leaf and DT were the only characters affected non-significantly due to variation among the treatments. For almost all the traits, reduction was caused due to late sowing with a maximum and pronounced effect noticed for grain yield (26.30%). Genotype ‘Gen/3/Gov’ seemed to be the best entry for late planting with reasonably high yield, moderate grain size and growth period. Correlation studies revealed that under timely-sown condition, biomass at final harvest and chlorophyll content (SPAD) were strongly and positively correlated with grain yield. Under late-sown condition, grain yield was positively and significantly correlated with biomass, ground cover at anthesis, days to anthesis, flag leaf emergence and maturity as well as SPAD and DT.

Nadim *et al*. (2012) evaluated on growth and yield response of wheat variety Gomal-8 using micronutrients and their application methods. The trial was laid out in a randomized complete block design with split-plot arrangements. Five different micronutrients were placed in main plot while their three application methods were assigned to sub-plots. Results revealed that application of boron @ 2 kg $ha^{-1}$ produced higher crop growth rate (23.58 g $m^{-2}$ $day^{-1}$), net assimilation rate (2.82 mg $m^{-2}$ $day^{-1}$), number of tillers (234.5 $m^{-2}$), number of grains (52.92 $spike^{-1}$) and grain yield (3.14 t $ha^{-1}$). The use of iron @ 12 kg $ha^{-1}$ also showed encouraging results similar to boron. Among various application methods, side dressing at 4 weeks after sowing (WAS) showed the best results as compared to soil application and foliar spray. Higher leaf area index and crop growth rate was obtained with the application of zinc @ 10 kg $ha^{-1}$. Also, different micronutrients had significant interaction with application methods for physiological and agronomic traits including number of tillers, leaf area index (LAI), crop growth rate (CGR), net assimilation rate (NAR) and grain yield. Side dressing best interacted with boron for producing higher number of tillers, grains per spike, net assimilation rate and grain yield. This method showed better combination with iron for higher number of tillers, LAI and grain yield.

Alam and Rahman (2008) carried out the research work with twenty wheat varieties/lines to study the effect of source-sink manipulation on grain yield in wheat. Significant variations among the genotypes were observed for grains $spike^{-1}$, 100-grain weight and grain yield main $spike^{-1}$. Removal of flag leaf caused decreased in grains $spike^{-1}$, 100-grain weight and grain yield main $spike^{-1}$ by 9.94%, 7.65% and 16.88%, respectively. Similarly removal of all leaves caused reduction of grains $spike^{-1}$, 100-grain weight and grain yield main $spike^{-1}$ by 17.17%, 13.27% and 27.92%, respectively. On the other hand, removal of 50% spikelets decreased 41.03% and 37.01% in grains $spike^{-1}$ and grain yield main $spike^{-1}$ and increased 9.44% in 100-grain weight. Similarly, 25% spikelets removal reduced grains $spike^{-1}$ and grain yield main $spike^{-1}$ by 25.13% and 23.38%, respectively but increased 4.08% in 100-grain weight. The variety/lines BL-1020, Ananda and Akbar showed high decrease in grains $spike^{-1}$, 100-grain weight and grain yield main $spike^{-1}$ by defoliation treatment.

Mehmet and Telat (2006) conducted and experiment with the trials conducted in two locations and over two years, the adaptation and stability statistics of 20 bread wheat genotypes were estimated for yield performances. Regression coefficient, mean squares of deviation from regression and determination coefficients were estimated. All the genotypes were found stable for their traits of plant densitity and days to heading. There were differences in stability performances among the genotypes for the traits of plant height, grain numbers spike$^{-1}$, grain weight spike$^{-1}$, 1000 kernels weight and grain yield. The unstability for plant height and grain weight spike$^{-1}$ among the genotypes were originated from the mean squares of deviation from regression; for the other traits it was resulted from not only the mean squares of deviation from regression but also from the differences among regression coefficients of genotypes.

The current study aimed at assessing the heat tolerance of twelve wheat genotypes under four environmental conditions (two sowing dates and two years). Wheat genotypes were sown at two dates: December (favorable) and January (heat stress) during winter seasons of 2005-2006 and 2006-2007. The combined analysis of variance showed that plant height, spike length, number of kernels per spike, harvest index and grain yield were significantly influenced by years, sowing dates, and genotypes. The results showed that sowing at the first date increased plant height, grain yield, and harvest index. Highly significant genotype differences were recorded for all characters. In general, genotypes (YR-19 and YR-20) produced the highest grain yield in both seasons, while, local cultivar 'Sama' produced the lowest grain yield. Regarding the interaction effect between sowing dates and wheat genotypes on grain yield, YR-20 produced the highest grain yield under the first sowing date. The stability analysis revealed that genotypes YR-19 and YR-20 showed high and stable yielding. On the other hand, YR-2 and YR-3 showed below-average stability (b = 1.582 & 1.594). Also, the genotypes YR-20 and YR-19 were relatively heat resistant (HSI values < 1), while local cultivar 'Sama' and YR-2 were relatively heat susceptible (HSI > 1).

Sixteen wheat genotypes including local varieties were tested in completely randomized design with three repeats. Data were recorded at four different moisture levels by using polyethylene glycol (PEG) 6000 on germination percentage, germination rate index, shoot length, root length, fresh weight of shoot, dry weight of shoot, fresh weight of root, dry weight of root, shoot/root ratio and analyzed for significance. The genotypes differ significantly in response to the moisture stress. There were highly significant differences for all traits. PK-18199 gave the maximum germination percentage, germination rate index, shoot length root length, coleoptile length, fresh shoot weight, dry shoot weight, fresh root weight, dry root weight and root/shoot ratio under all four moisture stresses. PK-18175 showed maximum resistance against moisture stress while WAFAQ 2001 showed minimum resistance. AS-2002 and KC033 also gave the better performance under all four moisture levels for most of the traits at seedling stage. 99FJ03 gave maximum root/shoot length ratio while PK 18199 gave minimum value of root/shoot length ratio showing resistance against water stress.

Islam (2011) carried out an experiment at Agronomy Field of Bangladesh Agricultural University (BAU), Mymensingh during the period from November 2009 to March 2010 with a view of finding out the effect of appropriate dose of USG on growth and yield of wheat. Three wheat varieties viz, Shatabdi, Bijoy and Prodip and 6 levels of nitrogen ($T_0$, $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$) were applied as treatments in this study. Among the application of USG on morpho-physiological and growth characters of wheat, the maximum plant height (98.33 cm), number of spikelet (21.33) and sterile spieklet (19.87) were found from $V_3T_5$. Similarly, $V_2T_3$ produced the highest no. of spikelet spilke$^{-1}$ (11.50) and grain yield (2.75 t ha$^{-1}$) whereas similar treatment also showed the maximum no of non effective tiller (1.07) with $V_1T_3$.The treatment combination of $V_2T_2$ were recorded the highest on 1000-grain yield (51.98 g), no of non sterile spike (2.07) and no of grains spike$^{-1}$ (48.87). The highest no of total tiller hill$^{-1}$ (5.13) and effective tiller (4.33) were taken from the treatment combinations of $V_1T_5$. The highest straw yield (4.67 t ha$^{-1}$) was recorded in $V_2T_4$.

Rahman (2009) carried out an experiment with high temperature stress during grain-filling period is one of the major environmental constraints limiting the grain yield of wheat in Bangladesh. Crop growth response and relative performance of yield components of ten wheat genotypes were studied in two temperature conditions in glass rooms in a Phytotron to identify the genotype tolerant to high temperature stress. A favourable day/night temperatures of 15/10, 20/15, and 25/20 $^0$C were maintained from sowing to 60 days after sowing (DAS), 61 to 80 DAS and 81 DAS to maturity, respectively, in one glass room (G1); whereas day/night temperatures in another glass room (G2) was always maintained at 5°C higher than that of G1. Green leaf area and number of tillers in different times, number of days for the occurrence of major crop growth stages, relative performance in yield components, grain yield and heat susceptibility index were estimated following the standard methods. The higher temperature enhanced plant growth, flowering, and maturation. Thus the number of days to booting, heading, anthesis, and maturity of wheat were significantly decreased that varied among the genotypes. Green leaf area and productive tillers/plant were drastically reduced in time under high temperature. The reduced number of grains/spike and smaller grain size resulted from drastic reduction in growth duration were responsible for the yield loss of wheat at high temperature. Out of ten wheat genotypes, three were characterized as high temperature tolerant based on their relative performance in yield components, grain yield and heat susceptibility index.

Alam and Rahman (2008) carried out a research work with twenty wheat varieties/lines to study the effect of source-sink manipulation on grain yield in wheat. Significant variations among the genotypes were observed for grains spike, 100-grain weight and grain yield main spike. Removal of flag leaf caused -1 -1 decreased in grains spike, 100-grain weight and grain yield main spike by 9.94%, 7.65% and 16.88% respectively. Similarly removal of all leaves caused reduction of grains spike, 100-grain weight and grain yield main spike by 17.17%, 13.27% and 27.92%, respectively. On the other hand, removal of 50% -1 spikelets decreased 41.03% and 37.01% in grains spike and grain yield main spike and increased 9.44% -1 -1 in 100-grain weight. Similarly, 25% spikelets removal reduced grains spike and grain yield main spike -1 -1 by 25.13% and 23.38%, respectively but increased 4.08% in 100-grain weight. The variety/lines BL-1020, Ananda and Akbar showed high decrease in grains spike s, 100-grain weight and grain yield main -1 spike by defoliation treatment.

Tariq (2010) carried out an experiment at Research Area, College of Agriculture, Dera Ghazi Khan. The experiment was laid out in Completely Randomized Design (CRD) with factorial arrangements having three replications during Rabi season 2009-10. Two wheat genotypes V1: Mairaj-2008 and V2: Fareed-2006 were used to evaluate the effect of drought introduced at different crop growth stages according to the given irrigation schedules i.e. (i): Control (no drought), ii: Irrigation skip at tillering (20-40 DAS), iii: Irrigation skip at jointing (40 -75 DAS), iv: Irrigation skip at spike emergence (75-90 DAS), and v: Irrigation skip at grain formation (105-115 DAS). It was found that Miraj-2008 produced significantly higher plant height, number of productive tillers pot$^{-1}$, number of spikelets spike$^{-1}$, spike length, weight of spike pot$^{-1}$, biological yield, harvest index, moisture contents, relative leaf water contents than that of Fareed-2006. No irrigation skipping resulted in maximum grain yield and yield contributing parameters. Both of the wheat varieties have no genetic potential to withstand against drought. However, skipping irrigation at grain formation crop growth stage abruptly reduced the grain yield followed by skipping irrigation at tillering stage as compared to rest of the crop growth stages. It is therefore suggested that irrigation at grain formation and tillering stage should never be missed in successful crop husbandry.

Afzaal (2006) experimented with nine wheat genotypes having introgression from chromosome 1D of Aegilops tauschii were studied under control (non-stress) and salt stress conditions. The objective was to detect variation in wheat genotypes against salt stress using physiological parameters such as transpiration rate, stomatal conductance, net $CO_2$ assimilation rate, grain yield plant$^{-1}$ and green biomass production and $CO_2$ fixation. Wheat Introgression Line (WIL) 1 and 2 showed highly significant correlation between stomatal conductance and transpiration rate as compared to all other genotypes in control and salinity. Genotype 2 and 4 showed significant correlation between transpiration rate and net photosynthesis in plants growing under controlled condition. Similarly yield and biomass production are strongly correlated in control and treated conditions in WILs 5, 6, 7. It is inferred that the tested genotypes had significant differences regarding the above mentioned parameters. It appeared that stomatal conductance, net photosynthesis and transpiration are directly and indirectly correlated with grain yield and biomass. The introgression lines tested in the present study showed plants with different segments of ID chromosome that promote these parameters differentially under saline conditions and can help identify chromosomal segments that can be used for improvement of wheat plants particularly for these parameters.

Abdelmulaa (2011) concluded that the induced terminal heat stress during both years was severe enough to cause a reduction in yield of the tested genotypes. The observed significant effect of sowing date and its interaction with years on yield entails the crucial impact of the onset and duration of winter season on wheat productivity in the non-traditional central areas of Sudan. The determined differential genotypic variability to terminal heat stress and the estimated correlation between yield and its components could be exploited in breeding programs to identify and develop new heat tolerant widely adapted cultivars. Such cultivars could be suitable for optimum sowing date as well as for terminal heat stress, e. g., genotype OASIS/ KAUZ//3BCN. Moreover, the genotype KAUZ"S"657C1-3-6-2-2-1-2, which exhibited a specific adaption and high yielding only under late sowing, could be identified and selected for improving tolerance to terminal heat stress prevailing in the central areas of Sudan.

# Chapter 3
# MATERIALS AND METHOD

The experiment was conducted at the Agronomy field, Sher-e-Bangla Agricultural University (SAU), Dhaka, during the period of November 2010 to March 2011 to study the performance of some wheat genotypes at AEZ 28. This chapter describes the materials and methods that were used in this study. For convenience, the chapter has been divided into some sections: site and soil, climate, crop, treatment, land preparation, experimental design, fertilizer application, seed sowing, intercultural operations, harvesting, data collection and data analysis. Materials used and methodologies followed in the present investigation have been described in this chapter.

## 3.1 Site and soil

The experimental field is located at $23^{0}41'$ N latitude and $90^{o}$ 22´ E longitude at a height of 8.6 m above the mean sea level. It belongs to the AEZ 28, Madhupur Tract. It was Deep Red Brown Terrace soil and belonged to Nodda cultivated series. The soil was sandy loam in texture having $p^{H}$ of 5.6, a member of hyperthermic Aeric Haplaquept under the order Inceptisol having only few horizons, developed under aquic moisture regime and variable temperature conditions. The experimental site is shown in Figure-1. General characteristics of the soil are presented in Appendix II.

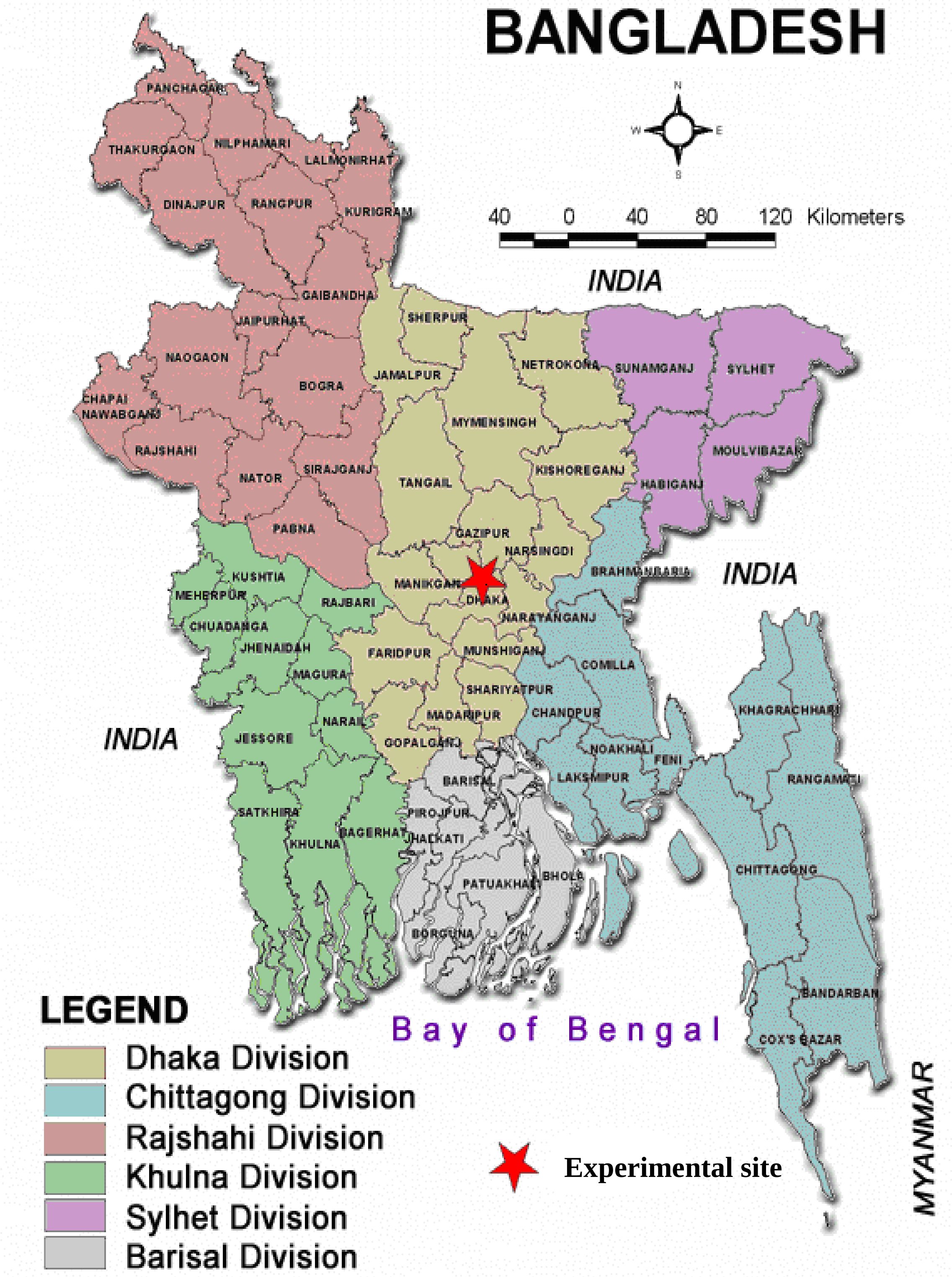


**Fig. 1: The map of Bangladesh showing experimental site**

### 3.2 Climate

The experimental field was situated under sub-tropical climate, usually the rainfall is heavy during kharif season, (April to September) and scantly in rabi season (October to March). In rabi season temperature is generally low and there is plenty of sunshine. The temperature tends to increase from February as the season proceeds towards kharif. Rainfall was almost nil during the period from November 2010 to January 2011 and scantly from February to March 2011. The monthly total rainfall, average temperature during the study period (November to March) has been presented in Appendix I.

### 3.3 Crop

The test crop was wheat (*Triticum aestivum*) of fifteen genotypes were collected from the Wheat Research Centre, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur.

### 3.4 Treatments

The experiment consisted of one factor and that was the wheat genotypes. Fifteen (15) genotypes were used under the experiment. The treatments of the experiment were as follows:

1. BAW1059
2. BAW1064
3. CVD5 (BAW1111)
4. CVD6 (BAW1114)
5. AYT5 (BAW1135)
6. AYT7 (BAW1137)
7. AYT9 (BAW1139)
8. AYT10 (BAW1140)
9. AYT11 (BAW1141)
10. BL3503
11. Bijoy
12. Prodip
13. Sourav
14. Shatabdi

15. Sufi

### 3.5 Land preparation

Repeated ploughing with power tiller and country plough was done on 7 November and final land was prepared on 10 November of 2010. Ploughing was followed by laddering in order to break clods as well as to level the land. All weeds, stubble and crop residues were removed from the experimental field. The layout of the experiment was done as per statistical design.

### 3.6 Experimental design

The experiment was laid out in Randomized Complete Block Design (RCBD) with 3 replications. The experimental unit was divided into 3 blocks each of which representing a replication. There were altogether 45 (15×3) unit plots, each plot measuring 4.0 m × 2.5m. Inter-block and Inter-plot spacings were 1m and 0.75m, respectively. Number of sowing line in each plot was 7 and line to line distance was 20 cm.

### 3.7 Fertilizer application

The following doses of manure and fertilizers were used:

| | | |
|---|---|---|
| Cowdung | : | 10 t $ha^{-1}$ |
| Urea | : | 220 kg $ha^{-1}$ |
| TSP | : | 180 kg $ha^{-1}$ |
| MoP | : | 50 kg $ha^{-1}$ |
| Zypsum | : | 110 kg $ha^{-1}$ |
| Zinc oxide | : | 4 kg $ha^{-1}$ |
| Boric acid | : | 5 kg $ha^{-1}$ |

The total amount of cowdung, TSP, MoP, gypsum, zinc oxide and boric acid were applied during final land preparation. Urea was applied in three equal splits, during final land preparation, crown root iniciation stage (21 DAS) and panicle initiation stage (53 DAS). The fertilizers were incorporated to soil by spading one day before sowing.

### 3.8 Sowing of seeds

Seeds were sown continuously in line on 11 November 2010 and the seeds rate being 120 kg $ha^{-1}$. A strip of wheat crop was established around the experimental field as a border crop.

### 3.9 Intercultural operations

Intercultural operations were done to ensure normal growth of the crop. The following intercultural operations were followed:

#### 3.9.1 Irrigation

Three irrigations were applied, the first irrigation at 22 days of sowing at crown root initiation (CRI), the second at 45 days at heading stage and the third irrigation at 62 days at grain filling stage.

#### 3.9.2 Weeding

Weeding was done twice during the whole growing period, the one after 20 days of sowing and the other after 36 days.

#### 3.9.3 Insect and pest control

The crop was attacked by different kinds of insects (cereal aphid and grass hopper) during the growing period. Curater-5G was applied to the 23 DAS. Insecticide was applied to the plots after irrigation.

### 3.10 Harvesting

For recording yield components data, ten hills from each plot were collected randomly. For calculating yield data plants of each plot were harvested. The crop was cut at the ground level. Threshing, cleaning and drying of grain were done separately for every plot. Then plot- wise weights of grain and straw were recorded.

### 3.11 Data collection

Data were collected on the following growth, yield and yield contributing components:

#### 3.11.1 Plant height

The plant height was measured from the ground level to top of the spike at 30 DAS, 50 DAS, 70 DAS, 90 DAS and at harvest. From each plot, plants of 10 hills were measured and averaged. The mean plant height was determined in cm.

#### 3.11.2 Number of tillers plant$^{-1}$

Ten hills were selected from each plot randomly. The number total tillers from 10 plants was counted and averaged them to have number of tillers plant$^{-1}$.

#### 3.11.3 Dry weight plant$^{-1}$

Five plants in each plot were uprooted with the help of hand weeder and cleaned with water. Plants were oven dried at 80ºC for 72 hours until a constant weight was obtained. The dry weight of plants were recorded in gram and converted into dry weight plant$^{-1}$. The data were collected at 30 DAS, 60 DAS, 90 DAS and at harvest.

#### 3.11.4 Number of spike plant$^{-1}$

Total number of spikes from 10 randomly selected plants from each plot was counted and then averaged them to have number of spike plant$^{-1}$.

#### 3.11.5 Spike length

Length of 10 spike per plot was recorded and averaged. It was measured from base to tip of the spike.

#### 3.11.6 Number of spikelets spike$^{-1}$

Total number of spikelets spike$^{-1}$ was calculated and averaged from 10 randomly selected plants from each plot.

#### 3.11.7 Number of grains spike$^{-1}$

Ten spikes were selected and the total grains from total spike were recorded and averaged to number of grains spike$^{-1}$.

#### 3.11.8 Thousand grain weight

Thousand grains were randomly selected from each plot and the weight (g) of grains was recorded after sun drying by an electrical balance.

#### 3.11.9 Grain yield

Grains from each unit plot were dried and then weighed carefully. The results were expressed as t ha$^{-1}$on 14% moisture basis.

#### 3.11.10 Stover yield

Like grain yield, dry weight of stover for individual plot was recorded and expressed as t ha$^{-1}$.

#### 3.11.11 Biological yield

Biological yield was calculated from the following formula

Biological yield = Grain yield + Stover yield

#### 3.11.9 Harvest index

Harvest index was determined by dividing the economic yield (grain yield) from the net plot by the total biological yield (grain + stover) from the same area (Donald, 1963) and multiplying by 100.

$$\text{Harvest index} = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$$

### 3.12 Statistical analysis

The data were analyzed statistically by F-test to examine whether the treatment effects were significant. The mean comparisons of the treatments were evaluated by DMRT (Ducan's Multiple Range Test). The analysis of variance (ANOVA) for different parameters was done by a computer package programme “MSTATC”.

# Chapter 4
# RESULTS AND DISCUSSION

The present experiment was conducted at Agronomy farm of Sher-e-Bangla Agricultural University. The results have been presented and discussed, and possible interpretations have been given under the following headings:

## 4.1 Growth parameters

### 4.1.1 Plant height

Significant variation was observed by different wheat genotypes on plant height (Table 1 and Appendix III). Different wheat genotype showed different plant height and it was ranged from 84.33 to 100.40 cm at harvest. The highest plant height was measured in AYT9 (BAW1139) genotype (32.33, 72.96, 93.58, 101.50 and 103.40 cm at 30, 50, 70, 90 DAS and at harvest, respectively) which was closely followed by Shatabdi at 90 DAS and at harvest. CVD5 (BAW1111); AYT10 (BAW1140) and Sourav also showed comparatively higher plant height at harvest but significantly different from AYT9 (BAW1139). The lowest plant height (24.00, 42.95, 69.51, 83.93 and 84.33 cm at 30, 50, 70, 90 DAS and at harvest, respectively) was observed in AYT11 (BAW1141) which was significantly different from all other treatments. BAW1059; BAW1064; AYT5 (BAW1135); AYT7 (BAW1137) and Prodip also showed comparatively lower plant height but significantly different from AYT11 (BAW1141). Similar findings were also observed by Sulewska (2004).

Table 1: Plant height of wheat genotypes at AEZ 28

| **Genotype** | **Plant height (cm) at different days after sowing (DAS)** | | | | |
|---|---|---|---|---|---|
| | **30** | **50** | **70** | **90** | **At harvest** |
| **BAW1059** | 28.73 fg | 58.29 d | 84.98 de | 91.90 f | 93.13 d |
| **BAW1064** | 29.20 de | 55.43 e | 83.43 ef | 91.63 f | 93.20 d |
| **CVD5 (BAW1111)** | 29.33 de | 60.63 cd | 88.17 bc | 97.13 cd | 98.63 bc |
| **CVD6 (BAW1114)** | 29.53 d | 46.24 g | 75.77 i | 94.60 de | 96.73 c |
| **AYT5 (BAW1135)** | 28.80 fg | 63.55 b | 84.23 ef | 88.33 g | 90.67 d |
| **AYT7 (BAW1137)** | 27.87 h | 52.17 f | 77.97 hi | 93.17 ef | 93.43 d |
| **AYT9 (BAW1139)** | 32.33 a | 72.96 a | 93.58 a | 101.5 a | 103.4 a |
| **AYT10 (BAW1140)** | 28.47 g | 51.26 f | 80.01 gh | 98.67 bc | 99.53 bc |
| **AYT11 (BAW1141)** | 24.00 i | 42.95 h | 69.51 j | 83.93 h | 84.33 e |
| **BL3503** | 29.07 ef | 61.23 bc | 90.65 b | 96.80 cd | 97.67 c |
| **Bijoy** | 27.60 h | 58.43 cd | 84.70 ef | 96.53 cd | 96.97 c |
| **Prodip** | 30.00 c | 58.35 d | 86.37 c-e | 92.20 ef | 92.60 d |
| **Sourav** | 28.80 fg | 46.84 g | 78.37 hi | 99.13 a-c | 100.1 a-c |
| **Shatabdi** | 29.33 de | 51.69 f | 81.80 fg | 99.73 ab | 101.9 ab |
| **Sufi** | 30.53 b | 59.85 cd | 87.83 b-d | 92.20 ef | 97.60 c |
| **SE** | **1.0492** | **2.8528** | **3.3124** | **1.1569** | **1.2542** |
| **CV(%)** | **8.542** | **12.538** | **10.563** | **9.486** | **7.336** |

### 4.1.2 Number of tillers plant$^{-1}$

Different wheat genotype under AEZ 28 had significant influence on number of tillers plant$^{-1}$ (Table 2 and Appendix IV). Number of tillers plant$^{-1}$ was significant at different days after sowing (DAS) except at 30 DAS. Among the test varieties, Sourav showed the highest number of tillers plant$^{-1}$ at all growth stages (7.87, 9.40, 9.27 and 9.00 at 50, 70, 90 DAS and at harvest respectively) which was statistically similar with Shatabdi at 50 and 70 DAS. Shatabdi also showed comparatively higher number of tillers plant$^{-1}$ at 90 DAS and at harvest but significantly different from Sourav. The lowest number of tillers plant$^{-1}$ at all growth stages was observed in Sufi (5.27, 5.33, 5.67 and 6.40 at 50, 70, 90 DAS and at harvest respectively) which was statistically similar with AYT9 (BAW1139) and closely followed by CVD5 (BAW1111) at the time of harvest.

Table 2: Number of tillers plant$^{-1}$ of wheat genotypes at AEZ 28

| Genotype | Number of tillers plant$^{-1}$ at different days after sowing (DAS) | | | | |
|---|---|---|---|---|---|
| | 30 | 50 | 70 | 90 | At harvest |
| **BAW1059** | 3.06 | 6.53 c-e | 6.73 d | 7.13 cd | 7.66 bc |
| **BAW1064** | 3.53 | 6.26 ef | 6.60 d | 6.26 ef | 7.80 b |
| **CVD5 (BAW1111)** | 3.33 | 5.93 f | 7.60 c | 7.33 c | 6.53 ef |
| **CVD6 (BAW1114)** | 3.46 | 6.20 ef | 7.13 cd | 6.66 de | 6.80 d-f |
| **AYT5 (BAW1135)** | 3.86 | 5.33 g | 5.93 e | 5.86 fg | 7.06 d |
| **AYT7 (BAW1137)** | 3.13 | 6.93 bc | 9.00 a | 8.20 b | 7.20 cd |
| **AYT9 (BAW1139)** | 3.06 | 6.80 b-d | 5.80 ef | 5.73 g | 6.40 f |
| **AYT10 (BAW1140)** | 3.06 | 5.46 g | 6.06 e | 6.46 e | 7.60 bc |
| **AYT11 (BAW1141)** | 3.46 | 7.13 b | 8.26 b | 6.66 de | 7.00 de |
| **BL3503** | 3.33 | 6.40 d-f | 7.13 cd | 8.26 b | 7.20 cd |
| **Bijoy** | 3.00 | 5.93 f | 7.60 c | 8.33 b | 7.60 bc |
| **Prodip** | 3.20 | 6.00 f | 7.00 d | 6.60 e | 7.00 de |
| **Sourav** | 3.86 | 7.86 a | 9.40 a | 9.26 a | 9.00 a |
| **Shatabdi** | 3.80 | 7.73 a | 9.20 a | 8.60 b | 8.00 b |
| **Sufi** | 3.60 | 5.26 g | 5.33 f | 5.66 g | 6.40 f |
| **SE** | **0.2297** | **0.5054** | **1.0536** | **1.1298** | **0.5349** |
| **CV(%)** | **3.685** | **8.547** | **7.368** | **10.826** | **11.346** |

### 4.1.3 Dry weight plant$^{-1}$

Significant variation was found by different wheat genotypes on dry weight plant$^{-1}$ at AEZ 28 under the present study (Table 3 and Appendix V). Different wheat genotype showed different dry weight plant$^{-1}$ and it was ranged from 35.72 to 21.55 g at harvest. There was no significant effect was observed at 30 DAS. But at 60, 90 DAS and at harvest the highest dry weight plant$^{-1}$ was measured in Shatabdi genotype (7.337, 20.20, and 35.72 g, respectively at 60, 90 DAS and at harvest) which was significantly different from all other treatments. But at the time of harvest BAW1059; AYT11 (BAW1141) and BL3503 showed second highest dry weight plant$^{-1}$ but significantly different from Shatabdi. The lowest dry weight plant$^{-1}$ (3.430, 8.570 and 21.55 g at 60, 90 DAS and at harvest, respectively) was recorded in Sufi which was closely followed by AYT10 (BAW1140). Some other treatments like AYT5 (BAW1135) showed second lowest dry weight plant$^{-1}$ but significantly different from Sufi. Srinivas *et al.* (1997) also observed that dry weight plant$^{-1}$ varied among the varieties.

Table 3: Dry weight plant$^{-1}$ of wheat genotypes at AEZ 28

| Genotype | Dry weight plant$^{-1}$ at different days after sowing (DAS) | | | |
|---|---|---|---|---|
| | 30 | 50 | 70 | 90 |
| **BAW1059** | 0.39 | 4.46 de | 10.40 h | 33.39 b |
| **BAW1064** | 0.26 | 4.72 b-d | 10.19 h | 28.36 d |
| **CVD5 (BAW1111)** | 0.28 | 3.76 fg | 12.38 fg | 27.45 d |
| **CVD6 (BAW1114)** | 0.42 | 3.56 g | 10.86 h | 27.44 d |
| **AYT5 (BAW1135)** | 0.34 | 4.96 b-d | 12.28 fg | 24.50 e |
| **AYT7 (BAW1137)** | 0.29 | 3.57 g | 14.49 cd | 30.52 c |
| **AYT9 (BAW1139)** | 0.31 | 3.56 g | 12.97 ef | 28.22 d |
| **AYT10 (BAW1140)** | 0.32 | 3.48 g | 11.26 gh | 21.97 f |
| **AYT11 (BAW1141)** | 0.40 | 4.61 c-e | 15.36 bc | 32.19 bc |
| **BL3503** | 0.26 | 5.25 b | 16.25 b | 33.85 b |
| **Bijoy** | 0.33 | 5.09 bc | 14.06 de | 27.84 d |
| **Prodip** | 0.37 | 4.13 ef | 14.31 cd | 30.88 c |
| **Sourav** | 0.33 | 5.17 b | 12.74 f | 26.68 d |
| **Shatabdi** | 0.40 | 7.33 a | 20.20 a | 35.72 a |
| **Sufi** | 0.31 | 3.430 g | 8.570 i | 21.55 f |
| **SE** | **0.0459** | **0.8384** | **2.7142** | **1.8436** |
| **CV(%)** | **4.652** | **8.356** | **9.241** | **11.524** |

## 4.2 Yield contributing parameters

### 4.2.1 Number of spike plant$^{-1}$

Number of spike plant$^{-1}$ was significantly influenced by different wheat genotypes at AEZ 28 under the present study (Table 4 and Appendix VI). Among the test wheat varieties the number of spike plant$^{-1}$ ranged from 6.33 to 9.04. Results showed that the highest number of spike plant$^{-1}$ (9.04) was obtained from Shatabdi which was significantly different from all other test varieties. BAW1059; BAW1064; AYT10 (BAW1140) and BL3503 also showed comparatively higher number of spike plant$^{-1}$ but significantly different from Shatabdi. Among the other wheat genotype the lowest number of spike plant$^{-1}$ (6.333) was found in Prodip which was closely followed by CVD5 (BAW1111) and BL3503. Similar research was also carried out by Arabinda *et al.* (1994).

### 4.2.2 Spike length

Significant variation was found on spike length by different wheat genotypes at AEZ 28 under the present study (Table 4 and Appendix VI). Among the test wheat varieties the spike length was ranged from 14.89 cm to 17.68 cm. Results showed that the highest spike length (17.68 cm) was obtained from Shatabdi which was significantly different from all other test varieties. AYT9 (BAW1139); BL3503 and Bijoy also showed comparatively higher spike length but significantly different from Shatabdi. Among the other test genotype the lowest spike length (14.89 cm) was found in Prodip which was closely followed by CVD6 (BAW1114). The genotype of CVD5 (BAW1111)and Sufi also showed comparatively lower spike length but significantly different from Prodip.

### 4.2.3 Number of spikelet spike$^{-1}$

Considerable variation was found in terms of number of spikelet spike$^{-1}$ caused by different wheat genotype at AEZ 28 under the present study (Table 4 and Appendix VI). Different wheat genotype showed different results on number of spikelet spike$^{-1}$ and it is ranged from 13.95 to 19.91. Results showed that the highest number of spikelet spike$^{-1}$ (19.91) was obtained from Shatabdi which was significantly different from all other test varieties. AYT7 (BAW1137); AYT9 (BAW1139) and AYT10 (BAW1140) also showed comparatively higher number of spikelet spike$^{-1}$ but significantly different from Shatabdi. The lowest number of spikelet spike$^{-1}$

(13.95) was found in AYT5 (BAW1135) which was also significantly different from all other treatments. But the treatment of CVD6 (BAW1114); AYT10 (BAW1140) and Bijoy also showed comparatively lower number of spikelet spike$^{-1}$ but significantly different from AYT5 (BAW1135).

### 4.2.4 Number of grains spike$^{-1}$

Significant variation was observed on number of grains spike$^{-1}$ by different wheat genotypes at AEZ 28 under the present study (Table 4 and Appendix VI). Results showed that the highest number of grains spike$^{-1}$ (56.83) was obtained from Shatabdi which was significantly different from all other test varieties. AYT9 (BAW1139) also showed comparatively higher number of grains spike$^{-1}$ but significantly different from Shatabdi. Among the other test genotype, the lowest number of grains spike$^{-1}$ (30.36) was found in Prodip which was also significantly different from all other treatments. But the treatment of AYT5 (BAW1135); AYT10 (BAW1140) and Bijoy also showed comparatively lower number of grains spike$^{-1}$ but significantly different from Prodip. Similar research was also carried out by Arabinda *et al.* (1994) and Wheat Research Centre (2003).

### 4.2.5 Weight of 1000-seeds

Different genotype of wheat under AEZ 28 had significant on 1000 seed weight (Table 4 and Appendix VI). Results showed that the highest 1000 seed weight (46.88 g) was obtained from BL3503 which was statistically similar with Shatabdi. The treatment of AYT10 (BAW1140) and Bijoy also showed comparatively higher 1000 seed weight but significantly different from Shatabdi. Among the other test genotype, the lowest 1000 seed weight (39.12 g) was found in Sufi which was statistically similar with AYT11 (BAW1141) and Prodip. But the treatments of BAW1059; CVD5 (BAW1111) and AYT7 (BAW1137) also showed comparatively lower 1000 seed weight but significantly different from Sufi. Similar findings was also achieved by Wheat Research Centre (WRC) (2003).

Table 4: Performance of yield contributing parameters of wheat genotypes at AEZ 28

| Genotype | Spike plant$^{-1}$ (no.) | Spike length (cm) | Spikelet spike$^{-1}$ (no.) | Grain spike$^{-1}$ (no.) | 1000 grain weight (g) |
|---|---|---|---|---|---|
| **BAW1059** | 7.60 bc | 16.78 c | 16.98 d | 43.18 d | 41.62 e |
| **BAW1064** | 7.80 bc | 15.80 d | 15.47 g | 42.11 de | 43.64 c |
| **CVD5 (BAW1111)** | 6.46 fg | 15.52 de | 15.93 f | 40.51 ef | 40.44 f |
| **CVD6 (BAW1114)** | 6.80 ef | 15.06 fg | 14.44 h | 38.89 fg | 41.67 e |
| **AYT5 (BAW1135)** | 6.93 e | 15.31 ef | 13.95 i | 34.05 i | 43.34 cd |
| **AYT7 (BAW1137)** | 7.06 de | 15.78 d | 17.95 c | 46.32 c | 40.96 ef |
| **AYT9 (BAW1139)** | 7.00 e | 17.14 b | 18.45 b | 49.51 b | 43.55 c |
| **AYT10 (BAW1140)** | 7.60 bc | 15.47 de | 14.35 h | 37.07 h | 45.25 b |
| **AYT11 (BAW1141)** | 6.93 e | 16.44 c | 17.89 c | 45.29 c | 39.29 g |
| **BL3503** | 8.00 b | 17.17 b | 16.70 de | 46.88 c | 46.88 a |
| **Bijoy** | 7.46 cd | 17.23 b | 14.50 h | 38.25 gh | 45.29 b |
| **Prodip** | 6.33 g | 14.89 g | 16.56 e | 30.36 j | 39.66 g |
| **Sourav** | 6.40 fg | 15.21 e-g | 15.74 fg | 42.10 de | 42.71 d |
| **Shatabdi** | 9.04 a | 17.68 a | 19.91 a | 56.83 a | 46.49 a |
| **Sufi** | 7.13 de | 15.16 efg | 17.11 d | 42.90 d | 39.12 g |
| **SE** | **0.5481** | **0.5459** | **1.1772** | **4.1811** | **1.9983** |
| **CV(%)** | **8.542** | **7.265** | **9.854** | **10.235** | **11.362** |

### 4.3 Yield parameters

#### 4.3.1 Grain yield

Significant variation was observed in terms of grain yield (Table 5 and Appendix VII). Yield performance of different varieties was different. Results under the present study revealed that the yield of the test varieties, ranged from 2.72 to 4.29 t $ha^{-1}$. The highest yield (4.29 t $ha^{-1}$) was recovered from Shatabdi which was significantly different from all other test varieties. BAW1059; AYT9 (BAW1139) and AYT10 (BAW1140) also showed comparatively higher performance on yield but significantly different from Shatabdi. The observed yield from the rest of the genotype, the lowest yield (2.72 t $ha^{-1}$) was obtained from Prodip which was statistically similar with Sufi (2.74 t $ha^{-1}$). The yield performance from other test varieties like CVD5 (BAW1111); AYT7 (BAW1137); AYT11 (BAW1141); BL3503 and Sourav showed comparatively lower seed yield but significantly different from Prodip. Similar research was also carried out by Arabinda *et al.* (1994) and WRC (2003).

#### 4.3.2 Stover yield

Stover yield exerted significant effect among the genotypes (Table 5 and Appendix VII). In accordance with different wheat genotypes, stover yield was also different. Results under the present study revealed that the stover yield of the test varieties, ranged from 3.97 to 6.64 t $ha^{-1}$. The highest stover yield (6.64 t $ha^{-1}$) was achieved with Shatabdi which was statistically similar with AYT9 (BAW1139) and Sourav. The other genotype of CVD5 (BAW1111); AYT10 (BAW1140) and Bijoy also showed comparatively higher performance but significantly different from Shatabdi. The achieved stover yield from the rest of the genotype, the lowest (3.97 t $ha^{-1}$) was obtained from BL3503 which was closely followed by AYT11 (BAW1141) and Prodip.

#### 4.3.3 Biological yield

Biological yield was significantly affected by different wheat genotype at AEZ 28 under the present study (Table 5 and Appendix VII). Results showed that the biological yield ranged from 7.043 to 10.90 t $ha^{-1}$ among the test varieties. It was observed that the highest biological yield (10.90 t $ha^{-1}$) was in Shatabdi which was statistically similar with AYT9 (BAW1139). BAW1059; AYT10 (BAW1140); Bijoy and Sourav also showed comparatively higher biological yield but significantly different from Shatabdi. The lowest biological yield (7.043 t $ha^{-1}$) was obtained from BL3503 which was closely followed by AYT11 (BAW1141) and Prodip. The other genotype of BAW1064; AYT7 (BAW1137) and Sufi also showed comparatively lower performance but significantly different from BL3503.

### 4.3.4 Harvest index

Significant variation was also observed in terms of harvest index (Table 5 and Appendix VII). Different wheat genotypes showed different result of harvest index. Results under the present study revealed that the harvest index of the test varieties, ranged from 43.64% to 33.64% among the test genotypes. The highest harvest index (43.64%) was obtained from BL3503 which was statistically similar with BAW1059 and closely followed by AYT5 (BAW1135). The other genotype of BAW1064; CVD6 (BAW1114); AYT11 (BAW1141) and Shatabdi also showed comparatively higher performance but significantly different from BL3503. The achieved harvest index from the rest of the genotype, the lowest harvest index (33.64%) was obtained from CVD5 (BAW1111) which was significantly different from all other treatments. But the results from AYT9 (BAW1139); Bijoy and Sufi showed comparatively lower harvest index value and significantly different from CVD5 (BAW1111).

Table 5: Yield and harvest index of some wheat genotypes at AEZ 28

| Genotype | Grain yield (t ha$^{-1}$) | Stover yield (t ha$^{-1}$) | Biological yield (t ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|
| **BAW1059** | 3.88 b | 5.13 cd | 9.013 bc | 43.05 a |
| **BAW1064** | 3.14 de | 4.54 e | 7.68 d-f | 40.86 bc |
| **CVD5 (BAW1111)** | 2.84 gh | 5.60 bc | 8.44 b-d | 33.64 f |
| **CVD6 (BAW1114)** | 3.23 d | 4.66 de | 7.90 de | 40.95 bc |
| **AYT5 (BAW11350** | 3.49 c | 4.78 de | 8.26 cd | 42.21 ab |
| **AYT7 (BAW1137)** | 3.00 e-g | 4.81 de | 7.81 d-f | 38.43 d |
| **AYT9 (BAW11390** | 3.65 c | 6.59 a | 10.23 a | 35.66 e |
| **AYT10 (BAW1140)** | 3.60 c | 5.66 bc | 9.26 b | 38.87 d |
| **AYT11 (BAW1141)** | 2.93 fg | 4.41 ef | 7.34 ef | 39.91 cd |
| **BL3503** | 3.07 d-f | 3.97 f | 7.04 f | 43.64 a |
| **Bijoy** | 3.26 d | 5.77 b | 9.03 bc | 36.09 e |
| **Prodip** | 2.72 h | 4.40 ef | 7.13 ef | 38.16 d |
| **Sourav** | 2.96 e-g | 6.27 a | 9.24 b | 31.05 g |
| **Shatabdi** | 4.29 a | 6.64 a | 10.90 a | 39.26 cd |
| **Sufi** | 2.73 h | 4.92 de | 7.65 d-f | 35.71 e |
| **SE** | **0.5508** | **0.5448** | **0.5642** | **0.6824** |
| **CV(%)** | **8.962** | **5.324** | **9.543** | **6.578** |

# Chapter 5
# SUMMARY AND CONCLUSION

The experiment was conducted at the Agronomy field, SAU, Dhaka, during the period from November 2010 to March 2011 to study the "Performance of some wheat genotypes at AEZ 28. The experiment consisted of factor containing 15 treatments (genotypes of wheat).

The experiment was laid out in Randomized Complete Block Design with 3 replications. The 15 genotypes of wheat were BAW1059; BAW1064; CVD5 (BAW1111); CVD6 (BAW1114); AYT5 (BAW1135); AYT7 (BAW1137); AYT9 (BAW1139); AYT10 (BAW1140); AYT11 (BAW1141); BL3503; Bijoy; Prodip; Sourav; Shatabdi; and Sufi. The unit plot size was 4.0 m × 2.5 m. Manures and fertilizer were applied at recommended doses of wheat.

Data were collected in respect of the wheat genotypes on growth, yield and yield contributing characters. The data obtained for different characters were statistically analyzed to find out the significant difference among the test wheat genotypes. The data on growth parameters were plant height, number of tillers plant$^{-1}$, and dry weight plant$^{-1}$ and the growth parameters were significantly affected by different wheat genotypes under the present study. Results showed that the highest plant height (103.40 cm) was with AYT9 (BAW1139) where the lowest plant height (84.33 cm) was with AYT11 (BAW1141) at harvest. Again, the highest number of tillers plant$^{-1}$ (9.00) was achieved by Sourav where the lowest (6.40) was obtained from AYT9 (BAW1139) and Sufi at the time of harvest. But in case of dry weight plant$^{-1}$, the highest (35.72 g) was observed in Shatabdi where the lowest (21.97) was found in AYT10 (BAW1140) at harvest.

The results found on yield contributing parameters were also significantly influenced by different wheat genotypes at AEZ 28 under the present study. The considered yield contributing parameters were number of spike plant$^{-1}$, spike length, number of spikelet spike$^{-1}$, number of grain spike$^{-1}$, and weight of 1000 seeds. The highest number of spike plant$^{-1}$ (9.04), spike length (17.68 cm), number of spikelet spike$^{-1}$ (19.91) and number, grain spike$^{-1}$ (56.83) and 1000 grain weight (46.49 g) were obtained from Shatabdi and the lowest number of spike plant$^{-1}$ (6.33) and spike length (14.89 cm) was obtained from Prodip. But the lowest spikelet spike$^{-1}$ (13.95), number of grain spike$^{-1}$ (34.05) and 1000 grain weight (30.36 g) respectively was obtained from AYT5 (BAW1135); Prodip and Sufi respectively.

The yield data (grain yield, stover yield, biological yield and harvest index) under the present study was also significantly affected by different wheat genotypes at AEZ 28. The recorded results indicated that the highest grain yield (4.29 t ha$^{-1}$), stover yield (6.64 t ha$^{-1}$) and biological yield (10.90 t ha$^{-1}$) were achieved with Shatabdi. But the lowest grain yield (2.72 t ha$^{-1}$) was achieved by Prodip and the lowest stover yield (3.97 t ha$^{-1}$) and biological yield (7.04 t ha$^{-1}$) were achieved with BL3503. On the other hand the highest harvest index (43.64) was observed in BL3503 where the lowest harvest index (33.64) was observed in CVD5 (BAW1111).

From the above discussion it can be concluded that among the 15 test wheat genotypes, Shatabdi showed the best performance in respect yield and yield contributing characters followed by 3.883 t ha$^{-1}$ in BAW1059.

Considering the situation of the present experiment, further studies in the following areas may be suggested:

1. Such study is needed in different agro-ecological zones (AEZ) of Bangladesh for regional compliance and other performance.
2. Another experiment may be carried out with many more wheat genotypes so that location based best genotype can be selected.

# Chapter 6
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# Chapter 7
# APPENDIX

Appendix I. Monthly average air temperature, relative humidity and total rainfall of the experimental site during the period from November 2010 to March 2011

| *Month* | *RH (%)* | *Max. Temp. (ºC )* | *Min. Temp. ( ºC )* | *Rain fall (mm)* |
|---|---|---|---|---|
| November | 50.26 | 24.80 | 16.40 | 0 |
| December | 48.36 | 24.52 | 14.18 | 0 |
| January | 55.53 | 25.00 | 13.46 | 0 |
| February | 50.31 | 29.50 | 18.49 | 0 |
| March | 44.95 | 33.80 | 20.28 | 25 |
| April | 61.40 | 33.74 | 23.81 | 185 |

**Source:** Bangladesh Meteorological Department (Climate division), Agargaon, Dhaka-1212.

Appendix II: Characteristics of experimental soil was analyzed at Soil Resources Development Institute (SRDI), Farmgate, Dhaka.

A. Morphological characteristics of the experimental field

| ***Morphological features*** | ***Characteristics*** |
|---|---|
| Location | Agronomy Farm, SAU, Dhaka |
| ***AEZ*** | Modhupur Tract (28) |
| General Soil Type | Shallow red brown terrace soil |
| Land type | High land |
| Soil series | Tejgaon |
| Topography | Fairly leveled |
| Flood level | Above flood level |
| Drainage | Well drained |
| Cropping pattern | Not Applicable |

*Source: Soil Resource Development Institute (SRDI)*

B. Physical and chemical properties of the initial soil

| ***Characteristics*** | ***Value*** |
|---|---|
| Partical size analysis | |
| % Sand | 27 |
| %Silt | 43 |
| % Clay | 30 |
| **Textural class** | Silty-clay |
| pH | 5.6 |
| Organic carbon (%) | 0.45 |
| Organic matter (%) | 0.78 |
| Total N (%) | 0.03 |
| Available P (ppm) | 20.00 |
| Exchangeable K ( me/100 g soil) | 0.10 |
| Available S (ppm) | 45 |

Source: Soil Resource Development Institute (SRDI)

Appendix III: Effect on plant height of some wheat genotypes at AEZ 28

| Source of variance | Degrees of Freedom | Mean square of plant height | | | | |
|---|---|---|---|---|---|---|
| | | 30 DAS | 50 DAS | 70 DAS | 90 DAS | At harvest |
| Replication | 2 | 0.043 | 0.020 | 0.190 | 0.238 | 0.864 |
| Factor A | 14 | 9.335* | 7.959* | 8.833* | 6.029* | 7.067* |
| Error | 28 | 3.303 | 2.416 | 2.915 | 2.015 | 4.719 |

Appendix IV: Effect on number of tillers plant$^{-1}$ of some wheat genotypes at AEZ 28

| Source of variance | Degrees of Freedom | Mean square of number of tillers plant$^{-1}$ | | | | |
|---|---|---|---|---|---|---|
| | | 30 DAS | 50 DAS | 70 DAS | 90 DAS | At harvest |
| Replication | 2 | 0.011 | 0.139 | 0.792 | 0.268 | 1.585 |
| Factor A | 14 | 0.273** | 1.901* | 4.812* | 3.908* | 1.426* |
| Error | 28 | 0.158 | 0.766 | 3.330 | 3.829 | 0.858 |

Appendix V: Effect on dry weight plant $^{-1}$ of some wheat genotypes at AEZ 28

| Source of variance | Degrees of Freedom | Mean square of dry weight plant$^{-1}$ | | | |
|---|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS | At harvest |
| Replication | 2 | 0.001 | 3.724 | 1.133 | 1.593 |
| Factor A | 14 | 1.008* | 3.248* | 2.791* | 5.519* |
| Error | 28 | 0.006 | 2.109 | 0.101 | 0.196 |

Appendix VI: Effect on yield contributing parameters of some wheat genotypes at AEZ 28

| Source of variance | Degrees of Freedom | Mean square of | | | | |
|---|---|---|---|---|---|---|
| | | Number of spike plant$^{-1}$ | Spike length (cm) | Number of spikelet spike$^{-1}$ | Number of grain spike$^{-1}$ | 1000 grain wt (g) |
| Replication | 2 | 1.238 | 0.485 | 1.175 | 0.653 | 1.025 |
| Factor A | 14 | 1.480* | 2.642* | 8.862* | 4.213* | 8.086* |
| Error | 28 | 0.901 | 0.894 | 4.157 | 2.445 | 1.980 |

Appendix VII: Effect on yield parameters of some wheat genotypes at AEZ 28

| Source of variance | Degrees of Freedom | Mean square of | | | |
|---|---|---|---|---|---|
| | | Grain yield (t ha$^{-1}$) | Stover yield (t ha$^{-1}$) | Biological yield (t ha$^{-1}$) | Harvest index (%) |
| Replication | 2 | 0.101 | 0.071 | 0.024 | 0.036 |
| Factor A | 14 | 0.607* | 2.088* | 3.860* | 7.740* |
| Error | 28 | 0.210 | 0.890 | 2.024 | 1.683 |