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Field Screening of Wheat (*Triticum aestivum* L.) Genotypes for Drought Tolerance under Medium and High Rainfall Conditions

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Abstract
Forty wheat genotypes possessing diverse genetic makeup were tested in field under medium rainfall conditions at Barani Agricultural Research Institute (BARI), Chakwal and under high rainfall conditions at University of Arid Agriculture, Rawalpindi. Main objective of study was to screen the genotypes for drought tolerance. Data were recorded for drought related parameters and yield attributes. The data collected were analyzed to understand the genetic mechanisms of various traits related to drought. From these genotypes having sufficient genetic diversity, Inqlab-91, MAW-1, Saleem-2000 and 2KC033 were screened out as drought tolerant parents on the basis of less yield reduction method, whereas the advanced lines 2495, 3C061, 3C062 and 3C066 were identified as drought susceptible parents among the material studied. The screened genotypes and breeding materials so generated may serve as raw material for the breeders to develop/evolve high yielding drought tolerant varieties of wheat for the rainfed areas.
Keywords: Screening, drought tolerance, medium and high rainfall, wheat

Introduction

In arid and semiarid regions wheat crops usually encounter drought during the grain filling period. Drought is one of the most damaging abiotic stresses affecting agriculture. It is an important abiotic factor affecting the yield and yield stability of food cereals and acts simultaneously on many traits leading to a decrease in yield (Boyer, 1982; Ludlow and Muchow, 1990). During the year 2006-2007, area under wheat crop in Pakistan was 8.578 million hectares, out of which 7.334 million hectares were irrigated and the rest, 1.243 million hectares, were planted under rainfed conditions. Total production was 23.29 million tonnes of wheat grain. Average per hectare yield was 2916 kg from irrigated areas and 1532 kg from rainfed areas (Anonymous, 2007). This shows a big yield gap between the two production situations.

In rainfed areas less moisture is available for wheat crop which imposes drought and inflicts yield loss to the crop. The term drought describes a condition in which available soil moisture is reduced to the point where the plant cannot absorb it rapidly enough to compensate for transpiration. Drought can occur as a result of low rainfall, high temperature or wind. It is not a uniform phenomenon and the reaction will depend on the stage of development of the plant at which drought occurs. The reduction in yield is the key concern of plant breeders and therefore, they accentuate on grain yield performance under drought stress conditions. Accordingly, drought indices which provide a measure of drought based on loss of yield under drought conditions in comparison to normal conditions have been used for screening drought-tolerant genotypes (Mitra, 2001). Various researchers have used different methods to evaluate genetic differences in drought tolerance. Drought tolerance is defined by Hall (1993) as the relative yield of a genotype compared to other genotypes subjected to the same drought stress.

Increase in yield of crops grown under less than optimum conditions can be obtained through either by improvement of cultural practices or by breeding varieties that are more productive under low moisture conditions. Although the need for crop varieties better adapted to semi arid conditions is widely recognized but plant breeders disagree on how to satisfy this need. Some think drought tolerance can be obtained simply by selecting for high yield. In this commonly used approach, it is asssumed that some varieties with superior yields under optimum conditions will also yield relatively well in sub-optimal conditions. The second major breeding approach is that a superior variety for semi- arid (sub-optimal) growing conditions must be selected, developed and tested in a semi-arid environment. Improved grain yield is regarded as most desirable aim of breeding in low soil moisture conditions. Selection for yield in wheat should initially be practised under a range of optimal and suboptimal conditions (Roy and Murty, 1970).

Keeping above factors in view the Present studies were planned with the following objectives:

(i) To investigate performance of wheat genotypes(commercial varieties and newly developed lines) for yield and yield related traits under high and medium rainfall conditions.
(ii) To select drought tolerant wheat genotypes based on their performance in high and medium rainfall areas.

The information so obtained will be of value to start a wheat breeding program to develop drought tolerant wheat cultivars for the rainfed areas.

Materials and Methods

Experimental Material

Forty wheat genotypes comprising of commercial cultivars and newly developed lines by various research institutes in the country were evaluated in field at University of Arid Agriculture, Rawalpindi (UAAR) and Barani Agricultural Research Institute (BARI), Chakwal for two years. UAAR is situated at 73^0 longitude, 33^0 latitude and at an altitude of 650 meters above sea level. BARI is situated at 72^0 longitude, 32^0 latitude and at an altitude of 575 meters above sea level. Seed of the wheat genotypes was collected from various research institutes of Pakistan (Table-1). An experiment comprising of these forty genotypes, was conducted in field at two locations i.e. at UAAR (high rainfall area), and at BARI, Chakwal (medium rainfall area) for the two years. Experiments were laid out according to randomized complete block design with three replications. Three five meter long rows of each entry were sown, maintaining an inter row spacing of 30 cm.

Data Collection

Number of days to heading, dry weight at heading (g), number of days to maturity, dry weight at maturity (g), plant height (cm), grain filling period (days), grain yield per m^2 (g), 1000-grain weight (g).

Statistical analysis

Data collected on the above mentioned characters were subjected to analysis of variance (Steel and Torrie, 1980) to determine whether the genotypes varied significantly among themselves for those traits.

Results and Discussion

Number of days to heading

Significant differences were observed among genotypes for number of days taken to heading at both locations during both the years (Tables-2&3). On the basis of two years average, maximum number of days to heading was taken by 3C068, Haider-2000, 3C061, 3C062 and Chakwal-86 while minimum number of days to heading was taken by Suleman-96 and AS-2000 at AAUR (high rainfall location). Whereas, at BARI, Chakwal (medium rainfall location), (Table-4), showed that maximum number of days to heading were taken by 3C061, 1C020, 3CO66, 3C065 and Chakwal-86 and. Minimum number of days to heading were taken by No.2495.

When Table-4 was critically examined it was observed that performance of cultivars at AAUR (high rainfall location) was almost similar during both years. Whereas, performance of cultivars at BARI, Chakwal (medium rainfall location) was also almost similar during both years. On the average of two years numbers of days taken to heading were more at AAUR as compared to BARI, Chakwal. Srialaby *et. al.* (1988) evaluated that drought at tillering reduced significantly number of days taken to heading. Ammar (1999) also suggested that grain yield was indirectly affected by numbers of days taken to heading and plant height through its significant positive correlation with vegetative period. Number of grains per spike, length of vegetative period, plant height and numbers of days taken to heading were major contributors to grain yield in semi arid areas. Water deficit had significant effects on number of days taken to heading (Benmoussa and Achouch, 2005). Sukhorukov (1989) studied that late heading genotypes caused greater reduction in grain yield under moisture stress. On the average of two years numbers of days taken to heading were more at AAUR as compared to BARI, Chakwal.

Dry weight at heading

Analysis of variance revealed significant differences among genotypes for dry weight at heading at both locations during both the years (Tables-2&3). On the basis of two year average (Table 5), maximum dry weight at heading was produced by 3C067, 3C061, 2KC033, 00C010 and 3C063. Minimum dry weight at heading was produced by NR-234 and AS-2000. At BARI, Chakwal (medium rainfall location), two years average at Chakwal showed that highest dry weight producers were 3C067, 3C061, 3C063 and 00FJ03. Minimum dry weight at heading was produced by V-02169 on the basis of two year average at BARI, Chakwal.

When Table-5 was critically examined it was observed that performance of cultivars at Rawalpindi (high rainfall location) was almost similar during both years. Whereas, cultivars showed different trend during both years at BARI, Chakwal (medium rainfall location).

Number of days to maturity

Analysis of variance revealed significant differences among genotypes for number of days taken to maturity at both locations during both the years (Tables-2&3). At AAUR (high rainfall location, Table 6) On the basis of two years average, maximum number of days to maturity was taken by 3C066, 3C061, 3C062, 98C017 and 3C063. Minimum number of days taken to maturity was taken by cultivars No.2495 and V-02169. At BARI, Chakwal (medium rainfall location), Two years average at BARI, Chakwal showed that maximum number of days to maturity were taken by 3C062, 3C061, 98C017, Rawal-87 and 3C066. Minimum number of days to maturity was taken by AS-2000 and V-02169 on the basis of two years average at BARI, Chakwal.

When Table 6 was critically examined it was observed that performance of cultivars at AAUR (high rainfall location) was quite variable during both years. Whereas, performance of cultivars at BARI, Chakwal (medium rainfall location) was almost similar during both years. On the average of two years numbers of days taken to maturity were more at AAUR as compared to BARI, Chakwal. Attarabashi *et al*. (2002) evaluated that number of days taken to maturity exhibited a negative correlation with grain yield.

Dry weight at maturity

Analysis of variance revealed significant differences among genotypes for dry weight. at maturity at both locations during both the years (Tables-2&3). At AAUR (high rainfall location, Table 7) On the basis of two years average, maximum dry weight at maturity was produced by MAW-1, 3C068, Inqlab-91, AS-2000 and Suleman-96. Minimum dry weight at maturity was produced by V-02172 and 00C010. At BARI, Chakwal (medium rainfall location), two years average (Table 7) showed that highest dry weight producers were Inqlab-91, AS-2000, 1C007, NR-234 and 3C068. Minimum dry weight at maturity was produced by Khyber-87, on the basis of two year average at BARI, Chakwal. The performance of cultivars at AAUR (high rainfall location) was variable during both years. Whereas, performance of cultivars at BARI, Chakwal (medium rainfall location) was almost similar during both years. On the average of two years dry weight at maturity were more at AAUR as compared to BARI, Chakwal. Srialaby *et. al.* (1988) evaluated that drought at tillering or heading showed significant reduction in dry weight at maturity.

Plant height (cm)

Significant differences were observed among genotypes for plant height at both locations during both the years (Tables-2&3). At AAUR (high rainfall location, Table-8) On the basis of two years average, maximum plant height was shown by Suleman-96, 98C017, 3C060, 99FJ016 and V-02169. Minimum plant height was exhibited by No.2495 and 3C066. At BARI, Chakwal (medium rainfall location), Two years average at BARI, Chakwal showed that maximum plant height was attained by Suleman-96, 98C017, 3C060, 99FJ016 and 00BT004. Minimum plant height was shown by No.2495 and 3C066 on the basis of two years average at BARI, Chakwal.

When Table-8 was critically examined it was observed that performance of cultivars at AAUR (high rainfall location) was quite variable during both years. Whereas, performance of cultivars at BARI, Chakwal (medium rainfall location) was almost similar during both years.

On the average of two years plant height were more at AAUR as compared to BARI, Chakwal. Srialaby *et. al.* (1988) evaluated that drought at tillering reduced significantly plant height. Ammar (1999) also suggested that grain yield was indirectly affected by plant height through its significant positive correlation with vegetative period. Number of grains per spike, length of vegetative period, plant height and numbers of days taken to heading were major contributors to grain yield in semi arid areas.

Grain filling period (days)

Significant differences were observed among genotypes for grain filling period at both locations during both the years (Tables-2&3). At AAUR (high rainfall location, Table-9) during 1st year, On the basis of two years average, maximum grain filling period was exhibited by NR-234, 3C066, SH-2000, 3C0663 and Suleman-96. Minimum grain filling period was shown by 3C060 and Haider-2000. At BARI, Chakwal (medium rainfall location), Two years average at BARI, Chakwal showed that maximum grain filling period was shown by SH-2000, Iqbal-2000, Uqab-2000, MAW-1 and 00FJ03. Minimum grain filling period was exhibited by 1C020 and 3C061 on the basis of two year average at BARI, Chakwal. The performance of cultivars at UAAR (high rainfall location) and at BARI, Chakwal (medium rainfall location) was almost similar during both years. On the average of two years grain filling period was low at AAUR as compared to BARI, Chakwal. Attarabashi *et al*. (2002) evaluated that grain filling period exhibited a negative correlation with grain yield.

Grain yield per m^2 (g)

Analysis of variance revealed significant differences among genotypes for grain yield at both locations during both the years (Tables-2&3). At AAUR (high rainfall location, Table-10) On the basis of two years average, maximum grain yield per m^2 was produced by Inqlab-91, 2KC033, 3C061, 1C001 and 3C062. Minimum grain yield was produced by V-02172 and 3C068. At BARI, Chakwal (medium rainfall location), On the basis of two years average at BARI, Chakwal it was observed that highest Grain yield per m^2 producers were Inqlab-91, 2KC033, Saleem-2000, MAW-1 and 99FJ03. Minimum grain yield per m^2 was produced by 3C066 on the basis of two years average at BARI, Chakwal.

When Table-10 was critically examined it was observed that performance of cultivars at AAUR (high rainfall location) was quite variable during both years. Whereas performance of cultivars at BARI, Chakwal (medium rainfall location) was almost similar during both years. On the average of two years Grain yield per m^2 were more at AAUR as compared to BARI, Chakwal. Grain yield showed high sensitivity to moisture stress (Rana *et al*., 1999). Water deficit had significant effects on grain yield which decreased under non-irrigated conditions by 30% and 34% in two trials (Benmoussa and Achouch, 2005).

1000 grain weight (g)

Differences among genotypes for 1000 grain weight at maturity were found significant at both locations during both the years (Tables-2&3). At AAUR, (high rainfall location, Table-11) On the basis of two years average, maximum 1000 grain weight was produced by NR-234, Uqab-2000, Margala-99, Rawal-87, Inqlab-91 and 99FJ016. Minimum 1000 grain weight was produced by 3C063 and Chakwal-97.

At BARI, Chakwal (medium rainfall location), When two years data was averaged for BARI, Chakwal location it showed that highest 1000 grain weight was produced by Uqab-2000, Suleman-96, 99FJ016, NR-234 and 3C069. Minimum 1000 grain weight was produced by 3C066 on the basis of two years average at BARI, Chakwal. When Table-11was critically examined it was observed that performance of cultivars at AAUR (high rainfall location) was almost similar during both years. Whereas, performance of cultivars at BARI, Chakwal (medium rainfall location) was also almost similar during both years. On the average of two years 1000 grain weight was more at AAUR as compared to BARI, Chakwal. A reduction in 1000 grain weight resulted in low grain yield under moisture stress. Therefore selection for 1000 grain weight under moisture stress conditions is recommended for drought resistance in breeding (Sukhorukov, 1989). Number of tillers per m^2, number of days taken to heading, spike length, 1000 grain weight and grain yield were important traits for selection under irrigated and rainfed conditions (Atale and Zope, 1991). Grain yield followed by number of tillers per m^2 and 1000 grain weight showed high sensitivity to moisture stress. Therefore the optimum selection criteria were number of tillers per m^2, number of grains per spike, and 1000 grain weight under irrigated and rainfed conditions and 1000 grain weight and harvest index under rainfed conditions were important characters for selection (Rana *et al*., 1999).

Yield reduction (%)

Differences among genotypes for yield reduction (high rainfall location yield -medium rainfall location yield) were significant during both the years (Table-2&3). During 1^{st} year, Minimum yield reduction was observed for Saleem-2000 (9.06%), MAW-1 (9.56%), Inqlab-91 (9.60%) and 2KC033 (10.42%) (Table-12). Maximum yield reduction (%) was exhibited by 3C066 (36.38%), 3C061 (35.59%), 3C062 (34.31%) and No.2495 (33.36%). During 2^{nd} year, same genotypes showed minimum yield reduction (%) but ranking was changed. Inqlab-91 (7.91%) exhibited minimum yield reduction (%) followed by MAW-1 (8.28%), 2KC033 (8.32) and Saleem-2000 (9.51%). Same trend was observed for cultivars showing maximum yield reduction (%).On the basis of two years average, Inqlab-91 (8.76%), MAW-1 (8.92%), Saleem-2000 (9.29%) and 2KC033 (9.37%) showed minimum yield reduction (%) and 3C061 (34.77%), 3C062 (33.59%), 3C066 (35.4%) and No.2495 (33.33%) showed maximum yield reduction (%) (Table-12).

Conclusion

A number of screening methods have been used; yield reduction (%) was used as selection criteria in present studies as followed by Mohammad, (1999). On the basis of two years screening at AAUR (high rainfall location) and BARI, Chakwal (medium rainfall location), Inqlab-91, MAW-1, Saleem-2000 and 2KC033 were selected as drought tolerant parents, whereas cultivar 2495, 3C061, 3C062 and 3C066 were identified as drought susceptible parents among the material studied.

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Table-1: Name and source of wheat genotypes used in the experiment sown at UAAR and BARI during 1st and 2nd year.

S. No.	Genotype	Source
1	Chakwal-86	Barani Agricultural Research Institute, Chakwal
2	Rawal-87	Barani Agricultural Research Institute, Chakwal
3	Khyber-87	Cereal Crop Research Institute, Pirsabaq, Peshawar
4	Inqlab-91	Wheat Research Institute, *AARI, Faisalabad
5	Suleman-96	Cereal Crop Research Institute, Pirsabaq
6	Chakwal-97	Barani Agricultural Research Institute, Chakwal
7	Margala-99	National Agricultural Research Centre, Islamabad
8	Iqbal-2000	Wheat Research Institute, AARI, Faisalabad
9	Uqab-2000	Wheat Research Institute, AARI, Faisalabad
10	Haider-2000	Cereal Crop Research Institute, Pirsabaq Peshawar
11	Saleem-2000	Cereal Crop Research Institute, Pirsabaq, Peshawar
12	AS-2000	Wheat Research Institute, AARI, Faisalabad
13	SH-2000	Wheat Research Institute, AARI, Faisalabad
14	GA-2000	Barani Agricultural Research Institute, Chakwal
15	MAW-1	Barani Agricultural Research Institute, Chakwal
16	98C017	Barani Agricultural Research Institute, Chakwal
17	00C010	Barani Agricultural Research Institute, Chakwal
18	2KC033	Barani Agricultural Research Institute, Chakwal
19	V-02166	Wheat Research Institute, AARI, Faisalabad
20	V-02172	Wheat Research Institute, AARI, Faisalabad
21	V-02169	Wheat Research Institute, AARI, Faisalabad
22	99FJ016	Barani Agricultural Research Station, Fatehjang, District Attock
23	99FJ03	Barani Agricultural Research Station, Fatehjang, District Attock
24	00FJ03	Barani Agricultural Research Station, Fatehjang,District Attock
25	1C001	Barani Agricultural Research Institute, Chakwal
26	1C002	Barani Agricultural Research Institute, Chakwal
27	1C007	Barani Agricultural Research Institute, Chakwal
28	1C020	Barani Agricultural Research Institute, Chakwal
29	00BT004	Bio-Technology Research Institute, *AARI, Faisalabad
30	No.2495	Regional Agricultural Research Institute, Bahawalpur
31	NR-234	National Agricultural Research Centre, Islamabad
32	3C060	Barani Agricultural Research Institute, Chakwal
33	3C061	Barani Agricultural Research Institute, Chakwal
34	3C062	Barani Agricultural Research Institute, Chakwal
35	3C063	Barani Agricultural Research Institute, Chakwal

36	3C065	Barani Agricultural Research Institute, Chakwal
37	3C066	Barani Agricultural Research Institute, Chakwal
38	3C067	Barani Agricultural Research Institute, Chakwal
39	3C068	Barani Agricultural Research Institute, Chakwal
40	3C069	Barani Agricultural Research Institute, Chakwal

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Table-2: Analysis of variance of forty wheat genotypes under high rainfall conditions (Rawalpindi) during 1st and 2nd year

S.No.	Character	MEAN SQUARES		
		Replications (df=2)	Genotypes (df=63)	Errors (df=126)
1	Number of days to heading	26.00	33.69**	3.71
2	Dry weight at heading	97.79	2657.05**	238.30
3	Number of days to maturity	3.66	25.15**	1.84
4	Dry weight at maturity	336.37	4300.81**	513.20
5	Plant height	4.76	109.82**	1.34
6	Grain filling period	15.44	18.24**	5.11
7	Grain yield	28.20	261.35**	4.54
8	1000 grain weight	8.15	35.35**	5.13

** Significant at 1 percent probability level

Table-3 Analysis of variance of forty wheat genotypes under medium rainfall conditions (Chakwal) during 1st and 2nd year

S.No.	Character	MEAN SQUARES		
		Replications (df=2)	Genotypes (df=63)	Errors (df=126)
1	Number of days to heading	3.35	41.72**	0.57
2	Dry weight at heading	332.63	10725.47**	43.77
3	Number of days to maturity	0.40	16.19**	0.69
4	Dry weight at maturity	105.12	7030.35**	134.46
5	Plant height	3.02	95.00**	1.22
6	Grain filling period	1.54	45.66**	1.30
7	Grain yield	6.85	426.72**	5.45
8	1000 grain weight	0.75	42.16**	0.44

** Significant at 1 percent probability level

Table-4: Number of days to heading of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR			BARI		
		Days taken to heading			Days taken to heading		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	128.67	129.33	129.00	122.67	127.67	125.17
2	Rawal-87	124.33	129.33	126.83	121.00	122.33	121.67
3	Khyber-87	122.00	131.33	126.67	119.67	121.00	120.34
4	Inqlab-91	121.33	126.00	123.67	120.67	116.67	118.67
5	Suleman-96	118.67	119.33	119.00	113.33	116.67	115.00
6	Chakwal-97	119.33	132.00	125.67	116.67	119.33	118.00
7	Margala-99	122.67	129.67	126.17	121.00	126.67	123.84
8	Iqbal-2000	118.00	130.67	124.34	114.33	118.67	116.50
9	Uqab-2000	122.00	135.33	128.67	114.67	119.33	117.00
10	Haider-2000	127.33	135.67	131.50	120.67	126.33	123.50
11	Saleem-2000	117.00	136.00	126.50	114.67	125.00	119.84
12	AS-2000	113.33	126.33	119.83	107.33	125.00	116.17
13	SH-2000	121.67	118.00	119.83	117.33	116.67	117.00
14	GA-2000	121.67	129.67	125.67	117.00	119.67	118.34
15	MAW-1	122.00	130.00	126.00	114.33	119.00	116.67
16	98C017	127.67	126.67	127.17	121.00	125.67	123.33
17	00C010	126.00	126.33	126.17	121.00	121.00	121.00
18	2KC033	121.67	125.67	123.67	116.67	118.33	117.50
19	V-02166	121.00	121.00	121.00	118.00	123.67	120.83
20	V-02172	127.67	123.00	125.33	122.00	126.00	124.00
21	V-02169	117.33	125.33	121.3	114.33	117.67	116.00
22	99FJ016	120.33	123.67	122.00	120.67	120.67	120.67
23	99FJ03	126.67	124.67	125.67	123.00	123.67	123.33
24	00FJ03	118.00	126.00	122.00	115.67	117.67	116.67
25	1C001	122.33	132.00	127.17	118.00	122.33	120.17
26	1C002	124.00	124.67	124.33	116.67	131.33	124.00
27	1C007	119.67	131.00	125.34	115.00	119.33	117.17
28	1C020	127.67	128.00	127.83	125.00	131.33	128.17
29	00BT004	121.00	126.00	123.50	116.00	120.00	118.00
30	2495	111.67	129.33	120.50	106.67	116.33	111.50
31	NR-234	122.00	121.67	121.83	113.67	125.67	119.67
32	3C060	128.00	134.00	131.00	123.33	123.67	123.50
33	3C061	130.33	129.33	129.83	127.33	131.00	129.17
34	3C062	128.33	131.33	129.83	122.67	120.67	121.67
35	3C063	129.67	122.67	126.17	120.00	129.00	124.50
36	3C065	130.00	123.67	126.83	123.33	127.33	125.33
37	3C066	130.67	125.67	128.17	121.33	132.00	126.67
38	3C067	127.33	130.33	128.83	116.00	120.33	118.17
39	3C068	128.67	135.00	131.84	116.67	120.00	118.34
40	3C069	122.00	130.00	126.00	122.00	125.67	123.84
	Average	123.24	127.89	125.57	118.28	122.76	120.52
	CV(%)	0.81	3.17	1.57	1.03	0.60	0.61
	LSD(0.05)	1.62	6.32	3.13	1.99	1.26	1.23

Table-5: Mean dry weight (g) at heading of forty genotypes sown at AAUR and BARI during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR Dry weight at heading			BARI Dry weight at heading		
		1st year	2nd year	Average	1st year	2nd	Average
1	Chakwal-86	293.74	275.60	284.67	205.77	273.57	239.67
2	Rawal-87	237.10	260.23	248.67	215.65	250.93	233.29
3	Khyber-87	201.22	230.77	216.00	164.37	229.70	197.03
4	Inqlab-91	268.67	300.20	284.43	258.80	260.40	259.60
5	Suleman-96	238.13	200.38	219.26	140.12	149.43	144.78
6	Chakwal-97	252.90	297.52	275.21	197.97	251.53	224.75
7	Margala-99	325.56	305.17	315.37	220.23	253.45	236.84
8	Iqbal-2000	235.08	246.60	240.84	230.27	235.05	232.66
9	Uqab-2000	189.40	216.98	203.19	190.28	196.67	193.47
10	Haider-2000	207.16	255.23	231.20	162.30	206.13	184.22
11	Saleem-2000	289.23	303.92	296.58	168.67	293.53	231.10
12	AS-2000	174.50	191.20	182.85	149.98	182.53	166.26
13	SH-2000	278.99	297.80	288.40	155.30	285.12	220.21
14	GA-2000	204.56	205.50	205.03	204.43	202.02	203.23
15	MAW-1	317.19	327.68	322.44	194.40	313.65	254.03
16	98C017	316.13	297.58	306.86	203.83	282.20	243.02
17	00C010	338.18	351.30	344.74	209.73	318.73	264.23
18	2KC033	326.34	385.45	355.90	178.40	318.67	248.54
19	V-02166	266.69	295.37	281.03	209.17	289.68	249.43
20	V-02172	280.90	332.03	306.47	191.27	287.05	239.16
21	V-02169	261.57	211.97	236.77	115.90	113.50	114.70
22	99FJ016	311.30	318.38	314.84	209.17	244.62	226.89
23	99FJ03	316.50	312.33	314.42	185.77	282.02	233.89
24	00FJ03	334.00	345.27	339.63	274.70	254.32	264.51
25	1C001	300.99	300.00	300.50	234.13	230.33	232.23
26	1C002	228.83	277.50	253.17	206.33	247.73	227.03
27	1C007	253.98	268.53	261.26	192.57	248.33	220.45
28	1C020	185.20	285.42	235.31	187.56	202.40	194.99
29	00BT004	223.33	223.53	223.43	157.38	194.03	175.71
30	2495	167.27	237.17	202.22	165.08	162.03	163.56
31	NR-234	182.96	182.37	182.67	169.60	172.20	170.90
32	3C060	273.99	295.37	284.68	174.43	261.67	218.05
33	3C061	333.62	388.40	361.01	199.03	340.07	269.55
34	3C062	212.17	280.58	246.38	206.87	215.83	211.35
35	3C063	317.47	368.48	342.98	211.17	327.37	269.27
36	3C065	276.14	310.18	293.16	212.17	278.33	245.25
37	3C066	253.34	303.80	278.57	235.10	272.43	253.77
38	3C067	341.14	404.30	372.72	195.23	348.67	271.95
39	3C068	275.29	325.02	300.16	208.67	282.07	245.37
40	3C069	220.13	246.80	233.47	183.07	205.45	194.26
	Average	262.77	286.55	274.66	194.37	249.09	221.73
	CV(%)	12.19	5.88	6.4	1.83	4.64	2.59
	LSD(0.05)	40.34	26.61	25.09	7.53	19.39	10.75

Table-6: Number of days to maturity of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR			BARI		
		Days taken to maturity			Days taken to maturity		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	158.67	170.67	164.67	156.67	169.00	162.83
2	Rawal-87	157.67	170.33	164.00	157.00	170.67	163.83
3	Khyber-87	157.00	168.00	162.50	154.33	166.67	160.50
4	Inqlab-91	157.33	165.67	161.50	157.00	163.00	160.00
5	Suleman-96	154.00	168.67	161.34	152.67	165.00	158.84
6	Chakwal-97	156.00	170.33	163.17	155.67	161.33	158.50
7	Margala-99	157.67	170.00	163.83	156.00	170.00	163.00
8	Iqbal-2000	157.00	170.00	163.50	155.33	170.33	162.83
9	Uqab-2000	156.00	172.00	164.00	156.67	169.33	163.00
10	Haider-2000	159.00	171.67	165.33	156.67	167.00	161.83
11	Saleem-2000	156.00	171.00	163.50	155.67	167.00	161.33
12	AS-2000	155.33	167.67	161.50	155.67	160.00	157.83
13	SH-2000	158.00	170.00	164.00	158.33	168.67	163.50
14	GA-2000	158.00	171.00	164.50	157.33	169.00	163.17
15	MAW-1	155.67	171.00	163.33	154.67	170.00	162.33
16	98C017	167.67	171.00	169.33	163.33	165.00	164.17
17	00C010	159.67	169.67	164.67	157.67	169.33	163.50
18	2KC033	157.67	169.00	163.33	156.33	163.00	159.67
19	V-02166	156.00	167.00	161.50	155.67	167.33	161.50
20	V-02172	155.33	168.00	161.67	154.67	166.00	160.33
21	V-02169	154.67	164.67	159.67	150.33	165.67	158.00
22	99FJ016	156.00	172.00	164.00	157.00	159.33	158.17
23	99FJ03	155.33	172.33	163.83	155.33	162.67	159.00
24	00FJ03	155.67	170.00	162.83	155.67	169.00	162.33
25	1C001	156.00	170.00	163.00	154.00	171.00	162.50
26	1C002	156.00	170.33	163.17	153.67	165.67	159.67
27	1C007	155.67	171.00	163.33	154.00	165.67	159.83
28	1C020	157.33	171.00	164.17	157.67	166.00	161.83
29	00BT004	154.67	171.00	162.84	153.00	169.00	161.00
30	2495	154.67	167.67	161.17	151.00	160.33	155.67
31	NR-234	160.67	174.67	167.67	158.67	168.33	163.50
32	3C060	159.67	168.67	164.17	156.67	169.67	163.17
33	3C061	168.67	172.33	170.50	157.67	171.00	164.33
34	3C062	167.67	171.33	169.50	162.67	169.00	165.83
35	3C063	161.67	176.00	168.84	156.67	168.33	162.50
36	3C065	164.67	170.00	167.33	155.33	168.67	162.00
37	3C066	174.33	170.67	172.50	157.67	169.67	163.67
38	3C067	160.00	169.67	164.83	156.67	165.00	160.83
39	3C068	164.67	169.67	167.17	161.00	161.33	161.17
40	3C069	161.67	170.67	166.17	160.00	166.00	163.00
	Average	158.73	170.16	164.45	156.30	166.73	161.51
	CV(%)	1.27	1.04	0.83	0.71	0.67	0.52
	LSD(0.05)	3.27	2.87	2.21	1.80	1.82	1.36

Table -7: Mean dry weight (g)at maturity of forty genotypes sown at AAUR and BARI during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR			BARI		
		Dry weight at maturity			Dry weight at maturity		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	432.50	315.28	373.89	332.37	305.38	318.88
2	Rawal-87	461.00	363.57	412.28	394.67	298.30	346.48
3	Khyber-87	293.50	320.15	306.83	259.67	234.53	247.10
4	Inqlab-91	485.87	439.73	462.80	461.17	435.30	448.23
5	Suleman-96	531.30	341.92	436.61	411.33	349.53	380.43
6	Chakwal-97	451.60	415.07	433.33	406.00	405.00	405.50
7	Margala-99	455.77	316.32	386.04	382.57	320.33	351.45
8	Iqbal-2000	391.33	390.38	390.86	359.33	371.67	365.50
9	Uqab-2000	410.67	419.50	415.09	363.43	410.00	386.715
10	Haider-2000	417.43	408.43	412.93	416.00	393.33	404.67
11	Saleem-2000	355.67	321.80	338.73	316.33	298.33	307.33
12	AS-2000	544.50	371.90	458.20	451.57	425.20	438.38
13	SH-2000	437.00	393.33	415.17	402.50	378.33	390.42
14	GA-2000	415.17	338.72	376.94	328.67	316.72	322.69
15	MAW-1	535.93	430.00	482.97	321.53	406.33	363.93
16	98C017	384.43	360.00	372.22	371.13	358.33	364.73
17	00C010	348.33	327.33	337.83	341.47	308.50	324.98
18	2KC033	420.20	330.00	375.10	305.70	318.37	312.03
19	V-02166	380.83	393.33	387.08	377.57	366.67	372.12
20	V-02172	342.23	305.00	323.62	298.37	285.00	291.68
21	V-02169	462.47	405.07	433.77	406.10	403.33	404.72
22	99FJ016	407.00	390.23	398.62	355.73	360.43	358.08
23	99FJ03	406.50	303.52	355.01	354.50	293.33	323.92
24	00FJ03	396.17	348.38	372.28	347.87	316.67	332.27
25	1C001	439.93	388.53	414.23	355.73	345.00	350.37
26	1C002	454.97	406.67	430.82	372.83	386.67	379.75
27	1C007	538.03	318.33	428.18	430.40	410.00	420.20
28	1C020	412.83	363.57	388.20	365.00	363.33	364.17
29	00BT004	447.30	353.33	400.32	356.17	325.00	340.58
30	2495	390.17	296.77	343.47	325.07	288.63	306.85
31	NR-234	502.33	358.33	430.33	423.23	412.25	417.74
32	3C060	419.93	343.38	381.66	392.37	348.63	370.50
33	3C061	360.23	348.37	354.30	354.07	330.48	342.28
34	3C062	432.33	355.07	393.70	378.17	367.67	372.92
35	3C063	393.17	351.97	372.57	319.77	310.00	314.88
36	3C065	423.50	363.33	393.42	377.10	365.00	371.05
37	3C066	350.93	338.33	344.63	326.37	305.10	315.73
38	3C067	464.70	363.47	414.08	403.23	410.17	406.70
39	3C068	488.77	438.33	463.55	427.40	333.63	380.52
40	3C069	390.80	307.13	348.97	303.10	310.05	306.58
	Average	426.93	361.10	394.02	366.89	349.26	358.08
	CV(%)	10.04	5.25	5.84	5.44	3.40	3.19
	LSD(0.05)	68.51	30.42	36.82	33.08	19.55	18.85

Table -8: Plant height (cm) of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR Plant height			BARI Plant height		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	91.67	99.33	95.50	91.00	96.33	93.67
2	Rawal-87	100.67	104.00	102.33	99.00	101.00	100.00
3	Khyber-87	88.33	96.67	92.50	92.67	93.67	93.17
4	Inqlab-91	95.00	94.67	94.83	94.00	91.67	92.83
5	Suleman-96	112.67	110.00	111.33	109.33	107.00	108.17
6	Chakwal-97	103.67	102.67	103.17	100.33	99.67	100.00
7	Margala-99	106.67	106.67	106.67	101.00	103.67	102.33
8	Iqbal-2000	96.00	104.33	100.17	98.33	101.33	99.83
9	Uqab-2000	99.67	104.00	101.83	101.00	101.00	101.00
10	Haider-2000	97.00	106.33	101.67	101.67	103.33	102.50
11	Saleem-2000	95.67	102.33	99.00	94.00	99.33	96.67
12	AS-2000	88.00	104.00	96.00	89.00	101.00	95.00
13	SH-2000	92.33	93.33	92.83	92.33	90.33	91.33
14	GA-2000	99.33	108.00	103.67	96.00	105.00	100.50
15	MAW-1	100.00	106.67	103.33	98.00	103.67	100.83
16	98C017	103.00	113.33	108.17	105.00	110.33	107.67
17	00C010	94.67	96.00	95.33	93.33	93.00	93.17
18	2KC033	103.00	91.67	97.33	104.67	88.67	96.67
19	V-02166	90.67	94.00	92.33	94.00	91.00	92.50
20	V-02172	92.67	114.00	103.33	92.00	111.00	101.50
21	V-02169	103.00	110.67	106.83	100.67	107.67	104.17
22	99FJ016	104.67	109.33	107.00	104.67	106.33	105.50
23	99FJ03	99.33	95.33	97.33	101.00	92.33	96.67
24	00FJ03	99.67	92.00	95.83	103.33	89.00	96.17
25	1C001	101.33	105.67	103.50	105.00	102.67	103.83
26	1C002	101.67	108.00	104.83	99.67	105.00	102.33
27	1C007	99.33	99.00	99.17	101.33	96.00	98.67
28	1C020	95.67	100.33	98.00	98.33	97.33	97.83
29	00BT004	109.00	104.00	106.50	108.00	101.00	104.50
30	2495	88.33	86.00	87.17	90.00	83.00	86.50
31	NR-234	101.67	95.00	98.33	100.33	92.00	96.17
32	3C060	104.00	111.33	107.67	103.33	108.33	105.83
33	3C061	87.33	93.67	90.50	90.33	90.67	90.50
34	3C062	87.00	99.33	93.17	89.00	96.33	92.67
35	3C063	93.33	99.00	96.17	91.00	96.00	93.50
36	3C065	87.00	99.67	93.33	90.33	96.67	93.50
37	3C066	84.33	92.00	88.17	85.33	89.00	87.17
38	3C067	90.00	95.00	92.50	89.00	92.00	90.50
39	3C068	93.00	89.00	91.00	92.67	86.00	89.33
40	3C069	97.00	93.33	95.17	97.00	90.33	93.67
	Average	96.93	100.74	98.84	97.17	97.74	97.46
	CV(%)	2.14	1.22	1.17	2.11	1.26	1.14
	LSD(0.05)	3.37	1.20	1.88	3.33	1.20	1.80

Table-9: Grain filling period of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR Grain filling period			BARI Grain filling period		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	30.00	41.34	35.67	34.00	41.33	37.67
2	Rawal-87	33.34	41.00	37.17	36.00	48.34	42.17
3	Khyber-87	35.00	36.67	35.84	34.66	45.67	40.17
4	Inqlab-91	36.00	39.67	37.84	36.33	46.33	41.33
5	Suleman-96	35.33	49.34	42.34	39.34	48.33	43.84
6	Chakwal-97	36.67	38.33	37.50	39.00	42.00	40.50
7	Margala-99	35.00	40.33	37.67	35.00	43.33	39.17
8	Iqbal-2000	39.00	39.33	39.17	41.00	51.66	46.33
9	Uqab-2000	34.00	36.67	35.34	42.00	50.00	46.00
10	Haider-2000	31.67	36.00	33.84	36.00	40.67	38.34
11	Saleem-2000	39.00	35.00	37.00	41.00	42.00	41.50
12	AS-2000	42.00	41.34	41.67	48.34	35.00	41.67
13	SH-2000	36.33	52.00	44.17	41.00	52.00	46.50
14	GA-2000	36.33	41.33	38.83	40.33	49.33	44.83
15	MAW-1	33.67	41.00	37.34	40.34	51.00	45.67
16	98C017	40.00	44.33	42.17	42.33	39.33	40.83
17	00C010	33.67	43.34	38.51	36.67	48.33	42.50
18	2KC033	36.00	43.33	39.67	39.66	44.67	42.17
19	V-02166	35.00	46.00	40.50	37.67	43.66	40.67
20	V-02172	27.66	45.00	36.33	32.67	40.00	36.34
21	V-02169	37.34	39.34	38.34	36.00	48.00	42.00
22	99FJ016	35.67	48.33	42.00	36.33	38.66	37.50
23	99FJ03	28.66	47.66	38.16	32.33	39.00	35.67
24	00FJ03	37.67	44.00	40.84	40.00	51.33	45.67
25	1C001	33.67	38.00	35.84	36.00	48.67	42.34
26	1C002	32.00	45.66	38.83	37.00	34.34	35.67
27	1C007	36.00	40.00	38.00	39.00	46.34	42.67
28	1C020	29.66	43.00	36.33	32.67	34.67	33.67
29	00BT004	33.67	45.00	39.34	37.00	49.00	43.00
30	2495	43.00	38.34	40.67	44.33	44.00	44.17
31	NR-234	38.67	53.00	45.84	45.00	42.66	43.83
32	3C060	31.67	34.67	33.17	33.34	46.00	39.67
33	3C061	38.34	43.00	40.67	30.34	40.00	35.17
34	3C062	39.34	40.00	39.67	40.00	48.33	44.17
35	3C063	32.00	53.33	42.67	36.67	39.33	38.00
36	3C065	34.67	46.33	40.50	32.00	41.34	36.67
37	3C066	43.66	45.00	44.33	48.34	37.67	43.01
38	3C067	32.67	39.34	36.01	40.67	44.67	42.67
39	3C068	36.00	34.67	35.34	44.33	41.33	42.83
40	3C069	39.67	40.67	40.17	38.00	40.33	39.17
	Average	35.49	42.27	38.88	38.32	43.97	41.14
	CV(%)	6.04	9.13	5.51	4.25	3.61	2.95
	LSD(0.05)	3.47	6.95	3.68	2.64	2.31	1.86

Table-10: Grain yield per m^2 (g) of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR Grain yield (g)			BARI Grain yield (g)		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	138.70	143.33	141.02	116.83	122.07	119.45
2	Rawal-87	144.67	146.60	145.63	123.20	111.87	117.53
3	Khyber-87	140.03	146.87	143.45	118.40	122.33	120.37
4	Inqlab-91	186.43	185.43	185.93	168.53	170.77	169.65
5	Suleman-96	140.73	144.33	142.53	119.23	121.17	120.20
6	Chakwal-97	143.03	134.00	138.52	117.53	115.33	116.43
7	Margala-99	143.77	144.67	144.22	122.60	126.50	124.55
8	Iqbal-2000	149.00	141.07	145.03	123.03	112.33	117.68
9	Uqab-2000	143.17	141.63	142.40	121.83	104.20	113.02
10	Haider-2000	139.63	145.17	142.40	118.90	122.67	120.78
11	Saleem-2000	146.43	154.17	150.30	133.17	139.50	136.33
12	AS-2000	141.50	129.00	135.25	120.37	108.07	114.22
13	SH-2000	133.47	149.17	141.32	111.57	126.97	119.27
14	GA-2000	143.40	131.40	137.40	120.40	111.93	116.17
15	MAW-1	132.57	152.53	142.55	119.90	139.90	129.90
16	98C017	131.77	145.20	138.48	111.93	113.77	112.85
17	00C010	133.67	152.43	143.05	107.20	124.50	115.85
18	2KC033	161.83	152.23	157.04	144.97	139.57	142.27
19	V-02166	134.70	145.48	140.09	112.73	117.17	114.95
20	V-02172	128.83	140.43	134.63	101.57	106.40	103.98
21	V-02169	124.27	151.87	138.07	102.93	120.07	111.50
22	99FJ016	138.03	147.50	142.77	118.67	113.10	115.88
23	99FJ03	155.43	153.23	154.33	130.00	129.70	129.85
24	00FJ03	123.10	149.22	136.16	102.60	127.40	115.00
25	1C001	163.07	149.70	156.38	124.83	124.37	124.60
26	1C002	139.53	140.97	140.25	118.77	120.40	119.58
27	1C007	141.00	145.63	143.32	119.53	120.50	120.02
28	1C020	134.23	147.50	140.87	111.00	119.67	115.33
29	00BT004	137.53	149.15	143.34	116.20	121.63	118.92
30	2495	151.97	153.40	152.68	101.27	102.63	101.95
31	NR-234	130.50	152.50	141.50	111.00	118.93	114.97
32	3C060	132.23	141.57	136.90	110.50	110.90	110.70
33	3C061	157.53	155.33	156.43	101.47	102.57	102.02
34	3C062	156.60	153.17	154.88	102.87	102.83	102.85
35	3C063	136.40	148.03	142.22	106.33	126.07	116.20
36	3C065	148.60	145.67	147.13	125.83	116.77	121.30
37	3C066	151.37	158.33	154.85	96.30	103.83	100.07
38	3C067	140.93	135.17	138.05	109.87	114.50	112.18
39	3C068	131.53	137.83	134.68	110.10	114.70	112.40
40	3C069	125.03	144.50	134.77	107.67	123.13	115.40
	Average	141.91	147.14	144.52	116.54	119.77	118.15
	CV(%)	2.13	2.06	1.47	3.02	2.23	1.98
	LSD(0.05)	4.91	4.93	3.47	5.73	4.35	3.80

Table-11: 1000 Grains weight (g) of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Locations					
		AAUR 1000 Grains wt.			UAAR 1000 Grains wt.		
		1st year	2nd	Average	1st year	2nd	Average
1	Chakwal-86	49.12	50.78	49.95	48.57	42.07	45.32
2	Rawal-87	53.04	53.06	53.05	50.90	40.93	45.92
3	Khyber-87	51.54	51.91	51.73	51.21	38.07	44.64
4	Inqlab-91	59.23	46.86	53.05	55.33	38.77	47.05
5	Suleman-96	53.43	49.42	51.43	51.88	46.87	49.38
6	Chakwal-97	41.11	43.82	42.47	40.17	41.87	41.02
7	Margala-99	54.80	51.82	53.31	52.68	40.20	46.44
8	Iqbal-2000	50.17	51.65	50.91	51.94	41.27	46.61
9	Uqab-2000	58.31	53.56	55.94	53.68	45.83	49.76
10	Haider-2000	51.09	49.48	50.29	48.92	42.47	45.70
11	Saleem-2000	53.90	50.69	52.30	48.81	38.93	43.87
12	AS-2000	51.14	47.09	49.12	49.08	43.47	46.28
13	SH-2000	51.58	46.72	49.15	48.95	35.13	42.04
14	GA-2000	48.55	48.49	48.52	49.73	43.73	46.73
15	MAW-1	53.56	49.54	51.55	51.02	40.57	45.80
16	98C017	43.41	46.07	44.74	42.98	42.20	42.59
17	00C010	50.22	40.68	45.45	46.20	28.37	37.29
18	2KC033	54.23	38.00	46.12	49.23	41.91	45.57
19	V-02166	51.58	49.72	50.65	49.71	33.97	41.84
20	V-02172	51.36	51.26	51.31	49.43	41.53	45.48
21	V-02169	47.93	46.61	47.27	46.69	38.40	42.55
22	99FJ016	50.96	53.74	52.36	52.44	45.47	48.95
23	99FJ03	49.66	50.60	50.13	31.90	43.43	37.67
24	00FJ03	44.69	41.20	42.94	43.40	41.07	42.23
25	1C001	46.45	46.90	46.68	51.29	37.03	44.17
26	1C002	51.71	49.62	50.67	31.37	41.60	36.48
27	1C007	50.26	48.97	49.62	48.18	40.23	44.21
28	1C020	49.24	50.59	49.92	44.26	44.07	44.16
29	00BT004	51.93	51.99	51.96	50.86	42.80	46.83
30	2495	51.29	51.53	51.41	49.48	43.57	46.52
31	NR-234	56.21	55.76	55.99	49.81	44.80	47.31
32	3C060	47.12	47.91	47.52	48.74	41.73	45.24
33	3C061	45.56	42.07	43.81	43.52	42.52	43.02
34	3C062	41.32	43.73	42.53	40.63	43.49	42.06
35	3C063	45.12	37.33	41.23	38.95	40.13	39.55
36	3C065	49.79	50.72	50.26	49.14	40.37	44.76
37	3C066	40.54	54.05	47.30	40.42	31.37	35.89
38	3C067	46.40	50.27	48.34	46.11	44.10	45.11
39	3C068	43.09	47.50	45.30	40.27	43.17	41.72
40	3C069	47.04	48.48	47.76	46.94	47.43	47.19
	Average	49.69	48.50	49.10	47.12	41.12	44.12
	CV(%)	4.25	9.63	5.07	2.23	1.90	1.37
	LSD(0.05)	3.34	6.43	3.68	1.76	1.50	1.08

Table-12: Grain yield reduction (% age) of forty genotypes sown at AAUR and BARI, Chakwal during 1st and 2nd year

S. No.	Genotypes	Yield Reduction (%)					
		1st year			2nd year		
		AAUR	BARI	Reduction (%)	AAUR	BARI	Reduction (%)
1	Chakwal-86	138.70	116.83	15.77	143.33	122.07	14.82
2	Rawal-87	144.67	123.20	14.85	146.60	111.87	23.69
3	Khyber-87	140.03	118.40	15.42	146.87	122.33	16.69
4	Inqlab-91	186.43	168.53	9.6	185.43	170.77	7.91
5	Suleman-96	140.73	119.23	15.27	144.33	121.17	16.04
6	Chakwal-97	143.03	117.53	17.86	134.00	115.33	13.92
7	Margala-99	143.77	122.60	14.76	144.67	126.50	12.55
8	Iqbal-2000	149.00	123.03	17.44	141.07	112.33	20.35
9	Uqab-2000	143.17	121.83	14.88	141.63	104.20	26.36
10	Haider-2000	139.63	118.90	14.85	145.17	122.67	15.48
11	Saleem-2000	146.43	133.17	9.06	154.17	139.50	9.51
12	AS-2000	141.50	120.37	14.94	129.00	108.07	16.22
13	SH-2000	133.47	111.57	16.41	149.17	126.97	14.9
14	GA-2000	143.40	120.40	16.01	131.40	111.93	14.75
15	MAW-1	132.57	119.90	9.56	152.53	139.90	8.28
16	98C017	131.77	111.93	15.04	145.20	113.77	21.61
17	00C010	133.67	107.20	19.76	152.43	124.50	18.32
18	2KC033	161.83	144.97	10.42	152.23	139.57	8.32
19	V-02166	134.70	112.73	16.32	145.48	117.17	19.42
20	V-02172	128.83	101.57	21.14	140.43	106.40	24.23
21	V-02169	124.27	102.93	17.12	151.87	120.07	20.92
22	99FJ016	138.03	118.67	14.01	147.50	113.10	23.32
23	99FJ03	155.43	130.00	16.38	153.23	129.70	15.38
24	00FJ03	123.10	102.60	16.64	149.22	127.40	14.61
25	1C001	163.07	124.83	23.38	149.70	124.37	16.91
26	1C002	139.53	118.77	14.88	140.97	120.40	14.61
27	1C007	141.00	119.53	15.24	145.63	120.50	17.2
28	1C020	134.23	111.00	17.2	147.50	119.67	18.83
29	00BT004	137.53	116.20	15.5	149.15	121.63	18.39
30	2495	151.97	101.27	33.36	153.40	102.63	33.1
31	NR-234	130.50	111.00	14.96	152.50	118.93	21.89
32	3C060	132.23	110.50	16.43	141.57	110.90	21.61
33	3C061	157.53	101.47	35.59	155.33	102.57	33.96
34	3C062	156.60	102.87	34.31	153.17	102.83	32.86
35	3C063	136.40	106.33	22.02	148.03	126.07	14.85
36	3C065	148.60	125.83	15.35	145.67	116.77	19.81
37	3C066	151.37	96.30	36.38	158.33	103.83	34.43
38	3C067	140.93	109.87	22.06	135.17	114.50	15.27
39	3C068	131.53	110.10	16.29	137.83	114.70	16.8
40	3C069	125.03	107.67	13.89	144.50	123.13	14.79
	Average	141.91	116.54	17.76	147.14	119.77	18.58
	CV(%)	2.13	3.02	11.75	2.06	2.23	9.22
	LSD(0.05)	4.91	5.73	3.39	4.93	4.35	2.78

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