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Morphological Quantitative Characterization of Wheat (*Triticum aestivum* L.) Genotypes under Normal and Late Sown Conditions

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Abstract: ***A field Experiment was conducted at research farm of Department of Seed Science and Technology, CCS HAU, Hisar, during Rabi 2016-17 to study "Morphological quantitative characterization of wheat (Triticum aestivum L.) genotypes under normal and late sown conditions". The 30 wheat genotypes (WH 157, WH 283, WH 542, WH 711, WH 1021, WH 1025, WH 1080, WH 1105, WH 1124, WH 1127, WH 1142, WH 1202, WH 1221, WH 1316, WH 1320, WH 1322, C 306, P 13729, DBW 88, DBW 90, DPW 621-50, HD 2967, HD 3059, HD 3086, KRL 19, KRL 210, PBW 550, PBW 723, PBW 725, RAJ 3765) were grown at two different sowing dates i.e. normal (6th Nov. 2016) and late (24th Dec. 2016) in Randomized Block Design (RBD) with three replication. The quantitative traits decreased significantly under late sown conditions as compared to normal sown condition. None of the genotype had very long or very short awns in normal sown conditions. But, in late sown condition one genotype WH 542 was noted very short awns length. Five genotypes (PBW 723, PBW 725, WH 1105, WH 1127 and P 13929)had long ear length in both sowing conditions. The beak length significantly increased with delay in sowing. Among all the genotypes, only one genotype (WH1322) had short, and two genotypes (PBW 550 and WH 1316) had very long lower glume beak length. In late sown condition, most of the genotypes reduced their days to heading, anthesis and maturity were completed their life cycle early to combat the stress. The pattern of days of anthesis was followed by days to maturing. The environment and temperature had significant effect on physiological maturity of crop. In normal sown condition, all the genotypes had higher number of spikelets per plant as compared to the late sown condition. The seed yield of wheat genotypes was influenced by the time of sowing. The higher seed yield of wheat was produced under normal sown conditions.***
Keywords: Wheat genotypes; Morphological; Quantitative; Sowing dates

1. Introduction

Wheat (*Triticumaestivum* L.) is one of the most extensively grown crop in the World. In India, bread wheat, an allohexaploid (AABBDD) with total of 42 chromosomes is most important species, covering more than 90 percent of the total wheat cultivated area in the country and is the second most important source of staple food after rice. It was grown on an area of 30.72 million ha with total production of 97.44 million tonnes and productivity of 3172 kg/ha during 2016-17.Haryana has grown wheat over an area of 2.54 million ha with production of 11.14 million tonnes and highest productivity of 4390 kg/ha in the country (Anonymous, 2017).

Genetic purity maintenance of varieties is of primary importance for preventing varietal deterioration during successive regeneration cycles and ensuring expected varietal performance level. Accurate identification of varieties is not only a pre requisite for DUS testing, but it is also important for the quality seed

production. India being a signatory to Trade Related Aspects of Intellectual Property Rights has enacted an agreement with member states which casts obligation to them to provide a system of plant variety protection either through patent or *sui generis* system or in combination. 'Protection of Plant Varieties and Farmers' Rights (PPV&FR)' Act 2001 was enacted to encourage public/private investment in research and development of new plant varieties by giving protection to different categories of plant varieties against unauthorized multiplication of seeds or propagating materials for a specified period (Anonymous, 2011). Protection and registration of new variety of plant is possible, if it confirms to the guidelines of criteria of Novelty, Distinctness, Uniformity and Stability (NDUS) guidelines fixed for that crop as prescribed by PPV&FR authority (Anonymous, 2007).

The qualitative and quantitative traits are often used to assess and describe wheat characters due to their role in the estimation of genetic diversity and discrimination of closely related types (Al Khanjari*et al.*, 2008). Seed shape, color and size are also used to identify wheat varieties (Dubey*et al.*, 2006). Seed size is of prime importance in basic plant research, since, plant reproduction, seed formation and development have significant effects, even in cereal breeding as a related trait for yield and vigour (Whan*et al.*, 2014).Heat stress at the beginning of flowering or during spikelet development reduces the number of potential grains. Therefore, high temperature spell from anthesis to grain filling and upto grain maturity deteriorates the grain quality and reduces the grain yield upto40-50 percent (Joshi *et al.*, 2007) because of the less time to utilize systematically natural resources. Winter cereals have many different physiological and morphological mechanisms that allow them to survive at low temperatures. Moreover, the low autumn temperatures adjust winter crops vernalization requirement to switch from the vegetative to the anthesis stage and flower normally in the spring (Herman *et al*., 2006 and Trevaskis*et al*., 2007).

The proper sowing time of various field crops is governed by the environmental requirements for the crop and for actual expression of character of a genotype. Time of sowing of a specific variety in a particular climatic condition exerts a profound effect on agronomic characters and physiological processes. Proper time of sowing help cultivars to express its growth patterns to its full extent in a diverse set of environmental dynamics beside genotype's environmental interaction. Other environmental factors like temperature, rainfall, humidity, solar radiation and soil types also contribute much towards the varietal performance under given locality (Paul, 1992).Keeping in view the above fact, the present study was conducted.

2. Material and Methods

The field experiment was conducted in Department of Seed Science and Technology, CCS HAU, Hisar during rabi 2016-17. The 30 wheat genotypes were grown at two different sowing dates *i.e.*D_1. normal (6^{th} Nov. 2016) and D_2. late (24^{th} Dec. 2016) in Randomized Block Design (RBD) with three replication. The seeds of 30 wheat genotypes were collected from the Wheat and Barley Section, Department of Genetics and Plant breeding, CCS HAU, Hisar. The genotypes were sown in five rows of four meter length at 20 cm row to row distance in each replication. All the recommended agronomical package and practices were followed for good crop stand. The wheat plants were observed in each replication of 30 genotypes in both sowing dates and data was recorded at different stages of plant growth as per guidelines published for DUS testing of wheat by Plant Variety and Farmers' Right Authority (PPV & FRA). The overall performance of quantitative traits (Plant height, ear length, awn length, flag leaf length, flag leaf width, beak length, days to heading, anthesis and maturity, number of spikelets, number of tillers and grain yield per plot) under normal and late sowing dates were measured as per standard methods. Based on plant height (excluding awns), genotypes were grouped into classes as very short (<75 cm), short (76- 90 cm), medium (91 – 105 cm) long (106-120 cm) and very long (>120 cm).The ear length parameter was also coded as: very short (< 6.0 cm), short (6.1 - 8.0 cm), medium (8.1 - 10.0 cm), long (10.1 -12.0 cm), and very long (> 12cm). The length of awns were grouped into five categories as very short (< 6.0 cm), short (6.0 - 7.5 cm), medium (7.6 - 9.0 cm), long (9.0-10.5 cm) and very long (> 10.5 cm).The flag leaf length was taken in centimeters (cm) and classified as short (<25 cm), medium (25-30 cm) and long (>30 cm). The flag leaf width was coded as narrow (<2.0 cm), medium (2.0-2.4 cm) and broad (>2.4 cm). The length of the beak was categorized as very short (<1.0 mm), short (1.1 - 2.9 mm), medium (3.0– 5.0 mm), long (5.1– 7.0 mm) and very long (>7.0 mm). Days to heading, the genotypes were grouped as very early (<80 days), early (81-90 days) and medium (91-100 days). Days to anthesis were grouped as very early (<90 days), early (91-99 days) and medium (>100 days). Days to maturity were grouped as early (126-135 days), medium (136-145 days), late (146-155 days) and very late (>155 days). The number

of spikelets were counted and averaged. All the genotypes were classified into following three categories *i.e.* low (17.0-18.5), medium (18.6-20.0) and high (> 20).

3. Results and Discussion

Quantitative characters are the variable ones which change according to the environment such as increased temperature, salinity, droughts etc. and the availability of nutrients. The characters like plant height, tillers, leaf characters like leaf length, breadth, area, yield and yield attributing characters like spike length, number of spikelet's per spike, grains per spike and grain yield are very easily influenced by environment.

Plant height is a determining character of genotypes and in the present study, genotypes showed a wide variation in plant height which grouped the genotypes into five classes *i.e.* very short, short, medium, long and very long (Table 1). It is a heritable character and used for varietal characterization though, it can be affected by environment. C 306 was recorded tallest and WH 711 was shortest among 30 genotypes under both sowing conditions.

The genotypes can also be differentiated on the basis of ear characters like ear length and awn length. These characters are more stable and variety specific. In present study, 30 genotypes had medium to very long ear length. Though, drastic reduction was observed in ear length in late sown condition as compared to normal. Five genotypes (PBW 723, PBW 725, WH 1105, WH 1127 and P 13929)had long ear length in both sowing conditions whereas, the numerical value was decreased. Thirty genotypes studied for the presence of awns which do not show much variation because in all the genotypes awns were present. All the genotypes were grouped only for awn length*i.e.*very short, short and medium.

Table 1.Diagnostic plant characters for varietal genotype identification in wheat (*Triticum aestivum* L.)on the basis of quantitative traits under late and normal sown conditions

Genotypes	Plant height (cm)		Ear length (cm)		Awns length (cm)		Flag leaf length (cm)	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
WH 1025	M 103	M 95	VL 12.20	L 10.30	M 7.70	S 7.30	M 29.3	S 23.0
WH 1080	M 102	M 94	M 9.70	M 9.40	S 7.20	S 7.30	M 26.7	S 23.0
WH 1142	M 102	M 94	L 10.70	M 10.00	S 7.60	M 8.00	M 27.3	M 25.7
C 306	L 145	L 125	M 9.40	M 8.90	M 8.00	M 8.30	M 29.8	M 25.7
HD 2967	L 107	M 95	L 10.70	M 9.30	S 7.10	M 8.30	M 26.3	S 24.0
HD 3086	M 96	M 90	L 10.50	M 9.70	S 6.70	S 7.00	M 27.9	M 26.7
KRL 19	M 92	S 84	L 10.70	M 9.60	S 6.70	L 9.30	M 30.0	M 25.7
KRL 210	M 102	M 92	M 9.80	M 9.60	M 8.00	S 6.70	M 27.4	M 26.0
DBW 88	L 108	L 96	L 10.70	M 10.00	M 8.00	S 7.00	M 28.3	S 24.7
DPW 621-50	M 101	M 94	M 9.60	M 9.30	M 7.70	M 7.70	M 28.3	M 25.3
PBW 550	S 86	M 81	L 11.00	M 10.10	S 6.60	S 7.10	M 28.3	M 27.3
PBW 723	M 105	M 97	L 11.10	L 10.90	S 6.60	M 8.00	M 26.0	S 24.7
PBW 725	M 105	M 91	L 10.70	L 10.20	S 7.20	M 7.70	M 27.7	S 23.7
WH 157	M 104	S 86	L 10.80	M 10.00	M 8.70	M 9.00	M 28.0	S 21.3
WH 283	M 92	S 89	VL 12.03	M 10.10	S 7.10	M 7.70	L 31.7	M 25.3
WH 542	S 88	S 84	M 10.00	M 8.90	S 6.70	VS 5.70	M 27.8	S 20.3
WH 711	S 81	S 75	L 10.30	M 9.50	M 7.80	S 6.30	M 27.1	S 22.7
WH 1105	M 102	M 91	L 11.20	L 10.40	M 7.70	S 7.00	L 31.3	M 28.3
WH 1127	L 113	M 102	L 10.70	L 10.50	S 7.60	M 7.70	M 29.1	M 26.7
WH 1221	L 107	M 90	VL 12.20	L 11.20	M 7.70	S 7.00	L 30.7	M 26.7
WH 1202	M 99	M 94	M 10.10	M 9.20	M 8.50	M 8.00	M 28.7	M 25.3
WH 1316	L 107	M 98	L 12.60	L 10.70	S 7.10	M 7.70	M 28.0	M 25.3
WH 1320	L 107	M 92	L 10.50	M 9.20	S 6.50	S 6.70	S 24.3	S 19.3
WH 1322	L 107	M 97	L 10.70	M 9.60	S 6.80	S 6.30	L 30.3	M 28.3
P 13729	M 102	M 95	L 11.20	L 10.60	S 6.90	S 7.00	M 29.8	M 29.0
HD 3059	M 103	M 97	L 10.60	M 9.40	M 7.80	S 7.00	M 28.0	S 21.0
DBW 90	M 103	M 97	L 10.30	M 9.50	S 7.40	M 8.00	M 26.7	S 24.7
WH 1021	L 112	M 94	VL 12.90	L 10.80	M 8.40	M 7.70	M 30.0	S 24.3
WH 1124	L 107	S 89	M 9.40	M 8.90	S 7.60	M 7.70	L 30.1	S 22.0

RAJ 3765	M 103	M 92	VL 12.07	M 9.60	S 7.60	M 8.00	M 29.7	M 28.3
SEM	**0.8**	**0.50**	**0.07**	**0.06**	**0.11**	**0.17**	**0.42**	**0.49**
CD	**2.26**	**1.43**	**0.21**	**0.18**	**0.30**	**0.47**	**1.20**	**1.39**

L=Long, M= Medium, S=Short, VL= Very long

Table 2.Diagnostic plant characters for varietal genotype identification in wheat (*Triticum aestivum* L.)on the basis of quantitative traits under late and normal sown conditions

Genotypes	Flag leaf width (cm)		Beak length (cm)		Days to heading		Days to anthesis	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
WH 1025	M 1.83	M 1.73	M 3.30	M 4.10	M 115	E 86	M 120	V.E 89
WH 1080	M 1.97	M 1.80	M 3.80	L 6.10	M 103	V.E 78	M 112	V.E 83
WH 1142	B 2.30	M 1.90	M 3.80	M 4.70	E 87	E 82	E 93	V.E 85
C 306	M 1.77	M 1.70	M 3.10	M 5.00	M 99	V.E 79	M 106	V.E 83
HD 2967	M 2.00	M 1.93	M 4.90	L 7.00	E 87	E 81	E 94	V.E 86
HD 3086	M 1.90	M 1.80	M 4.00	L 5.50	E 81	V.E 78	V.E 88	V.E 84
KRL 19	B 2.13	B 2.03	M 4.00	M 4.90	E 89	V.E 77	E 97	V.E 81
KRL 210	M 1.93	M 1.80	M 3.60	L 5.70	E 81	V.E 78	V.E 89	V.E 84
DBW 88	B 2.20	M 1.93	L 6.10	V.L 7.40	E 91	E 82	M 102	V.E 86
DPW 621-50	M 1.97	M 1.70	M 4.80	V.L 7.30	E 89	V.E 80	E 96	V.E 85
PBW 550	M 1.97	M 1.80	V.L 9.40	V.L 9.40	E 86	V.E 77	E 91	V.E 81
PBW 723	B 2.13	M 1.90	L 5.30	L 5.10	E 89	E 82	E 96	V.E 86
PBW 725	B 2.40	M 1.87	L 5.90	L 6.90	E 89	E 82	E 98	V.E 86
WH 157	M 1.97	M 1.87	M 3.70	M 4.20	E 89	V.E 75	E 94	V.E 81
WH 283	M 1.77	M 1.67	M 3.10	M 3.10	E 86	V.E 73	E 91	V.E 77
WH 542	M 1.83	M 1.63	M 4.50	L 5.60	M 99	V.E 80	M 104	V.E 85
WH 711	M 1.80	M 1.67	M 3.10	S 2.60	M 100	E 83	M 108	V.E 86
WH 1105	B 2.37	B 2.10	L 6.20	L 6.90	E 88	V.E 79	E 96	V.E 83
WH 1127	B 2.03	M 1.93	M 3.90	L 6.00	M 98	E 85	M 106	V.E 88
WH 1221	B 2.40	B 2.10	L 6.20	V.L 7.10	E 89	E 83	E 96	V.E 86
WH 1202	B 2.10	M 1.93	M 3.90	L 5.40	E 83	V.E 78	E 92	V.E 83
WH 1316	B 2.53	B 2.17	V.L 7.80	V.L 9.40	E 91	V.E 79	E 98	V.E 84
WH 1320	B 2.20	M 1.87	M 3.60	L 5.10	E 89	E 82	E 99	V.E 86
WH 1322	B 2.20	M 1.87	S 2.50	M 3.20	M 92	E 83	E 97	V.E 86
P 13729	B 2.37	B 2.17	L 5.50	V.L 8.30	E 84	V.E 77	E 92	V.E 83
HD 3059	B 2.23	M 2.00	M 4.70	L 5.50	E 85	V.E 80	E 94	V.E 84
DBW 90	B 2.03	M 1.77	M 4.20	L 5.20	E 83	V.E 77	E 93	V.E 83
WH 1021	M 1.83	M 1.67	M 5.00	L 6.40	E 83	V.E 78	E 91	V.E 83
WH 1124	M 2.00	M 1.70	M 3.90	M 4.90	E 85	V.E 79	E 93	V.E 85
RAJ 3765	M 1.90	M 1.70	L 7.00	V.L 9.10	E 91	V.E 76	E 99	V.E 79
SEM	**0.07**	**0.06**	**0.07**	**0.08**	**0.50**	**0.40**	**0.57**	**1.07**
CD	**0.19**	**0.16**	**0.21**	**0.24**	**1.42**	**1.15**	**1.62**	**0.39**

L=Long, M= Medium, S=Short, V.L= Very long, B=Broad, E=Early, V.E=Very early

Presence of awns is a good agronomic character because they also do photosynthesis at green stage and act an effective tool against herbivore. None of the genotype had very long or very short awns in normal sown conditions. But, in late sown condition one genotype WH 542 was noted very short awns length. Moreover, awns have been reported to contribute about 60 percent of total spike photosynthesis (Teare *et al.* 1972). Rehman *et al.* (2006), Mengistu *et al.* (2015), Goel *et al.* (2015), and Singh *et al.* (2014) also observed the similar results in their study on different varieties of wheat and grouped them into different categories on the basis of awn length.

Lower glume beak length is a good heritable character and on the basis of this character the genotypes were grouped into short, medium, long and very long type. Among all the genotypes, only one genotype (WH1322) had short, and two genotypes (PBW 550 and WH 1316) had very long lower glume beak length.. This experiment observed that there was significant increase in beak length by delay in sowing; also there was significant difference

among the genotypes, sowing dates. This trait was documented by Tasnuva*et al*. (2010) and Malik *et al.* (2014) for the characterization of wheat genotypes and they reported that beak length is key character for identification of wheat varieties.

Table 3.Diagnostic plant characters for varietal genotype identification in wheat (*Triticum aestivum* L.)on the basis of quantitative traits under late and normal sown conditions

Genotypes	Days to Maturity		No. of spikelet per spike		Effective tillers per row meter length		Seed yield (kg/ha)	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
WH 1025	late 154	E 115	M 18	L 16	135	123	5227	2742
WH 1080	late 152	E 112	H 19	L 18	104	88	4621	3485
WH 1142	M 139	E 113	M 22	M 20	100	89	5985	4008
C 306	late 148	E 116	M 20	L 18	98	93	3636	3091
HD 2967	M 140	E 114	L 20	M 19	110	76	4924	3682
HD 3086	M 139	E 112	M 18	L 17	129	75	6379	3924
KRL 19	E 136	E 115	L 20	L 18	123	77	4545	2500
KRL 210	M 140	E 112	M 18	L 16	125	78	5303	3386
DBW 88	M 144	E 115	M 20	L 18	89	81	4848	3258
DPW 621-50	M 143	E 115	M 20	M 19	103	95	5455	3977
PBW 550	E 135	E 111	M 19	L 18	104	79	4545	3250
PBW 723	M 140	E 114	M 20	L 18	101	92	6212	4295
PBW 725	M 140	E 114	M 20	L 18	124	76	4545	2803
WH 157	E 132	E 113	L 19	L 17	99	90	5303	3652
WH 283	E 133	E 112	H 18	L 16	96	84	4773	2561
WH 542	M 141	E 113	M 22	M 20	105	94	5000	4144
WH 711	M 141	E 116	M 19	L 18	87	83	4924	3780
WH 1105	M 142	E 113	M 20	M 19	96	62	5379	3417
WH 1127	M 145	E 116	M 19	L 18	104	99	5909	3992
WH 1221	M 141	E 116	M 20	M 19	87	77	6136	3909
WH 1202	M 143	E 112	M 19	L 18	113	105	5909	4136
WH 1316	M 143	E 113	M 20	M 19	91	87	4848	4159
WH 1320	M 146	E 118	M 20	L 18	89	68	4750	3341
WH 1322	M 144	E 116	H 20	L 18	138	83	4765	4091
P 13729	M 140	E 112	M 21	M 20	85	72	5424	4023
HD 3059	M 143	E 116	M 19	L 18	93	80	5227	3697
DBW 90	M 141	E 112	M 19	L 18	111	98	5000	4205
WH 1021	E 133	E 112	M 20	M 19	88	77	4697	3288
WH 1124	M 142	E 114	M 19	L 17	129	73	4773	3394
RAJ 3765	M 141	E 113	M 20	L 18	119	95	5303	3568
SEM	0.56	0.43	0.54	0.56	0.81	0.72	124	93
CD	1.59	1.22	1.53	1.60	2.30	2.03	352	264

L=Low, M= Medium, E=Early, H= High

Days to heading, anthesis and maturity are important traits to be studied for genotypes grown in North Western Plains Zone (NWPZ) conditions, since, drastic change in temperature affect the wheat crop in late sown condition. In late sown condition, most of the genotypes reduced their days to heading, anthesis and maturity were completed their life cycle early to combat the stress. The pattern of days of anthesis was followed by days to maturing. The results revealed that environment and temperature had significant effect on physiological maturity of crop. During high temperature crop complete its life cycle in short period and this negatively affects the biological and economic yield of the crop. Lima-Brito *et al.* (2006) also used these characters for classification of wheat genotypes. The number of spikelets per spike was examined for their practical utility and differentiated into different groups *i.e.* low, medium and high. In normal sown condition,

all the genotypes had higher number of spikelets per plant as compared to the late sown condition. Zhang *et al.* (2015) have also reported variation in the spikelet number of common wheat varieties grown in autum sown region. The results revealed that increase in temperature had adverse effect on spikelet number. Erkul *et al.* (2010) and Laghari *et al.* (2010) also documented in their studies that increase in temperature reduced the spikelet number in wheat and ultimately decrease the economic yield. The higher seed yield of wheat was produced under normal sown conditions. Sarkar *et al.* (2001) observed that early maturing genotype showed better performance under high temperature stress condition with less reduction in grain yield and had relatively higher grain growth attributes with more tolerance to heat stress for most of the yield attributing characters. They also reported that grain growth rate and heat susceptibility index could be taken as important criteria for breeding genotypes acclimatized to late planting condition. The performance of different wheat genotypes under late sown conditions was evaluated by Rashid *et al.* (2004). Grain yield obtained from December 15 sowing was significantly higher than December 30 sowing. Different genotypes showed no significant variation in respect of grain yield. The interaction effect showed that plant height, ear length, number of grain per ear and straw yield were significantly better in December 15 sowing than December 30 sowing while number of effective tillers per plant and number of grain were not significantly influenced by date of sowing. The physiological characteristics of winter wheat (cv. Shiraz) were studied by Mumtazi *et al.* (2005) with three sowing dates and four planting densities indicating that delay in sowing was associated with a significant reduction in the grain yield. So, that the grains yield in sowing date of January 5th was significantly less than in sowing dates of November 6th and December 6th. Moreover, with delay in sowing date, the developmental rate of wheat was enhanced and plants reached maturity more rapidly.

4. Conclusion

The quantitative traits decreased significantly under late sown conditions as compared to normal sown condition. None of the genotype had very long or very short awns in normal sown conditions. But, in late sown condition one genotype WH 542 was noted very short awns length. Five genotypes (PBW 723, PBW 725, WH 1105, WH 1127 and P 13929) had long ear length in both sowing conditions. The beak length significantly increased with delay in sowing. Among all the genotypes, only one genotype (WH1322) had short, and two genotypes (PBW 550 and WH 1316) had very long lower glume beak length. In late sown condition, most of the genotypes reduced their days to heading, anthesis and maturity were completed their life cycle early to combat the stress. The pattern of days of anthesis was followed by days to maturing. The environment and temperature had significant effect on physiological maturity of crop .In normal sown condition; all the genotypes had higher number of spikelets per plant as compared to the late sown condition. The seed yield of wheat genotypes was influenced by the time of sowing. The higher seed yield of wheat was produced under normal sown conditions.

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List of Publications

- One abstract entitled "Effects of integrated nutrient management on yield attributes and yield of wheat (*Triticum aestivum* L.) under irrigated condition" published in Golden Jubilee International Conference. Organized by Directorate of Research CCS Haryana Agricultural University on Nov-6-2019.
- One abstract entitled "Response of late sown wheat (*Triticum aestivum* L.) to organics" published in International Symposium: A need for sustainable Agriculture. Organized by Directorate of Research CCS Haryana Agricultural University on Feb-2-2019.
- Ainullah Habibi, Tamim Fazily and Abdul Hasib Halimi (2019). Varietal response of wheat to water stress condition of Baghlan province, Afghanistan. *SSRG International Journal of Agriculture and Environmental Science*. 6(3): 43-46.
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