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Effect of Various Sowing Dates on Growth, Yield and Yield Components of Different Wheat Genotypes

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Abstract: Optimum sowing dates provide favorable temperature to obtained maximum yield. Varietal selection is also play vital role in obtaining high wheat production. Two year field experiments were conducted at the Research Area of Agronomic Research Station, Bahawalpur, Pakistan, in which six selected genotypes (V_1-Aari-11, V_2-Aas-11, V_3-Meraj-08, V_4-Millat-11, V_5-Punjab-11, V_6-Seher-06) were sown at six different sowing date (D_1-1st November, D_2-11th November, D_3-21st November, D_4-1st December, D_5-11th December, D_6-21st December) with 10 days intervals during winter season to evaluate the effect of sowing dates on yield of selected wheat genotypes. The experiment was laid out under split plot design with three replications. Two year results revealed that wheat sown on 11th November performed better with respect to days taken to booting, heading, anthesis and maturity, germination count m^{-2}, number of tillers m^{-2}, plant height and number of grains spike^{-1}, 1000 grains weight and grain yield. It was also revealed that late sowing of wheat caused reduction in these attributes. Variations among genotypes were also observed. Genotypes Aas-11 showed maximum days to booting, heading, anthesis, maturity and maximum number of grains spike^{-1}, 1000 grains weight and grain yield. The maximum germination m^{-2}, numbers of tillers m^{-2} and plant height were shown by genotypes Millat-11, Meraj-08 and Sehar-06 respectively. On overall basis, it was concluded that wheat should be sown from 11th November to 21st November to get high production. Genotype Aas-11 was recommended to farmer of Southern Punjab, Pakistan to obtain high yield.

Key words: Wheat · Genotypes · Sowing · Dates · Yield · Pakistan

INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important cereal crop and mainly consumed as staple food in the world [1]. In Pakistan, wheat was annually produced 23.835 million tons from 9.129 million hectares during 2013-2014 [2]. High yield production of wheat is needed to feed the growing population of the world [3].

Selection of proper sowing date is vital to obtain high yield due to variation among the weather conditions [4]. Proper sowing date and varietal selection could be responsible for high crop production. Wheat is grown in winter season. It requires definite temperature and light for optimum growth [5]. Too early sowing, when temperature will be above then the optimum could also produce poor plants. At optimum temperature, early sowing enhances the wheat growth and nutrient uptake. Whereas delay in crop sowing cause reduction in yield [6]. The intensity of winter season become increased that causes the reduction in production [7].

Mostly in Punjab, wheat and cotton is dominant cropping system. In this cropping system, sowing of wheat becoming late due to which maintaining high yield is much difficult. At tillering stage, optimum planting date could produce good crop growth that increases the cold tolerance [8]. Low temperature due to late planting could produce fewer tillers [9]. Number of kernels and spikes m^{-2} are most important yield component of wheat. Both early and late sowing of wheat causes reduction in

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numbers of kernel per spike [10]. Temperature stress after anthesis cause drastic effect on grain yield production through reducing the kernel weight. Sowing at optimum time could enhance seed germination, plant height, number of spikelets, grains spike^{-1} and 1000-grain weight [11].

Sial *et al*. [12] reported shorter plant height, reduction in days to heading and maturity and reduction in grain yield due to late sowing of wheat. Sohail *et al.* [13] reported that late sowing reduced the wheat grain upto 29%. Due to late planting crop maturity date, number of spikes and grain weight become reduced in all genotypes. Tahir *et al.* [14] reported maximum grain yield at proper sowing date and lower grain yield in late sowing. Ali *et al.* [15] investigated the effect of planting dates on the yield of wheat genotypes and reported that wheat sown in the November 10 gave highest grain yield. Delay in planting from November 20 gradually reduced the wheat production. Iqbal *et al.* [16] stated that 50% yield become reduced with wheat sowing after 15 December. Wheat cultivars responded to delay sowing date with reduction in grain yield [6].

Sowing time of different wheat genotypes have been determined so far but still there is need to test new wheat genotypes. Present study was conducted to evaluate the genetic yield potential of various advance lines/genotypes under different planting dates.

MATERIALS AND METHODS

Two field experiments were conducted at Research Area of Agronomic Research Station, Bahawalpur, to evaluate effect of different sowing dates on the yield of advance wheat lines. The experiment was laid out in split plot arrangements with three replications with net plot area of 2.25 m × 7 m. The experiment was comprised of six sowing dates (D_1-1st November, D_2-11th November, D_3-21st November , D_4-1st December, D_5-11th December, D_6-21st December) and six wheat cultivars (V_1-Aari-11, V_2-Aas-11, V_3-Meraj-08, V_4-Millat-11, V_5-Punjab-11, V_6-Seher-06) during consecutive two years (2011-12 and 2012-13). Recommended doses of NPK (160-120-60 kg ha^{-1}) were applied in the form of urea, DAP and SOP. All the phosphorus and potash doses were applied at the time of sowing, whereas nitrogen was applied in two split doses, half dose at the time of sowing and remaining half dose at the time of 1st irrigation. Crop was sown on a well prepared seedbed at the rate of 120 kg ha^{-1}. Other agronomic practices were done to maintain the crop growth.

Data regarding germination m^{-2} and number of days taken to booting, heading, anthesis and physiological maturity were recorded. At the time of physiological maturity number of fertile tillers m^{-2}, plant height, number of grains spike^{-1}, 1000-grain weight and grain yield were recorded. The Collected data were subjected to statistical analysis by using split plot design [17].

RESULTS

.Days to Booting, Heading, Anthesis and Maturity: Data regarding days to booting, heading, anthesis and maturity showed significant variation among sowing dates and genotypes. The same pattern was found during both year trials in these attributes that's why we showed average data of two consecutive years (Table 1). Non-significant results were obtained between the crop sown at 1st November and 11th November. Among sowing dates, wheat sown at 1st November and 11th November showed maximum number of days to booting (31), heading (99), anthesis (105) and maturity (143). Crop sown in 21st December showed minimum days to booting, heading, anthesis and maturity (Table 1). With respect to genotypes, significant variation was observed and genotype Aas-11 showed significantly maximum days to booting (91), heading (97), anthesis (103) and maturity (136). Genotype Sehar-06 showed lower number of days taken to booting, anthesis and maturity, while lower number of days taken to heading was shown by genotype Meraj-08.

Growth Parameters: Data regarding germination count m^{-2}, number of tillers m^{-2} and plant height is shown in Table 2. Significant variation was found among sowing dates and genotypes with respect to these attributes. Crop sown in 11th November showed significantly maximum average germination count m^{-2} (207.50), number of tillers m^{-2} (421) and plant height (102 cm) as compared to other sowing dates during two consecutive years. Crop sown on 21st December showed significantly lower germination count m^{-2}, number of tillers m^{-2} and plant height. In case of genotypes, comparison of data showed that Millat-11 showed significantly higher germination count m^{-2} (200.83). The maximum average number of tillers m^{-2} was shown by genotype Meraj-08 which showed 387 number of tillers m^{-2}. Genotype Sehar-06 showed maximum average plant height (101 cm) as compared to other genotypes. The lowest germination count m^{-2}, number of tillers m^{-2} and plant height were reported by genotype Aas-11, Sehar-06 and Meraj-08, respectively.

Table 1: Effect of different sowing dates and genotypes on average days to booting, heading, anthesis and maturity during two consecutive years

	Average across sowing dates during 2011-13			
	Days to booting	Days to heading	Days to anthesis	Days to maturity
1st November	91.33 a	99.17 a	105.17 a	142.83 a
11th November	91.33 a	99.17 a	105.17 a	142.67 a
21st November	89.00 b	96.17 b	102.33 b	137.94 b
1st December	86.83 c	92.72 c	98.22 c	128.89 c
11th December	84.11 d	90.06 d	95.39 d	126.44 d
21st December	81.83 e	87.44 e	91.44 e	123.33 e
LSD (p=0.05)	0.0715	0.1060	0.1081	0.3616
	Average across genotypes during 2011-13			
Aari-11	89.33 b	95.61 b	101.22 b	134.22 c
Aas-11	90.50 a	97.17 a	102.83 a	135.56 a
Meraj-08	84.17 f	90.67 e	96.11 f	131.61 f
Millat-11	87.00 d	93.00 d	98.78 d	133.72 d
Punjab-11	88.94 c	95.17 c	100.33 c	134.72 b
Sehar-06	86.50 e	93.11 d	98.44 e	132.28 e
LSD (p=0.05)	0.0642	0.1111	0.1315	0.1988

Table 2: Effect of different sowing dates and genotypes on average growth of wheat during two consecutive year

	Average across sowing dates during 2012-14		
	Germination count m^{-2}	Number of tillers m^{-2}	Plant height (cm)
1st November	199.33 c	397.67 c	98.33 c
11th November	207.50 a	421.33 a	102.33 a
21st November	203.17 b	409.50 b	100.00 b
1st December	197.17 d	372.83 d	95.17 d
11th December	191.67 e	359.83 e	91.00 e
21st December	186.33 f	345.16 f	85.50 f
LSD (p=0.05)	1.1530	2.0385	0.5356
	Average across genotypes during 2012-14		
Aari-11	197.83 b	385.33 b	93.00 d
Aas-11	194.83 f	385.33 b	94.67 b
Meraj-08	196.50 d	387.33 a	94.17 c
Millat-11	200.83 a	384.33 b	94.67 b
Punjab-11	197.50 c	385.17 b	94.83 b
Sehar-06	196.17 e	378.17 c	101.00 a
LSD (p=0.05)	0.0575	1.9790	0.4506

Table 3: Effect of different sowing dates on average yield and yield components of different wheat genotypes during two consecutive year

	Average across sowing dates during 2012-14		
	Number of grains $spike^{-1}$	1000 grains weight (g)	Grain yield (t ha^{-1})
1st November	52.66 c	40.50 b	5.76 c
11th November	55.83 a	44.17 a	6.14 a
21st November	54.00 b	42.17 b	5.94 b
1st December	49.50 d	37.83 c	4.90 d
11th December	44.83 e	34.50 d	4.00 e
21st December	40.17 f	32.17 e	3.33 f
LSD (p=0.05)	0.3112	1.9929	0.0923
	Average across genotypes during 2012-14		
Aari-11	48.17 e	39.33 a	4.91 d
Aas-11	52.33 a	39.17 a	5.37 a
Meraj-08	48.66 d	38.17 ab	5.18 b
Millat-11	46.16 f	38.17 ab	4.74 f
Punjab-11	51.83 b	37.67 b	5.05 c
Sehar-06	49.83 c	38.83 ab	4.83 e
LSD (p=0.05)	0.0108	1.4854	0.1850

Yield and Yield Component: Data regarding yield and yield component is shown in Table 3. Comparison of sowing dates showed significant variation while observing average number of grains spike^{-1}, 1000 grains weight and grain yield during consecutive two years (Table 3). It was revealed that crop sown on 11th November reported maximum number of grains spike^{-1}, 1000 grains weight and grain yield as compared to other sowing dates. It showed 56 numbers of grains spike^{-1}, 44.17 g of 1000 grains weight and 6.14 t ha^{-1} grains yield. With respect to genotypes, Aas-11 reported maximum average number of grains spike^{-1} and grain yield of two consecutive years which showed 52 numbers of grains spike^{-1} and 5.37 t ha^{-1} grains yield. The maximum average 1000 grains weight (39.17 g) was also shown by genotype Aas-11 and was non-significant to genotypes Aari-11, Meraj-08, Millat-11 and Sehar-06. Lowest number of grains spikes^{-1} and grain yield was shown by genotype Millat-11 while lowest 1000 grain weight was reported by genotype Punjab-11.

DISCUSSION

Temperature at the time of sowing at 1st November was comparatively higher which was not favorable for obtaining maximum yield. Crop sowing on 11th November showed better results as compared to all other sowing dates. It could be due to the optimum temperature available for crop growth. Aslani and Mehrvar [18] investigated the effect of optimum and late sowing on yield and yield component of wheat and reported higher yield and yield component with sowing on optimum sowing date. Crop sown on 21st November showed significantly lower value of all the parameters recorded. Reason could be due to lower temperature with passage of days of winter season. Late sowing of crop causes the reduction in number of days taken to booting, heading, anthesis and maturity which also causes the reduction in yield and yield component. Delay sowing of crop cause reduction in growth as well as yield of crop [19].

It was reported that temperature rose up to 35°C in the end of March [12]. Late sowing of crop affect the development of plant organs and cause the reduction in plant height, numbers of days taken to heading, maturity, grain filling and yield and yield component [20, 21]. Hossain *et al*. [22] reported the reduction in days taken to maturity from late sowing of crop. Optimum sowing date provide favorable environment at tillering stage which produced more number of spikes however genotypic variation could be there in response to different environmental conditions [20, 23].

High temperature caused early maturity and caused reduction in days to maturity [1, 24]. Some genotypes have potential to produced high yield even under high temperature [1,25]. High temperature reduced the grain filling period which caused reduction in grain weight. Genotypes NR-397 and NARC-2009 were reported as a high yielding genotype under rainfed environment at reproductive [13].

CONCLUSION

From this study, it is concluded that yield and yield components of different wheat genotypes were significantly affected by sowing dates. Delay in sowing of wheat can cause severe reduction in growth and yield. For wheat it was recommended that crop should be sown at optimum sowing date which could be from 11th November to 21th November. Genotype Aas-11 was recommended to the farmer of Southern Punjab to obtained high yield according to their ecological climatic conditions.

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