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VARIATION OF GRAIN GROWTH OF WHEAT CULTIVARS

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Abstract

An experiment was carried out to study the grain growth pattern of wheat *(Triticum aestivum* L.) cultivars and to find out association and linear regression of spike weight and grain weight with time. Spike characters indicated that cultivar differences were significant in all the cases with a few exceptions. Linear regression and correlation coefficients revealed that the association between both spike weight and grain weight with time were highly positively significant among the cultivars but their regression coefficients were non-significant.

Key Words: Grain growth, correlation, regression, wheat.

Introduction

Genetic potentialities and environment including cultural practices determine yield, but final grain yield is mainly depended on potential grain growth of any cultivar. Number of grains/spike and grain size had provided much information about the structure of cereal crops, but little about the fundamental causes of variation in yield (Thorne, 1974). Seed weight/spike is dependent on the number of seeds and seed size and shape (Amin *et al.*, 1995*).* The yield of a grain crop is a function of the rate and duration of accumulation of dry weight in the seed fraction and consequently factors influencing either the rate or duration will have a direct influence on yield. Gallaghar *et al.* (1976) established the usefulness of relating grain growth of wheat as a linear process and expressing final weight/grain as a product of a growth rate and duration. They commented that if cereals are to yield well in regions where drought and high temperature during grain filling are frequent, varieties must be bred which not only increase the rate but also sustain the duration of grain growth. Rawson and Evans (1970), Bremer (1972) and Rawson and Rawali (1972a) reported the differences in weight between grains within the year and the general pattern of such variation and its development with time. Bhardwaj and Verma (1985) observed that grain weight/ear and spikelet as well as single grain weight of wheat increased steadily from anthesis to maturity. Relative growth rate of grain showed differences in respect of the variety as well as the age of the grain. Knowledge in this regard is very scanty in wheat of Bangladesh. So, the present experiment was set up to find out variability of different phases of grain growth of wheat *(Triticum aestivum* L.) cultivars in the northern region of Bangladesh.

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Materials and Method

The experiment was conducted in the research field of the Department of Botany, University of Rajshahi, Bangladesh. Eight cultivars of wheat (Opata, BL 1183, C 306, BAW 452, BAW 171, Pavon 76, Kanchan and Barkat) were grown in a randomized complete block design with three replications. Each replication plot was 8 m long and 8 m wide. The field was prepared after repeated ploughings. Before sowing, basal doses of nitrogen (80 kg N /ha), TSP (40 kg P_2O_5 /ha) and MP (40 kg K_2O /ha) were added and were mixed with the soil. The seeds were sown on 10 November 2003 at the rate of 50 kg/ha. The row to row and plant to plant distances were 20 cm and 10 cm, respectively. Spikes were harvested from the experimental field on 10 January 2004 onward. Before harvest, some spikes were tagged at different days of anthesis for each cultivar and harvests were taken at an interval of 7 days. Six harvests were taken during the period of experimentation. Six spikes of main tillers were cut (per replication = 2 spikes) per cultivar at each harvest and they were dried in an oven at 85°C for 24 hours. After drying, the following characters were recorded: Spike weight, number of spikelets/spike, number of grains and grain weight. Statistical analysis was done accordingly for almost all the characters by a statistical package named Irristat Version 3.1 to show the significant difference among means. Linear regression analysis was carried out according to Gomez and Gomez (1984) with the help of Microsoft Excel data analysis tool pack.

Results and Discussion

The result of the present investigation indicates that cultivar differences were significant in all the cases except spike weight per main tiller at 21 days after anthesis (DAA). Rahman (2004) observed significant varietal difference of seed growth parameters in wheat at different DAA. Mean performance (Table 1) revealed that spike weight per main tiller and grain weight per spike increased gradually with time and showed variability in some cases. On the other hand, number of spikelets per spike and grain number per spike showed less variation in all the cases. Barkat showed the maximum mean values for all these parameters. The minimum values of spike weight per main tiller, number of spikelets per spike, number of grains per spike and grain weight per spike were obtained in Pavon 76, BL 1183, BAW 171 and C 306, respectively. Saha and Abi-Antaun (1988) reported that head weight per plant, grain number, grain size, and fertility are the most important yield contributing characters. Geweifel (1991) reported that variation in grain yield was most closely associated with variation in number of grains per spike and number of spikes per m^2. Bouzerzour and Benmahamed (1991) observed a positive and highly significant correlation between grains per m^2 and grains per spike and also between these components and yield. Rahman and Paul (1998) observed that spike weight increased with increasing time under irrigated condition, but decreased by water deficiency in

Table 1. Mean values of spike characters at different days after anthesis of eight cultivars of wheat. Rajshahi, 2003.

Days after anthesis

Cultivars	7		14		21			
	Spike weight(g) / main tiller	No. of spikelets/ spike	Spike weight(g) / main tiller	No. of spikelets spike1	Spike weight(g) / main tiller	No. of spikelets/ spike	Grain no./ spike	Grain weight(g)/ spike
Opata	0.53bc	17.33a	0.69cd	16.00b	1.27a	17.33a	41.83ab	0.84c
BL1183	0.64ab	13.33c	1.09b	13.67c	1.55a	15.33b	35.83b	1.08b
C306	0.49bc	12.83c	0.56d	12.50d	l.27a	16.83ab	37.00b	0.42e
Kanchan	0.6Iab	15.67b	0.81c	17.17a	1.52a	17.67a	41.00ab	1.02bc
BAW452	0.85a	16.50ab	l.l8ab	16.00b	1.70a	17.00a	46.50a	1.30a
BAWI7I	0.50bc	17.67a	0.84c	15.83b	1.13a	15.83b	27.67c	0.63d
Pavon 76	0.46bc	16.33ab	0.79c	16.33ab	1.40a	17.17a	43.67ab	0.83cd
Barkat	0.93a	17.33a	l.27a	16.33ab	1.59a	15.33b	41.00ab	0.99bc
LSD at5%	0.25	1.75	0.16	1.07	-	1.27	8.49	0.21

Days after anthesis

Cultivars	28				35			
	Spike weight(g) / main tiller	No. of spikelets/ spike	Spike weight(g) / main tiller	No. of spikelets/ spike	Spike weight(g) / main tiller	No. of spikelets/ spike	Grain no./ spike	Grain weight(g)/ spike
Opata	l.98bc	1817a	47.00a	1.39bc	1.88b	16.67bc	43.67b	l.33b
BL1183	2.14b	15.17b	39.00ab	l.62b	2.39b	13.17d	32.l7cd	1.79b
C306	1.21d	14.50b	36.67b	0.64ab	2.20b	17.50b	44.67b	1.57b
Kanchan	2.13b	17.50a	38.00ab	1.57b	2.33b	17.00b	35.17c	1.73b
BAW452	2.61a	18.33a	47.00a	1.94a	2.07b	16.00bc	32.67cd	1.56b
BAWI7I	l.84bc	18.17a	30.67b	l.24cd	1.97b	17.00b	26.67d	l.44b
Pavon 76	1.49d	17.50a	39.00ab	1.05d	1.88b	17.00b	36.50c	1,39b
Barkat	2.42ab	17.00ab	44.83a	1.76ab	3.53a	19.33a	60.33a	2.85a
LSD at5%	0.35	2.48	9.31	0.31	0.66	1.68	6.17	0.50

Days after anthesis

Cultivars	42			
	Spike weight(g) / main tiller	No. of spikelets/ spike	Grain no./ spike	Grain weight(g)/ spike
Opata	2.00de	16.67b	44.50ab	1.47c
BLI 183	2.68b	13.83c	37.67b	2.2lab
C306	2.57bc	16.17b	44.83ab	l.92b
Kanchan	2.42c	17.67ab	38.00b	1.78bc
BAW452	2.98ab	16.67b	46.17a	2.30a
BAWI7I	2.35cd	18.00a	35.33b	1.76bc
Pavon76	1.80e	18.83a	37.17b	1.34c
Barkat	3.22a	18.33a	52.00a	2.57a
LSD at 5%	0.40	1.35	8.53	0.44

In a colum, means followed by a common letter are not significantly different at 5% level by DMRT.

the soil. Evans and Wardlaw (1976) observed that number of grains that develop in a spike of wheat is dependent on the number of florets and the effective fertilization of them after anthesis. Again, grain weight per ear is dependent on the number of grains and its size and shape (Amin *et al.*, 1995).

Grain number per spikelet was considered as the main yield component in wheat by Hsu and Walton (1971). Bhuiya and Kamal (1994) stated that grain yield of wheat is the product of four components viz., number of ears per plant, number of spikelets per ear, number of grains per spikelet and individual grain weight. Some workers reported that the yield advantage of wheat mostly depends on the higher number of grains per unit area (Gale, 1979 and Perry and D'Antuono, 1989). Furthermore, the increased grain number has been arisen by spikes per unit area (Lupton, 1974) or more grains per spike (Syme, 1970) due to a higher spikelet number (Rawson, 1970) or a higher floret fertility (Angus and Sage, 1980). Rawson and Ruwali (1972b) suggested that high yields with uniform grain can be obtained by increasing spikelet number using branched ears, rather than by increasing seed set per spikelet.

Linear regression and correlation coefficients between spike weight on time and grain weight on time for the cultivars were studied and the results (Fig. 1) revealed that in all the cases, association between spike weight and time showed highly significant positive correlations which were r^2= 0.877** in Opata, r^2= 0.984** in BL 1183, r^2 = 0.926** in C 306, r^2= 0.935** in Kanchan, r^2= 0.861** in BAW 452, r^2= 0.976** in BAW 171, r^2= 0.905 in Pavon 76 and r^2= 0.911** in Barkat but their corresponding regression coefficients were non-significant. Simpson (1968) observed very high positive correlation between weight of grain per plant and number of kernels per plant in wheat. Kulik (1985) observed that grain yield was positively correlated with number of ears per m^2, number of productive tillers per m^2 and number and weight of grains per main ear.

Figure 2 indicates that among the cultivars, the association between grain weight on time also showed highly positive correlations, such as r^2= 0.691** in Opata, r^2= 0.965** in BL 1183, r^2= 0.944** in C 306, r^2= 0.818** in Kanchan, r^2= 0.597** in BAW 452, r^2= 0.948** in BAW 171, r^2= 0.848** in Pavon 76 and r^2= 0.802** in Barkat. On the other hand, their corresponding regression coefficients were also non-significant in all the cases. Briggs and Aytenfisu (1980) observed that kernels per ear and 1000-kernel weight was the most stable association of yield components in spring wheat. Islam (1977) found a significant positive correlation between grain yield per plant and 1000-seed weight. Labuschagne and Van-Deventer (1992) reported that grain number and grain weight of both primary and secondary tillers were significantly correlated with

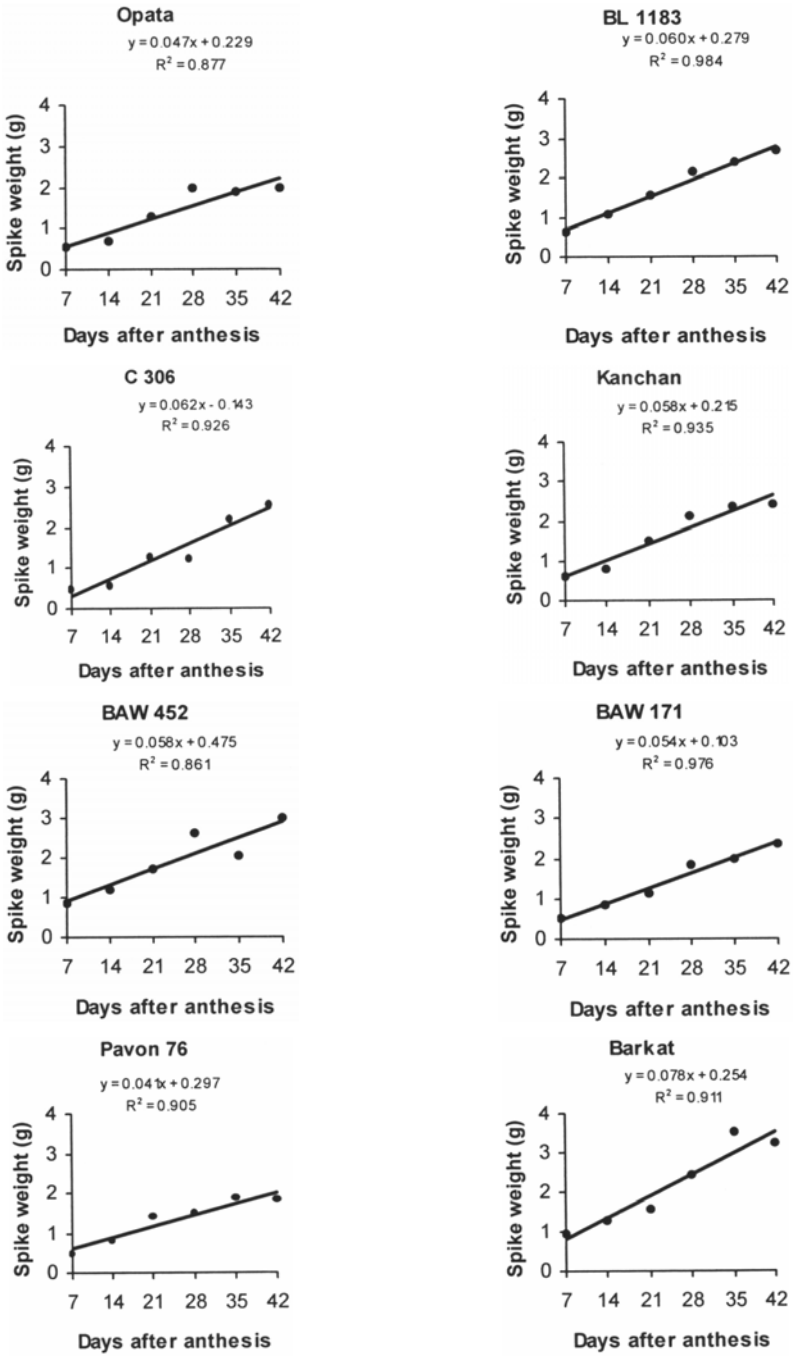

Fig. 1. Regression of spike weight on times (different days after anthesis) of eight cultivars of wheat.

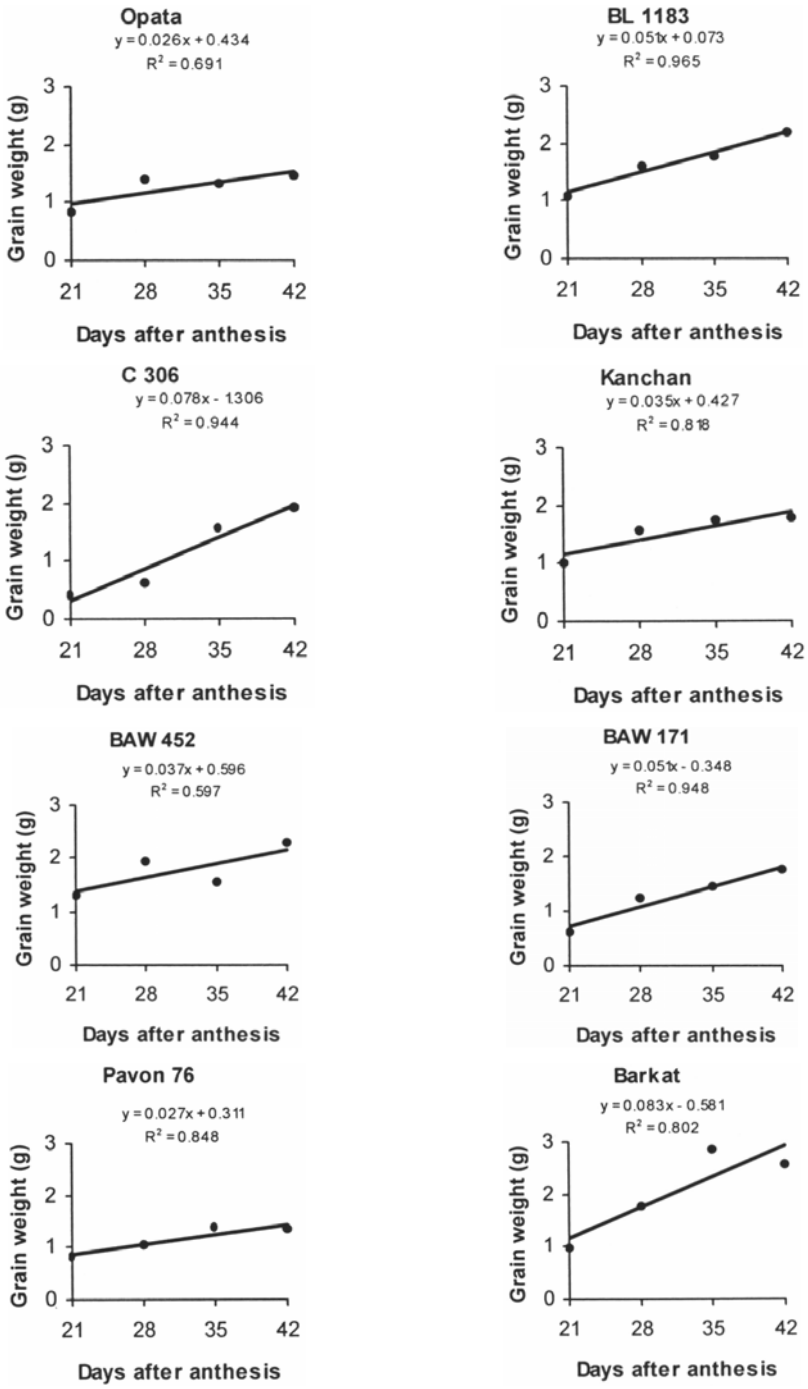

Fig. 2. Regression of grain weight on times (different days after anthesis) of eight cultivars of wheat.

yield at two different moisture levels (80 and 50% field capacity). Chai *et al.* (1993) noticed that grain weight per plant was correlated highly and significantly with dry weight per plant in wheat.

In the present investigation, it is observed that spike weight and grain weight had close relation with time. Therefore, independent and dependent variables were closely related each other and changed with time. Among the cultivars, wide variation was observed for all the spike characters at different days after anthesis.

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