ANNUAL REPORT

2016-17

WHEAT RESEARCH INSTITUTE

FAISALABAD

CONTENTS

INTRODUCTION

Wheat is important crop of Pakistan. It fulfill the dietary requirement of food for the people of Pakistan. At the time of wheat sowing the condition of the season was harsh. The first rain was received at the end of the month of January2017. At this time the crop has completed its tillering. The govt has fixed the target of wheat sowing area 6800 000he which is lesser than the last year area with a production of 19500tonnes which is also less than the last year. However the per ha yield was more than the last year. The area , production and average yield kg ha^{-1} for the last years is presented below.

Years	Area 000 Ha		Production 000 tonnes		Average Yield kg ha^{-1}	
	Pakistan	Punjab	Pakistan	Punjab	Pakistan	Punjab
2010-11	8805	6691	25090	19041	2850	2846
2011-12	8666	6483	23517	17702	2714	2731
2012-13	8690	6511	24303	18587	2797	2855
2013-14	9199	6901	25979	19739	2824	2860
2014-15	9180	6979	25478	19282	2775	2763
2015-16	9260	6937	25482	19541	2868	2817
2016-17	9110	6800	2600	19500	2854	2868

Seven wheat and four lines of durum was included in the national uniform wheat yield trials. The list is as under

Sr.#	V-Code	Parentage/Pedigree
1	12066	F 60314.76/ MRL// CNO 79/3/ LUCO-M/4/HEI/3* CNO 79// 2* SERI/5/ KAUZ// BOW/NKT PB- 33188-2A-0A-0A-1A-0A
2	13348	VORB/SOKOLL CMSA06M00621S-040ZTM-040ZTY-16ZTM-01Y-0B
3	14154	BECARD/QUAIU #1 CMSS07B00230S-099M-099NJ-099NJ-23WGY-0B
4	14170	SUP152/BLOUK #1 CMSS06B00033S-0Y-099ZTM-099NJ-099NJ-3WGY-0B
5	14225	MUTUS*2//ND643/2*WBLL1 CMSS08Y00872T-099TOPM-099Y-099M-099NJ-099NJ-18WGY-0B
6	14168	ITP40/AKURI CMSS07Y00441S-0B-099Y-099M-099NJ-099NJ-4WGY-0B
7	14227	FRNCLN/NIINI #1//FRANCOLIN #1 CMSS08Y00895T-099TOPM-099Y-099M-099NJ-099NJ-2WGY-0B
Durum		
1	D-13202	CADO/BOOMER//YALLARIO PBD. 1131-0A-0A-9A-0A-0A

2	D-13206	SNTURKM 183-84/D-94654 PBD. 1142-0A-0A-14A-0A-0A
3	D-13207	SNTURKM 183-84/KAMBRA-1 PBD. 1144-0A-0A-1A-0A-0A
4	D-13219	LD357E/2*TC60//JO69/3/FGO/4/GTA/5/SRN_1/6/TOTUS/7/ENTE/MEXI_2//HUI/4/YAV_1/3/LD357E/2*TC60//JO69/8/SOMBRA_20/9/JUPAREC2001/10/SOMAT_3/PHAX_1//TILO_1/LOTUS-4/11/SOOTY_9/RASCON_37//WODUCK/CHAM_3 CDSS04Y00755T-0TOPB-12Y-0M-06Y-1M-1Y-0B

Twenty five lines were included in the PUWYT 16-17 trial for testing in the Punjab province

S. NO.	ENTRY NAME	PARENTAGE/PEDIGREE
1	V-14057	PFAU/MILAN//SHAFAQ-06/3/KIRITATI PB. NO. 34509-3A-0A-0A-2A-0A
2	V-14084	Fret-2/Fsd-08 PARB-13-09-0k-0A-0K-0A-0K-3A-0A
3	V-14117	KLEIN DON ENRIQUE*2/3/FRET2/WBLL1// TACUPETO F2001 CMSS07Y00889T-099TOPM-099Y-099M-099Y-9M-0WGY
4	V-14122	KACHU/BECARD//WBLL1*2/BRAMBLING CMSS07B00580T-099TOPY-099M-099NJ-099NJ-34WGY-0B
5	V-14124	KACHU#1//WBLL*2/KUKUNA CMSS07Y00129S-0B-099Y-099M-099NJ-099NJ-12WGY-0B
6	V-15207	KACHU//KIRITATI/2*TRCH CMSS08Y00152S-099Y-099M-099Y-2M-0WGY
7	V-15210	SERI.1B*2/3/KAUZ*2/BOW//KAUZ/4/2*MUNAL CMSS08Y00599T-099TOPM-099Y-099M-099Y-3M-0WGY
8	V-15211	QUAIU #1/2*SUP152 CMSS08Y00628T-099TOPM-099Y-099M-099NJ-6WGY-0B
9	V-15235	MUNAL*2/WESTONIA CMSS08Y00833T-099TOPM-099Y-099M-099NJ-099NJ-14WGY-0B
10	V-15238	SHORTENED SR26 TRANSLOCATION//2*WBLL1*2/KKTS/3/BECARD CMSS08Y01115T-099M-099Y-099M-099NJ-14WGY-0B
11	V-15249	SOKOLL/3/PASTOR//HXL7573/2*BAU/4/WBLL4// OAX93.24.35/WBLL1 PTSA08M00051S-050ZTM-050Y-19ZTM-010Y-0B
12	V-15250	MUNAL*2/WESTONIA CMSS08Y00833T-099TOPM-099Y-099M-099NJ-099NJ-14WGY-0B
13	V-13165	WBLL1*2/CHAPIO*2//MURGA CMSS06Y00931T-099TOPM-099Y-099ZTM-099Y-099M-16WGY-0B
14	V-13192	ONIX/KBIRD CMSS07Y00419S-0B-099Y-099M-099Y-2WGY-0B
15	V-14270	TOB/ERA//TOB/CNO67/3/PLO/4/VEE#5/5/KAUZ/6/FRET2/7/ PASTOR//MILAN/KAUZ/3/BAV92 CMSA07M00366S-040M-0NJ-0NJ-17Y-0B
16	V-14271	KA/NAC//TRCH/3/KINDE CMSA07M00457S-040M-0NJ-0NJ-2Y-0B
17	V-14266	C80.1/3*BATAVIA//2*WBLL1/3/EMB16/CBRD//CBRD/4/CHEWINK #1 CMSA08Y00012T-049(1A1RSR25HO)B-050ZTY-02(1A1R)ZTM-02Y-03B-0Y
18	V-14268	WBLL1*2/TUKURU//CROSBILL #1

		CMSS06B00421S-0Y-099ZTM-099NJ-099NJ-1WGY-0B
19	V-14269	METSO/ER2000/3/PASTOR//HXL7573/2*BAU CMSA07Y00629S-040ZTY-040M-0NJ-0NJ-12Y-0B
20	V-14262	KA/NAC//TRCH/3/DANPHE #1 CMSA07M00445S-040ZTM-040ZTY-45ZTM-010Y-01B-0Y
21	HYT-60-5	KACHU*2/MUNAL #1 CMSS09Y00816T-099TOPM-099Y-099ZTM-099NJ-099NJ-18WGY-0B
22	HYT-60-7	KACHU/2*MUNAL #1 CMSS09Y00817T-099TOPM-099Y-099ZTM-099NJ-099NJ-10WGY-0B
23	HYT-60-57	WBLL1*2/4/SNI/TRAP#1/3/KAUZ*2/TRAP//KAUZ/5/ KACHU/6/TRCH/SRTU//KACHU CMSS10Y00287S-099Y-099M-5WGY-0B
24	HYT-27-21	SWSR22T.B.//TACUPETO F2001*2/BRAMBLING/3/2*TACUPETO F2001*2/BRAMBLING CMSS08Y01122T-099M-099Y-099M-099Y-1M-0WGY
25	HYT-27-11	QUAIU*2/KINDE CMSS08Y00627T-099TOPM-099Y-099M-099NJ-38WGY-0B

In barley PUBYT 16-17 eight lines were included for testing in the trials

B-15002	Alanda-01/4/Alanda//Lignee527/Arar/3/BF891M-612 ICB02-0487-97AP-0AP-0AP-0AP
B-15003	Alanda-01/4/Alanda//Lignee527/Arar/3/BF891M-617 ICB02-0488-16AP-0AP-0AP-0AP
B-15006	AGER/2*PETUNIA 1 CBSW01WM00121T-0TOPY-4M-1Y-1M-1Y-0M-0AP
B-14003	Lignee527/Chn-01//Alanda/3/As57/Kc ICB96-0343-0AP-3AP-0AP-20AP-0AP-2AP-0AP
B-14007	Hml02/ARABIABIAD//ER/APM/3/BELFORTBARLEY /Carben//Ms23... ICB02-1135-0AP-10TR-0AP
B-14011	Rhn-03/7/Giza121/CI06248/4/Apm/IB65//11012-2/3/Api/CM… ICB05-0998-0AP-4AP-0AP
B-05011	GOB/ALELI//CANELA//GUCNZA CBSW98 M0000……
B-09006	HML02/ARABIABIAD//ER/APM/3/BELFORTBARLEY /CA/4/RBEN// MS2375 ICB89-0014-5LAP-1AP-0TR-0AP-5AP-0AP-4AP
B-09008	LEGIA/LAUREL'S'//ALELI/3/ARTA ICB98-1076-32AP-0AP

The weather conditions were not so good for wheat because there was hail strom in some part of the province which effect the spike. The hail storm created the sterility in heads. The attack of yellow rust was observed in traces in some part of the province on the wheat variety Punjab.81, Millat.2011 and

Galaxy.2011. However the wheat variety Faisalabad.2008 remained clear from the yellow rust.

	2015-16				2016-17			
Months	Sunshine hours	Rain fall	Fog	Frosty night	Sunshine hours	Rain fall	Fog	Frosty Night
Nov	178	0	0	0	167	0	9	0
Dec	195	0	6	8	195	0	8	1
Jan	100	12.2	14	0	110	11.9	7	5
Feb	219	5.8	0	0	189	3.7	0	0
March	198	78.00	1	0	238	16.21	0	0
April	250	6.1	0	0	289	19.2	0	0
Total	1140	102.1	21	8	1188	51.01	24	6

There was sever attack of yellow rust on susceptible wheat varieties in humid areas specially near the river basin.The maximum temperature in the end of march was 38-39 c. According to the expert prematurely rising in temperature are likely to accelerate the peace of ripening of wheat crop. Wheat crop in Punjab normally harvested in the middle of April but it is expected to be harvested in the first week of April.In the first weak of April the rain affected the wheat crop. There was hail storm in some part of the Punjab province.There was rain on the harvest of wheat crop. In Faisalabad Hailstorm was also occurred in some part. But the lose was minimum.

BREAD WHEAT (Triticum aestivum L.)

Germplasm Improvement and its Maintenance

Crossing Block

The role of germplasm improvement of wheat has been well recognized. Germplasm maintenance and evaluation, is the main objective which covers the whole range of activities starting from collection of samples, its characterization, evaluation, and documentation. Germplasm improvement and maintenance provides an opportunity to incorporate the desirable genes in the existing varieties through hybridization. The main objects of crossing block were to maintain genotypes/lines with their typical characteristic and to combine high yield, adaptability and tolerance to biotic and abiotic stresses, quality and other desirable traits. During this season crossing block constituted 658 wide diversified entries which was planted twice i.e. (1^{st} and 3^{rd} week of November) to get synchronization of desirable male and female parents. The crossing Block composed of different groups viz; current varieties (50), old varieties (53), exotic lines (61), disease resistant (85), drought tolerant (18), salt tolerant (06), heat tolerant (33), grain quality (17), high grain weight (18), high yielding (255), harvest plus (18), *Triticum pyrum* (05), CSISA (18)and miscellaneous lines (21). Data were recorded for 11 different traits. In crossing block entries, a wide range of variability for each trait was observed (Table 1).

Table 1: Genetic diversity of different traits in crossing block during 2016-17.

Traits	Range	Traits	Range
Days to heading	90-122	Tillers/plant	6-15
Days to maturity	136-158	1000 grain weight (g)	18.2-51.4
Plant height (cm)	75-135	Leaf and yellow rusts	0-100S
Protein content (%)	12.2-17.5	Gluten content (%)	34-39
Canopy temperature (^{0}c) (booting & anthesis)	11.2-19.2 14.6-21.4	NDVI range (booting & anthesis)	0.71-0.89 0.68-0.85
Leaf color (light green, medium. dark), size (Broad, medium, narrow) & orientation (droopy, semi droopy, erect, semi erect)			Wide range

SA-42, 088200 and IV-119 took 90, 91 and 93 days respectively for emergence from leaf sheath. Turaco/Prinia, V-11189 and Sulamen-96 were shortest duration varieties which took 136, 137 and 138 days to maturity, respectively while CB-253, CB-128 and NR-378 were longest duration genotypes which took 158, 154, and 153 days respectively. CB-164 and Doller bird exhibited lowest (18.7 and 19.2 g) while NR-436 and CB-188 exhibited (49.1 and 51.9 g) 1000 grain weight. TD-2 and SKD-1

were found shortest (75cm and 80cm) while Frontana and 03BT007 were found tallest (135 and 130 cm) genotypes. In crossing block the leaf rust reaction (leaf and yellow rust) ranged from 0-100S. Six genotypes exhibited reaction for loose smut and 12 genotypes exhibited reaction for alternaria blight. However, no stem rust inoculum was found. A wide range of leaf color (green, light green and dark green), leaf orientation (droopy, semi droopy, erect and semi erect) and leaf size (broad, narrow and medium) were also recorded. A wide range of leaf color (Green, light green and dark green), leaf orientation (droopy, semi droopy, erect and semi erect) and leaf size (broad, narrow and medium) were also recorded. About 975 target crosses were made keeping in view different objectives like higher yield, heat, drought, disease resistance and acceptable quality.

Prebreeding Nursery and Local Land Races

Pre-breeding is an alternative term used for genetic enhancement as it is the sophisticated process and essential planned part of moving the desired resistance genes into genetic backgrounds which allow direct use in wheat breeding programs. The exploitation of local land races for cultivar improvement is limited by crossing incompatibility barrier and linkage drags but it is an urgent need to conserve as many land-races as possible to ensure that genetic diversity may not lost as these are characterized by disease resistance and better able to withstand the challenges posed by environmental stresses. Therefore, this factor necessitate to conserve these land races to ensure the genetic diversity. Pre breeding nursery and local land races included 172 and 45 entries, respectively. These entries were evaluated for agronomic and pathological aspects for inclusion in the breeding program (table 2).

Table 2: Genetic diversity in pre breeding nursery and local Land races during 2016-17.

Sr.N0	Traits	PBN Range	LLR Range
1	Plant height (cm)	90-115	110-150
2	Days to heading	97-112	102-118
3	Days to maturity	138-151	134-148
5	Tiller/plant	06-16	05-11
6	Canopy temperature (^{0}c) (booting & anthesis)	10.9-19.8 14.8-21.9	11.7-19.2 15.1-22.2
7	NDVI range (booting & anthesis)	0.74-0.90 0.67-0.86	0.73-0.88 0.66-0.85
8	Leaf & yellow rust reactions	0- 100 S	0- 100 S
9	Leaf color, size & orientation		Wide range

Hybrid Seed Program

Cytoplasmic Male Sterile (A) lines, maintainer line (B) and fertility restorer lines are the main components of hybrid seed production. Thirty three A-lines (CMS lines) along with the same number of B-lines (maintainers) were planted in the field. Thirty three CMS lines were maintained by crossing with their respective maintainer (B-lines). Sixteen fertility restorers were also maintained by selling.

FILIAL GENERATIONS

Generations (F_1 – F_7)

A number of crosses were made to combine high yield, disease resistance, good quality parameter, heat and drought tolerance. Resultantly a large number of genotypes were obtained in successive generations due to recombination and crossing over. Single heads of selected plants having desirable characters in F_2-F_4 generations were selected in artificial rusts epidemic condition and each entry was bulked for further evaluation. Selected bulk was used where segregates were distinguishable for morphological traits studied while bulk method was practiced where variation was not clear in a cross up to F_4 generation. Single heads selected in F_5 generation were threshed separately for raising single head rows in F_6 generation for separation of different homozygous genotypes obtained in segregation. Selected single head rows progenies were raised in F_7 generation. Finally from F_7, 179 uniform single head rows progenies were selected and promoted to test in the preliminary yield trials (Table 3).

Table :-3 Detail of filial generations planted at WRI and KSK during 2016-17

Generation	Entries/crosses studied at WRI, Faisalabad	Entries selected at WRI, Faisalabad	Entries/crosses studied at KSK	Entries selected at KSK
F1	856	809	0	0
F2	730	511 SHB	367 SHB	285 SHB
F3	384 SHB	305 SHB	105 SHB	85 SHB
F4	256 SHB	189 SHB	100 SHB	55 SHB
F5	121 SHB	109 SH	0	0
F6	1841 SHR	526 SHR	0	0
F7	432 SHRP	179 lines	0	0

SHB= Single head bulk, and SHRP=Single head row progeny, SHR=Single head rows

Breeding for Durable Rust Resistance

A number of crosses were made between the parents of diverse origin for pyramiding minor and major rust resistance genes which is called durable rust resistance. About 210 fresh crosses of durable rust resistance were attempted. F1 generation was sown during last week of Nov with plot size of 1 row x 2.5 m. In F1 198 crosses were studied and 180 crosses were selected. F2 generation was sown with 1.8*6m

plot size. F2 contained 141 entries and 82 entries were selected. F3 generation was sown with 3 rows*3m plot size. F3 contained 21 entries and 20 entries were selected

Filial generations (F_2 –F_7)

One hundred and fifty crosses for heat tolerance were harvested. F_2-F_6 generation were sown during 1st week of December. Plot size of F_2-F_5 was 1.8*6m while of F_6 was 1 row of 2.5m. Data regarding disease incidence and plant type was recorded. At maturity, single heads from desirable plants of F_2, F_3 and F_4 were bulked to raise successive generations. The selected material was finally evaluated on grain basis. For generation advancement 102, 58, 14 crosses were finally selected from F_2, F_3, F_4 respectively. F5 contained 21 entries, out of which 20 crosses and 240 single heads were selected. In F6, 132 single head rows were selected from 228 single head rows. In F7,60 single head row progenies were selected.

Table :4 Detail of filial generations studied for Heat Tolerance at WRI during 2016-17

Generation name	Entries studied	Selected
F2	179	102
F3	89	58
F4	19	14
F5	21 entries	20 crosses,240 S.H
F6	228 S.H.R	132 S.H.R
F7	95S.H.R.P	35 S.H.R.P

Heat stress studied

In tunnel, thirty bread wheat genotypes were sown in two rows of 2.5 meter each. The material was sown in and outside the tunnel frame during 2nd week of November. Material was also planted in late sown condition. Post anthesis heat shock was imposed by covering the tunnel with polypropylene sheet for about three weeks after anthesis. Six lines showed better terminal heat stress tolerance ability on the basis of yield and 1000 grain weight.

Table :5 Yield performance of promising lines under normal, tunnel and late sown Condition.

Sr .#	Genotype	Yield			1000 Grain Weight		
		Nor	Tunnel	Late	Nor	Tunnel	Late
1	QUAIU#1/2*SUP152	2661	1800	2224	35.3	34.1	34.6
2	V-14170	2149	1939	2042	36.1	34.8	35.5
3	V-14225	2541	1687	1825	36.4	33.9	31.6
4	KA/NAC//TRCH/3/DANPHE#1	2831	1929	2201	33.7	31.8	32.1

5	PASTOR//MILAN/KAUZ/3/BAV92	2723	1847	2142	40.1	34.2	32.3
6	Galaxy-13	3270	1922	2444	39.3	37.3	30.1

Heat Tolerance Yield Trial

Heat tolerance yield trial comprising of 50 entries including local check variety Ujala-16. Trial was planted in normal and late sown condition with interval of 15 days. On the basis of the result following entries performed well

of selected

Table:6 Yield performance and different parameters entries

Sr.#	Genotypes	Yield(kg/ha)		1000 Grain weight(g)	
		Normal	Late	Normal	Late
1	PASTOR//HXL7573/2*BAU/3/ATTILA/3*BCN/4/SOKOLL/3/PASTOR//HXL7573/2*BAU	3107	3042	36.3	33.9
2	SOKOLL/3/PASTOR//HXL7573/2*BAU/4/PARUS/PASTOR	2889	2575	36.7	31.9
3	PFAU/MILAN//SHAFAQ-06/3/KIRITATI	3291	2824	37.4	28.2
4	FRET-2/FSD-08	3100	2830	33.1	28.7
5	KLIEN DON ENRIQUE*2/3/FRET2/WBLLI//TACUPETU F2001	3226	2758	38.8	32.3
6	KACHU/BECARD//WBLLI*2/BRAMBLING	3186	2902	38.9	26.8
7	KACHU#1//WBLL*2/KUKUNA	3190	3030	42.8	37.5

Study Of Promising Bread Wheat lines Under Drought Stress

Twelve advanced lines of bread wheat along with check varieties viz., V-13005, V-12120, V-12066, V-13371, V- V-13372, V-13338, V-13325, V-13348, V-11098, V-12304, Galaxy-13 and Fsd-08 were sown in triplicate at three levels of irrigations on November 20, 2015, one set with rain fed condition (L0) 2nd with one irrigation (L1) and 3rd with normal irrigated condition (L2). All the agronomic practices were same except irrigation. The line V-12304 has the highest grain yield 4884 kg/ha against check under one irrigation while V-11098 has performed best under no irrigation by producing highest grain yield (3841kg/ha). Punjab-11 (5220 kg/ha) followed by V-12120 (5177 kg/ha) has given highest grain yield under three irrigation treatment. Results are tabulated below

Table:7 Study Of Promising Bread Wheat lines Under Drought Stress

Lines/variety	Yield With No Irrigation)	Yield With One Irrigation	Yield With 3 Irrigations
V-13005	3433.33	4883.70	4820.00
V-12120	3129.63	4611.11	5177.04
V-12066	2996.30	4273.33	4734.07
V-13371	3108.15	4297.04	4669.63
V-13372	3151.85	4645.19	4832.59
V-13338	2981.48	4670.37	5137.04
V-13325	3113.33	4739.26	4150.37
V-13348	3353.33	4627.41	4782.96
V-11098	3841.48	4750.37	4200.74
V-12304	3031.85	4907.41	4948.15
Galaxy 13	3099.26	4540.00	5161.48
Punjab 11	3172.59	4657.78	5220.00

YIELD TRIALS 2016-17

Station Yield Trials

The most promising lines selected from different sources i.e. F_7 generation, International nurseries/ trials, drought, heat stress and plant pathology program were evaluated in station yield trials (A & B Trials).

Preliminary wheat yield trial (A-Trial)

During the reported year, eleven trials of bread wheat in irrigated condition were conducted under normal conditions. Each Normal trial consisted of 15 test entries/lines with 3 check varieties FSD-08, Punjab-11 and Galaxy-13 in bread wheat yield trials as check varieties. The planting was done following RCB design with three replications. The lines that performed better than the three checks, in their respective trials are given in Table 8 with their data regarding days to heading, days to maturity, plant height, lodging %age, disease reaction and grain yield.

Table : 8 Yield performance and related traits of promising lines in preliminary yield trials

Sr. No.	Variety Code	Days to 50 % Heading	Days to Maturity	Plant Height (cm)	Lodging (%)	Disease Reaction		Yield (kg ha^{-1})
						Lr	Yr	
A-I Trial								
1	V-16002	100	146	121	100	TMSS	0	4927
2	V-16003	104	147	122	100	0	0	4973
3	V-16004	105	147	116	100	0	0	5150
4	V-16005	90	144	101	100	TR	0	4844
5	V-16006	105	146	121	100	0	0	5248

6	V-16007	99	147	103	90	0	0	4959
7	V-16009	91	145	98	100	5M	0	4933
8	V-16012	108	148	108	100	0	0	4286
Check	FSD-08	97	146	105	50			4787
Check	Punjab-11	97	147	103	0			5287
Check	Galaxy-13	105	146	110	100			4976
							LSD	238
A-II Trial								
1	V-16018	99	146	111	100	0	0	4549
2	V-16023	97	147	114	100	0	0	5457
3	V-16024	99	146	113	100	0	0	4465
4	V-16025	99	147	118	90	0	0	4897
5	V-16027	99	146	106	100	TR	0	5109
Check	FSD-08	97	145	102	70			5051
Check	Punjab-11	96	146	103	0			5751
Check	Galaxy-13	105	145	110	100			4630
							LSD	265
A-III Trial								
1	V-16033	105	148	102	100	0	TM	4210
2	V-16034	98	147	118	90	0	TR	5349
3	V-16036	98	146	116	100	0	0	5493
Check	FSD-08	96	143	113	80			4686
Check	Punjab-11	96	146	105	0			5464
Check	Galaxy-13	105	146	111	100			4567
							LSD	241
A-IV Trial								
1	V-16049	98	146	102	100	TM	TM	4826
2	V-16050	99	144	112	100	TM	0	4138
3	V-16051	97	145	114	100	TM	5M	4493
4	V-16052	98	145	116	100	TMS	0	4426
5	V-16055	97	146	130	100	20MSS	TM	4619
6	V-16056	97	146	118	100	20MSS	0	4900
7	V-16057	95	144	125	100	20MSS	TMS	5178
8	V-16058	92	145	108	100	10MSS	TM	5189
9	V-16060	106	147	118	100	TS	5MSS	4883
Check	FSD-08	96	145	102	60			4658
Check	Punjab-11	96	147	107	0			5278
Check	Galaxy-13	105	147	110	100			4733
							LSD	242
A-V Trial								
1	V-16061	96	145	112	90	5MS	10MSS	4983
2	V-16063	90	142	98	100	5S	5MSS	5198
3	V-16065	99	145	110	80	5MR	TM	5255
4	V-16066	105	146	110	100	5MS	0	4228
Check	FSD-08	97	146	106	90			4973
Check	Punjab-11	98	147	103	0			5537
Check	Galaxy-13	105	146	105	100			4796
							LSD	211
A-VI Trial								

1	V-16077	93	144	109	90	5MSS	10MSS	4751
2	V-16079	99	147	113	100	TR	0	5114
3	V-16080	93	144	95	100	5M	0	4698
4	V-16081	105	148	105	100	0	0	5330
5	V-16084	99	145	105	100	5MSS	0	4757
6	V-16087	95	146	112	100	TR	0	5528
7	V-16090	106	147	97	100	5MSS	10MSS	4354
Check	FSD-08	96	146	107	90			4940
Check	Punjab-11	97	148	103	0			5770
Check	Galaxy-13	105	147	111	100			4852
							LSD	246
A-VII Trial								
1	V-16093	93	147	110	100	TM	0	5154
2	V-16094	106	147	126	100	5M	0	5084
3	V-16097	97	144	110	100	TMS	5MS	4416
4	V-16098	105	144	110	100	TMS	10MSS	4420
5	V-16100	106	148	104	100	5MSS	0	4477
6	V-16102	106	148	102	100	10MSS	TMS	4464
7	FSD-08	97	146	109	70			5074
Check	Punjab-11	99	147	103	0			5627
Check	Galaxy-13	105	147	109	100			4691
							LSD	227
A-VIII Trial								
1	V-16106	95	146	107	90	0	0	5289
2	V-16108	94	147	118	100	0	5MSS	4235
3	V-16111	97	148	115	90	0	5MSS	5209
4	V-16114	97	147	118	100	TR	0	4802
5	V-16115	94	145	112	100	TMS	TMS	4993
6	V-16117	99	146	116	100	0	5MSS	4975
7	V-16119	97	148	117	0	TMS	5MSS	5317
8	V-16120	99	148	110	0	TS	5MSS	5109
Check	FSD-08	96	145	104	70			5173
Check	Punjab-11	96	147	102	0			5383
Check	Galaxy-13	99	146	115	100			5050
							LSD	247
A-IX								
1	V-16124	99	148	109	90	TM	TMS	4670
2	V-16125	99	148	112	80	5MSS	5MSS	5277
3	V-16128	97	147	103	90	0	0	4504
4	V-16129	99	145	110	90	5M	5MSS	5166
5	V-16131	97	144	117	10	5MS	20MSS	5242
6	V-16132	109	149	115	0	TM	10MSS	4561
7	V-16133	109	149	114	10	TMS	5M	4760
8	V-16134	99	146	113	0	5M	0	6038
Check	FSD-08	96	144	106	30			5448
Check	Punjab-11	97	147	103	0			4969
Check	Galaxy-13	99	146	107	100			4996
							LSD	246
A-X								

1	V-16136	93	144	98	0	TMS	TMR	5473
2	V-16140	105	147	96	30	5MSS	0	4965
3	V-16141	99	146	106	80	TS	10MSS	4374
4	V-16144	94	144	113	10	TMS	10MSS	5467
5	V-16145	99	148	113	0	TMS	5RMR	5141
6	V-16146	99	147	110	50	TMS	5M	5087
7	V-16147	105	147	97	60	TMSS	0	5164
8	V-16148	93	147	98	90	0	20MSS	5096
9	V-16149	97	148	111	90	TM	TM	4730
10	V-16150	98	147	99	40	5M	10MRMSS	5522
Check	FSD-08	97	146	109	80			5222
Check	Punjab-11	97	147	106	0			5399
Check	Galaxy-13	99	146	109	100			5040
							LSD	223
A-XI								
1	V-16152	99	146	111	0	TMS	TM	5764
2	V-16153	95	145	103	0	TM	5M	5350
3	V-16154	99	142	101	10	TM	TM	4971
4	V-16155	95	143	113	0	TMS	TMSS	5063
5	V-16157	99	144	108	40	0	0	5700
6	V-16158	99	144	111	20	0	0	5011
7	V-16159	99	144	103	50	0	0	5479
8	V-16160	98	146	108	90	5M	0	5458
9	V-16161	95	145	107	50	10M	0	5723
10	V-16163	98	147	101	0	0	0	5807
11	V-16164	98	146	103	0	TMS	5MSS	5675
Check	FSD-08	94	145	101	50			5211
Check	Punjab-11	96	147	106	0			5440
Check	Galaxy-13	99	146	114	90			5384
							LSD	231

Drought Stress Trials

Thirty four lines were selected in preliminary yield trial under moisture stress condition and nine lines were selected from regular yield trial in rainfed condition.

Table : 9 Yield performance and related traits of promising lines in preliminary yield trials

A-1	**V-Code**	H.D	DM	PH	LR	YR	Yield kg/ha
1	**V**-16233	99	148	85	0	0	3808
2	**V**-16221	98	145	90	0	0	3773
3	**V**-16234	101	144	80	0	0	3725
4	**V**-16222	97	142	90	0	0	3723
5	**V**-16227	92	145	95	0	0	3721
6	**V**-16230	96	144	85	0	0	3712
	FSD-08	91	145	90	0	0	3706

	Galaxy-13	97	146	90	0	0	3716
	Dhurabi-09	99	145	85	0	0	3375
	CK-50	98	144	85	0	0	3688
A-II	V-codes	H.D	DM	PH	LR	YR	Yield kg/hec
1	**V**-16260	92	147	93	0	10Mss	4165
2	**V**-16259	91	145	80	0	0	3909
3	**V**-16261	94	144	85	0	0	3769
	FSD-08	90	146	88	0	0	3630
	Galaxy-13	96	149	92	0	0	3724
	Dhurabi-09	97	148	94	0	0	3024
	CK-50	95	144	80	0	0	3671
A-III	V-codes	H.D	DM	PH	LR	YR	Yield kg/ha
1	**V**-16266	91	149	99	20Ms	0	4397
2	**V**-16278	91	148	90	0	0	4026
3	**V**-16264	94	144	100	0	0	4028
4	**V**-16277	88	145	91	0	0	3994
5	**V**-16274	91	144	95	0	0	3988
6	**V**-16280	90	146	87	0	0	3986
7	**V**-16276	88	146	90	0	0	3954
8	**V**-16281	87	146	95	0	0	3872
9	**V**-16270	87	146	98	0	0	3867
10	**V**-16265	88	145	101	0	0	3810
11	**V**-16282	82	144	92	0	0	3815
12	**V**-16262	85	144	105	0	20S	3804
13	**V**-16275	77	145	85	0	0	3781
14	**V**-16269	76	146	99	0	20S	3686
	FSD-08	78	145	90	0	0	3916
	Galaxy-13	79	146	96	0	0	3714
	Dhurabi-09	79	145	95	0	0	3488
	CK-50	78	146	85	0	0	3707
A-IV	V-codes	H.D	DM	PH	LR	YR	Yield kg/ha
1	**V**-16284	90	148	94	0	0	4874
2	**V**-16291	95	145	90	0	0	4581
3	**V**-16289	90	146	94	0	0	4493
4	**V**-16293	89	147	85	0	0	4358
5	**V**-16294	91	145	90	0	0	4301
6	**V**-16290	90	144	95	0	0	4295
7	**V**-16286	90	144	90	0	0	4218
8	**V**-16297	92	145	105	0	0	4122

9	**V**-16287	92	147	95	0	0	4118
10	**V**-16295	94	148	90	0	0	4099
11	**V**-16288	92	149	100	0	0	3662
	FSD-08	94	147	89	0	0	4078
	Galaxy-13	92	148	91	0	0	3957
	CK-50	97	148	100	0	0	4099

Regular wheat yield trial (B-Trial)

This year, nine trials of bread wheat were conducted under normal conditions. Trials were planted with plot size of 6m x 1.62m using RCB design with three replications and harvested plot size was 5m x 1.62m. Each Normal trial consisted of 15 test entries/lines with 3 check varieties (FSD-08, Punjab-11 and Galaxy-13 in bread wheat yield trials . Promising lines that surpassed three check varieties are given in Table 12 with their respective data of days to heading, days to maturity, plant height, lodging %age, disease reaction and grain yield.

Table :10 Yield performance and related traits of promising lines in regular yield trials

Sr. No.	Variety Code	Days to 50 % Heading	Days to Maturity	Plant Height (cm)	Lodging (%)	Disease Reaction		Yield (kg ha^{-1})
						Lr	Yr	
1	V-15026	96	143	111	100	0	0	5371
2	V-15044	95	146	108	90	10R	0	5000
3	V-15049	98	147	105	100	0	0	5136
4	V-15051	101	147	121	80	0	0	5167
5	V-15070	96	147	118	90	0	0	4979
6	V-15080	93	142	103	90	20R	0	5317
7	V-15082	93	139	108	100	0	0	5803
8	V-15099	97	143	102	90	20R	0	5072
9	V-15100	96	142	103	10	10R	TMS	6128
10	V-15102	97	143	98	60	0	0	5646
11	V-15113	97	147	112	80	0	0	6047
12	V-15115	97	145	113	70	0	0	5390
13	V-15147	103	145	98	90	0	0	5035
14	V-15153	105	147	111	90	0	0	5245
15	V-15166	93	143	101	90	0	0	5559
16	V-15168	97	143	98	90	10MR	0	6387
17	V-15174	96	146	82	90	0	0	5779
18	V-15179	95	143	107	90	20M	0	5469
19	V-15182	96	143	104	100	0	0	5154
20	V-15190	99	145	108	100	20M	0	4840
21	V-15203	96	144	117	40	0	0	5806
22	V-16172	94	147	107	100	TS	0	5297

23	V-16174	96	146	108	100	0	0	4961
24	V-16178	105	147	112	30	TMS	0	4839
25	V-16180	98	146	108	50	0	0	5761
26	V-16181	95	145	108	50	TMS	0	4887
27	V-16197	96	145	97	30	5M	0	4986
28	V-16202	105	148	102	90	0	0	4928
29	V-16212	89	139	100	70	0	0	6259
30	V-16213	93	147	100	80	5M	0	5757
31	V-16215	105	147	104	90	TMS	0	5574
32	V-14058	96	147	96	90	0	TMS	5519
33	V-14061	99	147	100	90	0	TS	4989
34	V-14116	94	141	104	90	10M	TMS	4811
35	V-15212	95	145	118	80	5MS	0	5859
36	V-15216	99	146	113	70	0	0	5731
37	V-12138	106	146	120	50	0	0	4769
B-I(RF)								
1	V-15291		90	144	100	0	5S	4204
2	V-15265		95	149	97	0	0	3662
3	V-15309		92	145	105	0	0	3694
4	V-15327		97	149	96	0	0	3688
5	V-15311		90	144	102	0	0	3550
6	V-15329		95	145	97	0	0	3696
7	V-15331		92	145	100	10MSS	5S	3649
8	V-15306		92	144	94	0	0	3647
9	V-15267		95	146	94	0	0	3495
	FSD-08		91	145	93	0	0	3799
	Galaxy-13		96	148	89	0	0	3502
	Dhurabi-09		98	149	95	0	0	3070
	CK-50		96	148	99	0	10MSS	3715

International Nurseries/trials

37th Elite Spring Wheat Yield Trial (37th ESWYT)

37th ESWYT comprising of 50 entries were planted in 2 replications with plot size of 5m x 6rows. The trial was sown on 25th November 2016.eleven lines gave higher yield than local check variety Faisalabad- 08

Table:- 11 Yield performance of selected lines in 37th ESWYT

S.NO	ESWYT	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	127	97	100	0	0	36.5	5269
2	147	97	98	0	TMRMS	35.4	5143
3	108	97	106	0	0	38.4	5005

4	144	94	110	TMS	0	36.5	4996
5	105	96	106	0	0	38.6	5001
6	132	99	103	0	0	38.0	4936
7	130	97	95	0	0	40.0	4973
8	142	96	99	0	0	39.2	4979
9	138	99	115	0	0	36.2	4929
10	136	96	100	0	0	34.2	4854
11	116	95	110	0	0	36.2	4836
12	113	96	105	0	0	38.4	4785
13	106	97	115	0	0	37.0	4804
14	131	96	100	0	0	36.5	4756
15	150	95	99	0	0	34.6	4790
	FSD-08	96	92	10MSS	0	36.0	4778

24th Semi Arid Wheat Yield Trial (24th SAWYT)

24rd SAWYT comprising of 50 entries including local check variety Faisalabad-08 was planted in 5m x 6rows plot size with 2 replications. The trial was sown on 25th 2016. Out of 50 entries, seventeen lines gave higher yield than local check variety Faisalabad-08 .

Table:-12 Yield performances of selected entries in 23rd Semi Arid Wheat Yield Trial

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	336	94	105	0	0	38.0	5692
2	317	93	95	0	0	36.2	5657
3	324	94	105	0	0	34.2	5384
4	305	96	100	5MS	0	35.4	5373
5	345	96	109	5MS	0	36.8	5180
6	328	94	109	0	0	37.2	5154
7	315	97	106	0	0	38.6	5116
8	308	88	100	0	10S	38.0	5091
9	348	96	97	0	0	38.0	5076
10	339	97	90	0	0	37.8	5061
11	349	94	105	0	0	35.0	5000
12	337	94	96	0	0	34.0	4997
13	344	96	105	0	0	32.6	4912
14	319	97	106	0	0	32.9	4891
15	342	93	100	0	0	35.6	4885
16	304	96	106	5MSS	0	36.8	4826
17	350	96	97	0	0	36.0	4821
	FSD-08	94	90	10S	0	37.8	4817

24th HIGH RAINFALL WHEAT YIELD TRIAL

The 24th HRWYT comprising of 50 entries including local check variety Fsd-08 was planted in duplicate on 25th November, 2016 keeping row to row distance 27 cm. On the basis of the result following entries performed well.

Table :-13 Yield performances of selected entries in 24th HRWYT

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	239	94	104	0	0	42.3	3874
2	232	94	95	0	0	37.6	3310
3	220	93	111	0	0	35.2	3135
4	234	96	102	0	0	35.2	3121
5	218	96	107	0	0	40.1	3015
6	240	94	104	0	0	34.6	3001

4th WHEAT YIELD CONSORTIUM YIELD TRIAL (4th WYCYT)

4th WYCYT comprising of 30 entries including local check variety Faisalabad-08 was planted in 5m x 6rows plot size with 3 replications. Out of 30 entries, five genotypes gave higher yield than local check variety Faisalabad-08.

Table:14 Yield performance of selected lines 4th WYCYT

Sr.No	4th WYCYT	H.D	PH	LR	YR	Yield kg/ha
1	29	106	95	0	10MRMS	4750
2	3	103	85	0	0	4535
3	18	106	95	0	0	4346
4	2	108	75			4130
5	9	95	99	0	0	4159
	FSD-08	95	90	30MSS		4136

17th DRYLAND SPRING BREAD WHEAT YIELD TRIAL (16th DSBWYT)

17th DSBWYT comprising of 50 entries including local check variety Faisalabad-08 was planted in 5m x 6rows plot size with 2 replications. The trial was sown on 25th November 2016. Out of 50 entries, three genotypes gave higher yield than local check variety Faisalabad-08.

Table:- 15 Yield performance of selected entries in 17th DSBWYT

S.NO	DSBWYT	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	8	90	146	80	0	0	4286
	FSD-08	73	141	91	0	0	4235

17th Elite Spring Bread Wheat Yield Trial (17th ESBWYT)

17th ESBWYT comprising of 50 entries including local check variety Faisalabad-08 was planted in 5m x 6rows plot size with 2 replications. The trial was sown on 19th 2015.Out of 24 entries, one genotypes gave higher yield than local check variety Faisalabad-08 .

Table:- 16 Yield performance of selected entries in 17th ESBWYT

S.NO	ESBWYT	Days to heading	Plant Height	Disease Reaction		Plant height	Yield kg ha^{-1}
				LR	YR		
1	1	96	142	0	0	80	4592
	FSD-08	96	144	0	20s	91	4587

7th Harvest Plus Yield Trial (HPYT)

The trial comprised of 50 advanced lines. The trial was sown on 25th November 2016 in replication

Table:- 17 Yield performance of selected entries in 7th HPYT

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		Yield kg ha^{-1}
				LR	YR	
1	404	94	97	0	0	3496
2	406	91	104	0	0	3542
3	420	64	102	0	0	3366

National Regional Yield Trials (NRYT)

The trial was comprised of 25 entries including check variety. The trial was sown in triplicated following RCBD

Table:- 18 Yield performance of selected entries in NRYT

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		Yield kg ha^{-1}
				LR	YR	
1	1	98	107	0	0	2856
2	10	97	99	0	0	3128`
3	12	98	103	0	0	3082
4	16	98	102	0	0	3348

17th Dryland Spring Bread Wheat Yield Trial (17th DSBWYT)

17th DSBWYT comprising of 50 entries including local check variety Faisalabad-08 was planted in 5m x 6rows plot size with 2 replications. Out of 50 entries, one genotype gave higher yield than local check variety Faisalabad-08.

Table:19 Yield performance of selected entries in 17th DSBWYT

Sr.No	17th DSBWYT	H.D	DM	PH	LR	YR	Yield kg/ha
1	8	90	146	80	0	0	4286
	FSD-08	73	141	91	0	0	4235

15th HIGH TEMPERATURE WHEAT YIELD TRIAL

The 15th HTWYT comprising of 50 entries including local check variety Ujala-16 was planted in duplicate on 25th November, 2016 keeping row to row distance 27 cm. On the basis of the result following entries performed well.

Table:20 Yield performance of selected entries in 15th HTWYT

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha-1
				LR	YR		
1	30	98	102	0	0	34.2	3233
2	50	98	99	0	0	34.1	3232
3	48	94	108	0	0	36.1	3198
4	22	89	98	0	5MS	35.2	3121
5	17	94	95	0	0	32.8	3103
6	41	89	98	0	0	39.3	3061
7	20	98	89	0	0	38.8	3038
8	39	92	108	0	0	37.6	3032
9	5	97	105	0	0	38.9	3021
10	14	98	107	0	0	39	2997

17th Spring Bread Wheat Observation Nursery for Heat Tolerance

The 17th SBWON-HT comprised of 160 including a check variety Galaxy-13. It was planted on 1st December, 2016 with plot size 3*2 rows. On the basis of the result following entries gave good yield.

Table:21 Yield performance of different entries from 17th SBWON-HT

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	5	97	100	0	0	33.1	3730
2	30	94	90	0	0	31.1	6322
3	44	99	90	0	10MS	37.9	4209
4	62	95	87	0	0	27.6	4036
5	95	96	86	0	0	33.2	3614
6	99	94	93	0	0	26.6	3614
7	100	96	91	0	0	35.5	4848
8	108	95	92	0	0	36.6	4748
9	124	98	92	0	0	36.8	4281
10	157	94	96	0	0	30.3	4459

6th STRESS ADAPTIVE TRAIT YIELD NURSERY

The 6th SATYN comprising of 27 entries was planted in duplicate on 25th November, 2016 keeping row to row distance 27 cm. On the basis of the result following entries performed well.

Table :22 Yield performance and different parameters of selected entries of 6th SATYN

S.NO	SATYN	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	9418	98	105	0	0	31.1	2862
2	9420	100	109	0	0	44.2	2784
3	9427	110	110	0	0	36	2747
4	9404	96	105	10MS	0	32.9	2733
5	9416	100	101	0	0	34.7	2724
6	9419	97	105	0	0	40.1	2682
7	9422	91	106	0	0	35.2	2613

49thInternational Bread Wheat Screening Nursery (IBWSN)

The nursery comprised of 294 entries which was planted on 10th November 2016. The nursery was planted on

Table:- 23 Yield performance of selected entries in 49th IBWSN

S.NO	E.No.	Days to heading	Plant Height	Disease Reaction		1000 KW	Yield kg ha^{-1}
				LR	YR		
1	1009	96	94	0	0	18.15	465
2	101	96	98	0	0	17.03	843
3	1031	98	102	0	0	19.29	918

17th Spring Bread Wheat Observatory Nursery (17th SBW-ON)

17th SBW-ON comprising of 150 entries including local check variety Faisalabad-08 was planted in two rows. Out of 150 entries, three genotypes were disease free and gave higher yield than local check variety Faisalabad-08.

Table:24Yield performance of selected lines in 17th SBW-ON

Sr.No	17th SBWON	H.D	DM	PH	LR	YR	Yield kg/plot
1	SBWON-17-0052	99	144	101	0	0	0.646
2	SBWON-17-0037	90	141	95	0	5MS	0.618
3	SBWON-17-0069	98	142	86	0	0	0.612
	FSD-08	99	144	82	0	0	0.556

Out station yield trials

Punjab Uniform Wheat Yield Trials

The Punjab Uniformity Wheat Yield was conducted on 23 locations. On over all bases the line V-14124 performed well. The detailed result are as under.

Table:25 Summary of Punjab Uniform Wheat Yield Trial 2016-17

Rank	V-CODE	Average Yield (kg/ha)	Rank	V-CODE	Average Yield (kg/ha)
1	V-14124	4360	31	V-14084	3913
2	TWS1335	4144	32	14B-1005	3908
3	TWS1351	4129	33	V-14269	3907
4	V-15235	4129	34	V-14268	3897
5	9515	4111	35	13FJ29	3894
6	15C042	4106	36	WV-1038	3884
7	TWS1334	4105	37	V-14266	3877
8	HYT-27-11	4072	38	Rustam-2012	3874
9	Johar-16	4070	39	18V-4	3873
10	14BT022	4055	40	15C044	3866
11	V-14122	4036	41	V-15207	3860
12	V-14271	4027	42	15B-1131	3856
13	14BT004	4022	43	NR-448	3851
14	NS-14	4017	44	V-14057	3850
15	V-15250	4016	45	HYT-60-7	3842
16	13FJ35	4009	46	14BT016	3840
17	15B-1116	4007	47	V-15249	3820
18	NIAB-317	3990	48	Rustam Naz-2016	3803
19	PGBM-18	3982	49	V-13192	3801
20	V-15210	3975	50	V-14117	3784
21	NR-491	3970	51	TWS1355	3783
22	Galaxy-13	3968	52	V-13165	3781
23	HYT-60-57	3961	53	NS-13	3778
24	V-15238	3958	54	NR-499	3737
25	HYT-60-5	3954	55	Kanzo-1201	3713
26	14B-1572	3952	56	V-14270	3676
27	NR-505	3936	57	HYT-27-21	3652
28	V-14262	3928	58	13-3044	3379
29	NR-488	3925	59	13FJ20	3351
30	V-15211	3913	60	A-24	3331

Table: 26 Result of Punjab Uniform Wheat Yield Trial 2016-17

S.No	V-CODE	WRI FSD	Okara	Sargodha	Gujranwala	Kot Naina	KSK	Khanewal
1	V-14124	5817	3668	5838	4373	3593	4299	4382
2	TWS1335	5615	3921	5167	4868	4188	4310	4246
3	TWS1351	6019	3946	5746	4478	4520	3859	4943
4	V-15235	5564	4580	5521	4892	4144	3321	4523
5	9515	5103	3982	5313	4917	4901	4105	4104
6	15C042	6112	2865	6429	4500	4683	3468	4819
7	TWS1334	5729	3310	5296	5095	4543	4358	4496
8	HYT-27-11	5526	4475	4779	4257	3459	4260	4638
9	Johar-16	5107	3900	5704	5200	4745	4165	4607
10	14BT022	4147	4467	5017	4720	3646	3621	4696
11	V-14122	5115	4009	5954	4837	4280	3620	4204
12	V-14271	4735	3513	5646	5205	3663	3753	4763
13	14BT004	5480	4349	5867	4333	4302	3898	4417
14	NS-14	4732	3379	5617	5050	4797	3800	4036
15	V-15250	4936	3110	4948	4179	4364	3757	4241
16	13FJ35	5525	4488	5458	4074	4615	3329	4428
17	15B-1116	5357	4315	4442	3897	4593	4468	4353
18	NIAB-317	5617	2791	4179	4380	4407	3909	4638
19	PGBM-18	5351	4023	5525	4754	3735	3263	4629
20	V-15210	4494	3044	4883	4900	3888	3313	4778
21	NR-491	5916	4088	3736	4366	4131	3603	4158
22	Galaxy-13	4470	3717	4838	3972	3980	3770	4257
23	HYT-60-57	5905	3624	4504	4165	4069	4105	4597
24	V-15238	5688	3576	6027	4921	4472	3464	4396
25	HYT-60-5	5485	3288	4683	4463	4686	3337	4073
26	14B-1572	5723	3844	4363	5230	4183	3328	4331
27	NR-505	4550	3743	5258	4427	3986	4563	4333
28	V-14262	4391	3648	4904	4517	3535	3965	4507
29	NR-488	5264	4192	4875	4123	3930	3584	4313
30	V-15211	4869	3707	5329	4967	4590	3725	4225
31	V-14084	5645	3688	5188	4600	4086	3249	4288
32	14B-1005	5433	4025	5195	4435	3994	3688	4290
33	V-14269	4677	3570	5179	3935	4223	3929	4126
34	V-14268	4763	3913	5313	4953	3649	3475	4901
35	13FJ29	4920	2694	5154	4596	4432	3753	3981
36	WV-1038	4270	3713	4108	5770	4095	3785	4328
37	V-14266	5715	4397	3667	4732	3859	3387	4277
38	Rustam-2012	3581	3653	4542	4255	3497	3428	4043

39	18V-4	4903	3334	5567	4679	4423	3867	4377
40	15C044	5353	3538	4371	4142	4468	4004	4832
41	V-15207	4800	2680	5575	3700	4407	3404	4302
42	15B-1131	4712	3689	4083	3534	3816	4025	3439
43	NR-448	4581	3938	4079	4113	4052	3663	3482
44	V-14057	4879	3915	5242	4215	3741	3946	4560
45	HYT-60-7	5799	3795	4679	4550	3620	3907	4381
46	14BT016	5395	3658	5092	3483	4233	4360	4389
47	V-15249	5792	4142	4358	4954	4150	3947	4438
48	Rustam Naz 2016	5457	3738	5525	4550	3163	3574	4440
49	V-13192	5566	2928	5158	4767	4736	3329	4329
50	V-14117	5783	3356	5146	4396	4595	3525	4310
51	TWS1355	5673	3179	4688	4335	3425	3718	3831
52	V-13165	5393	2474	4646	3962	4094	2673	4261
53	NS-13	4700	3809	4238	4492	3897	3969	4390
54	NR-499	5595	3904	5025	3921	4152	3804	3535
55	Kanzo-1201	5031	3988	3992	4392	4163	3328	3974
56	V-14270	5360	3502	4867	4750	4031	3975	4105
57	HYT-27-21	5207	3027	5308	4483	4789	2757	4038
58	13-3044	3800	4104	4550	5137	3889	3369	3834
59	13FJ20	3801	3312	3946	3330	3213	2463	3477
60	A-24	5380	2690	4975	4292	3843	3606	3458

Result of Punjab Uniform Wheat Yield Trial 2016-17

S.NO	V-CODE	Sahiwal	Dhakkar	B.nagar	RARI BWP	R.Y. Khan	Multan	Alipur	Vehari
1	V-14124	4736	3354	3692	4768	4700	4515	5179	5574
2	TWS1335	4265	3123	4383	4339	4392	3333	5655	3300
3	TWS1351	4415	3533	3776	4911	4050	2583	6131	4056
4	V-15235	5256	3741	3773	3817	3817	3500	6190	2844
5	9515	4962	3182	3743	4502	4350	3583	5298	2933
6	15C042	4683	3758	4371	4758	4275	2750	5417	3267
7	TWS1334	4633	3261	3818	5044	4342	3833	5119	4463
8	HYT-27-11	4399	3944	3149	4773	4233	4083	4762	3074
9	Johar-16	5017	3580	3702	4606	4033	2432	5417	4259
10	14BT022	4610	4086	3498	3792	4225	4648	5357	4470
11	V-14122	4823	3731	3125	4088	4517	3417	4286	3219
12	V-14271	4259	3607	3593	3619	4175	3417	5179	4419
13	14BT004	4038	3560	3388	5163	4433	3167	3988	3533
14	NS-14	4343	3028	3989	4872	4250	3917	5179	4422
15	V-15250	4842	3553	3875	5133	4508	3500	5238	4159
16	13FJ35	3679	2872	2933	4181	4967	4250	4702	3833
17	15B-1116	4470	3072	3820	4576	4700	4250	5298	3074

18	NIAB-317	5136	3406	3749	4739	4433	3083	5179	4433
19	PGBM-18	4416	3295	4068	4142	4617	3417	5833	3948
20	V-15210	4574	3391	4137	3905	4617	4098	4583	3948
21	NR-491	4009	3098	4068	4053	4542	3500	3810	4211
22	Galaxy-13	4961	3899	3425	4265	4442	3250	5595	5570
23	HYT-60-57	4401	3059	3754	4226	4408	3417	6071	3126
24	V-15238	3998	3370	3478	4610	4533	4000	5119	2793
25	HYT-60-5	4217	3210	3521	4630	4508	2667	4226	3693
26	14B-1572	4507	3848	3043	4591	4442	3125	4583	2348
27	NR-505	4378	3194	2922	4749	4617	3583	4643	2493
28	V-14262	4488	3428	3918	3486	4325	2750	4583	5826
29	NR-488	4888	3344	3273	4403	3850	3083	5298	4330
30	V-15211	4400	3462	3863	4191	3717	3750	4226	3293
31	V-14084	4466	3552	4204	4502	3625	4375	3571	4122
32	14B-1005	3760	3018	3739	4191	4633	3167	4643	5626
33	V-14269	4123	3419	4026	3822	4717	3417	3512	4489
34	V-14268	4340	3589	3740	4241	4458	3250	5417	2974
35	13FJ29	3979	3504	3593	4655	3967	4285	4762	5241
36	WV-1038	4591	3362	3848	4112	3942	5167	3869	4463
37	V-14266	4582	3358	3686	3792	4333	3417	5238	3385
38	Rustam-2012	4582	3175	3744	4275	4717	4333	4583	3481
39	18V-4	3793	2950	3295	3945	4633	2917	4464	2885
40	15C044	4593	3123	4320	4043	4392	3917	4107	3115
41	V-15207	4257	3440	3856	2530	4558	3417	4940	2390
42	15B-1131	3946	2968	3567	4862	3992	3000	5417	4333
43	NR-448	3943	3770	2998	4157	3933	3167	5060	3989
44	V-14057	5016	3222	3617	4704	4050	3917	4940	3052
45	HYT-60-7	4722	3748	3833	4576	4525	3583	4286	2570
46	14BT016	4912	2998	3579	3886	3867	2917	4524	3367
47	V-15249	3966	3294	4052	4324	4317	3333	3750	2541
48	Rustam Naz 2016	4774	3244	3689	4167	3533	4000	4405	2789
49	V-13192	4275	3144	3395	4162	4000	4183	5417	2208
50	V-14117	3900	3704	3995	2732	4308	3083	5298	2329
51	TWS1355	3975	3459	4068	4961	4400	3250	4167	4641
52	V-13165	4033	2847	3413	3871	4717	3833	4881	4767
53	NS-13	4278	3047	3886	4167	3875	2750	4345	3763
54	NR-499	4236	3581	3648	3915	3783	2917	5119	2396
55	Kanzo-1201	4596	2992	3529	4704	4142	3083	4405	3659
56	V-14270	4147	3009	3840	3454	4192	3250	4107	2674
57	HYT-27-21	3712	3358	3268	3486	4342	3417	3750	2800
58	13-3044	4097	3074	3047	3491	4225	2833	4643	2652
59	13FJ20	3612	2628	2779	2313	4225	2750	2679	4315
60	A-24	3833	2720	3349	4201	3858	2667	3393	2174

Result of Punjab Uniform Wheat Yield Trial 2016-17

S.NO	V-CODE	BARI Chakwal	Attock	Bhaun	Fatehjang	AZRI Bhakkar	Piplan	Karor	UAF FSD	Average
1	V-14124	5938	798	4598	3400	4911	4510	5258	2383	4360
2	TWS1335	5601	856	4526	2828	4813	3963	4314	3311	4144
3	TWS1351	5056	1008	4314	2850	4238	4167	4357	2007	4129
4	V-15235	5365	670	4190	3084	4600	4483	4945	2140	4129
5	9515	4809	1034	4094	4500	3997	4028	4153	2958	4111
6	15C042	5030	936	4125	2917	3950	3921	4092	3317	4106
7	TWS1334	5029	792	4031	2878	4783	4040	3823	1702	4105
8	HYT-27-11	6733	606	4956	3700	3887	3477	4265	2235	4072
9	Johar-16	4774	850	3949	3722	3850	3586	3742	2661	4070
10	14BT022	5666	801	4447	2406	4221	3808	4063	2857	4055
11	V-14122	6007	695	4617	2456	4332	4090	4325	3086	4036
12	V-14271	4823	714	3883	3006	5108	4375	4250	2913	4027
13	14BT004	5816	472	4250	1823	4543	4050	4537	3094	4022
14	NS-14	4984	648	3874	2745	4167	4014	4030	2513	4017
15	V-15250	5319	973	4423	3023	4417	3792	3921	2151	4016
16	13FJ35	5076	620	3881	4245	4325	3867	3753	3111	4009
17	15B-1116	5510	664	4219	2389	3683	3954	4647	2420	4007
18	NIAB-317	5323	997	4428	2389	4200	3995	4167	2204	3990
19	PGBM-18	5274	700	4107	1817	4192	3845	4183	2460	3982
20	V-15210	4873	895	4034	3000	4342	4333	4990	2408	3975
21	NR-491	5689	890	4595	2022	5073	3968	4457	3325	3970
22	Galaxy-13	4960	848	4092	1961	4343	4136	4030	2485	3968
23	HYT-60-57	5582	903	4514	2906	4067	3875	3963	1857	3961
24	V-15238	4350	800	3640	2167	4217	3952	4130	3332	3958
25	HYT-60-5	4950	1025	4242	4000	4667	4201	4350	2812	3954
26	14B-1572	5427	603	4127	2784	4760	4067	4342	3294	3952
27	NR-505	6244	720	4806	2422	4150	4121	4071	2557	3936
28	V-14262	4295	917	3700	2267	5140	4167	4238	3350	3928
29	NR-488	4262	600	3368	4612	4238	3757	3903	2792	3925
30	V-15211	5616	892	4490	3545	3683	3683	3441	2340	3913
31	V-14084	5180	825	4164	1984	4658	3908	4075	2041	3913
32	14B-1005	4742	870	3904	2889	3790	3975	3740	2138	3908
33	V-14269	5189	850	4218	2661	4633	3883	4430	2827	3907
34	V-14268	4570	786	3749	2934	4597	3962	4117	1935	3897
35	13FJ29	4582	789	3777	2917	4557	3777	3708	1951	3894
36	WV-1038	5050	944	4187	2589	3407	3742	3550	2433	3884
37	V-14266	5410	703	4208	2689	4208	3952	4054	2125	3877
38	Rustam-2012	5573	745	4328	3089	4257	3997	3804	3411	3874
39	18V-4	6325	795	4897	2422	4375	3704	4427	2104	3873
40	15C044	4735	742	3780	1967	4433	3879	4243	2826	3866
41	V-15207	5225	950	4295	3567	4980	4022	4138	3359	3860
42	15B-1131	5255	811	4179	3678	4542	3995	4044	2802	3856
43	NR-448	6294	836	4869	1723	4627	4395	4880	2037	3851
44	V-14057	4945	675	3870	2067	4142	3383	3723	2730	3850

45	HYT-60-7	3427	553	2787	3823	4663	3949	4083	2512	3842
46	14BT016	4834	800	3924	3022	4044	3843	3897	3291	3840
47	V-15249	3391	711	2907	4239	4343	3900	4240	2763	3820
48	Rustam Naz 2016	4842	817	3955	2506	3557	3713	4508	2536	3803
49	V-13192	4771	570	3679	2650	4240	3893	4080	1949	3801
50	V-14117	5245	542	3975	2589	4445	3834	3983	1954	3784
51	TWS1355	4771	717	3793	2523	3690	3658	3984	2110	3783
52	V-13165	5588	806	4432	2600	3253	3813	4370	2238	3781
53	NS-13	4642	424	3449	4056	3817	3941	4216	2748	3778
54	NR-499	5377	628	4089	2289	4085	3973	4075	1912	3737
55	Kanzo-1201	4344	853	3638	2834	4067	4050	3870	1777	3713
56	V-14270	3614	903	3261	2745	4025	3880	4183	2672	3676
57	HYT-27-21	4698	992	3991	1545	4698	3747	4393	2203	3652
58	13-3044	3034	442	2418	2189	3042	3690	3513	2643	3379
59	13FJ20	5988	659	4467	2550	4023	3975	4033	2540	3351
60	A-24	2103	789	2106	1828	4803	4257	4403	1884	3331

National Uniform Wheat Yield Trials

Table:27 Summary of National Uniform Wheat Yield Trial 2016-17

No.	Genotype/ Advance Line	Yield Kg/Hac	No.	Genotype/ Advance Line	Yield Kg/Hac
1	V-14154	4265.9	31	NRL-1206	3911.71
2	DN-126	4201.57	32	CT12176	3910.54
3	AZRC-11	4158.53	33	12FJ26	3891.96
4	12B2511	4140.89	34	NR-491	3890.4
5	DN-117	4137.92	35	14C036	3889.8
6	NW-5-20-1	4136.65	36	V-12066	3882.72
7	TWS-12245	4120.39	37	V-14227	3868.08
8	AZRC-20	4103.83	38	PR-121	3852.67
9	NR-488	4098.42	39	013BT034	3851.81
10	PR-115	4097.37	40	LOCAL CHECK	3851.75
11	PR-120	4076.72	41	QS-3	3841.55
12	TWS-12464	4075.71	42	IV-II	3834.3
13	PAK-13	4061.84	43	AUR-0810	3822.43
14	PR-119	4046.78	44	NR-448	3822.39
15	14B1030	4044.45	45	NW-1-8183-8	3796.32
16	UOS-1	4023.37	46	NR-443	3792.76
17	TWS-12155	4010.78	47	BARDC-10-16	3790.66
18	V-13348	3994.93	48	IV-I	3780.67
19	9496	3994.83	49	WB-1038	3765.92
20	PR-118	3994.39	50	14C040	3752.16
21	122557	3990.12	51	KT-335	3722.53
22	122559	3985.18	52	AUR-0809	3714.7
23	FSD-08	3984.91	53	AZRC-18	3671.82
24	DN-111	3980.01	54	DANI-16	3670.21
25	NR-487	3973.01	55	MSH-3	3641.7

26	V-14168	3956.6	56	SRN-13121	3629.29
27	V-14170	3946.3	57	KT-325	3537.27
29	V-14225	3933.85	59	WBG-14	3477.07
30	NIBGE GANDUM-M3	3912.35	60	SD-1013	3422.02

DURUM WHEAT (*Triticum durum* Desf.) 2016-17

Maintenance Of Germplasm And Hybridization

The main objective of research work on durum is to develop high yielding, good quality and disease resistant wheat varieties through interspecific crosses. Two hundred and forty two (242) cultivars/ advanced lines of Durum and Triticale were sown to make the desirable cross combinations. Fifty seven (57) crosses were attempted and 50 fresh crosses were harvested for next year's planting.

FILIAL GENERATIONS (F_1-F_7)

F_1-GENERATION

Fifty three crosses were planted in a single row of 2.5m length along with their parents to compare their morphology and vigor. Thirty crosses having desirable traits were harvested to advance the generation.

F_2-F_7 GENERATIONS

The filial generations (F_2-F_7) were sown and selected for desirable traits. Segregating materials were surrounded by the spreader rows of highly susceptible variety (Morocco). Modified bulk method was used for selection in F_2, F_3 and F_4 generations. From F_5, uniform, disease resistant and desirable heads were selected to raise single head rows of F_6 generation. Outstanding and stable lines from F_6 were selected and harvested for inclusion in F_7 generation. Entries studied and selected in different generations are given in the Table no. -

Table 28 Details of Filial Generations of Durum wheat

Sr. No.	Generation	Entries Studied	Entries Selected
2	DF1	50	30
3	DF2	32	25
4	DF3	18	16
5	DF4	18	12
6	DF5	20	250 S.H (11 Crosses)
7	DF6	263 SHR	45 SHRP
8	DF7	38	11

48th INTERNATIONAL DURUM YIELD NURSERY

During 2016-17, 48th International Durum Yield Nursery was received from CIMMYT. Fifteen lines out of 50 lines were selected on the basis of yield and their performance against diseases. The line E-723 had the highest yield (4442 kg/ha) followed by E-747 (4356 kg/ha) and E.733 (4323 kg/ha). The yield of Durum-97 (check) was 2910 kg/ha.

40th INTERNATIONAL DURUM YIELD TRIAL - MEDITERRANEAN DRYLAND

During 2016-17, 40th International Durum Yield Trial was received from ICARDA. In this trial, 7 lines out of 24 lines were selected on the basis of yield performance. The line E- 23, E-19 and E.22 produced the highest yield i.e. 4054, 3704 and 3676 kg/ha, respectively. The yield of Durum-97 (check) was 2731 kg/ha.

48th INTERNATIONAL DURUM SCREENING NURSERY

During 2016-17, 48th International Durum Screening Nursery was received from CIMMYT. 19 lines out of 164 lines were selected on the basis of their performance against diseases and 1000-grain weight. The line E-7008, E-7025 and E-7060 gave the highest 1000-grain weight (50.14, 49.4 & 49.0 g). The 1000-grain weight of Durum-97 (check) was 43.32g.

40th INTERNATIONAL DURUM OBSERVATION NURSERY - MEDITERRANEAN DRYLAND

During 2016-17, 40th International Durum Observation Nursery was received from ICARDA. 10 lines out of 96 lines were selected on the basis of their performance against diseases and 1000-grain weight. The line E- 54, E-37 and E-72 gave the highest 1000-grain weight (49.08, 48.62 & 48.16 g). The 1000-grain weight of Durum-97 (check) was 42.62g.

YIELD EVALUATION OF CIMMYT MATERIAL IN NORMAL AND LATE SOWN CONDITIONS

Eighty three (83) promising lines were selected from candidate lines received from CIMMYT for further study in yield trials. The yield performance of top five high yielding lines compared to check variety is as under

Table 29 yield performance wheat ines

Entry No.	Yield (kg ha-1)	% increase over Punjab-11
4040	6316	35.97
4029	6232	34.16
4041	6170	32.83
4031	6077	30.83
3037	5942	27.92

Yield trials

Station Yield Trials

The most promising lines selected from different sources i.e. F_7 generation, International nurseries/ trials, drought, heat stress and plant pathology program were evaluated in station yield trials (A & B Trials).

Preliminary durum yield trial (A-Trial)

During the reported year, two trials of durum wheat were conducted under normal conditions. Each normal trial consisted of 15 test entries/lines with 3 check varieties (Durum-97, Wadanak-85 & Ujala-16). The planting was done following RCB design with three replications. The lines that performed better than the three checks are given in Table-1 with their data regarding days to heading, days to maturity, plant height, lodging %age, disease reaction and grain yield.

Table 30: Yield performance and related traits of promising Durum lines in preliminary yield trials

Sr. no	Line/ Genotype	Days to 50% heading	Days to maturity	Disease reaction		Plant height (cm)	Yield Kg/ha
				Leaf rust	Yellow rust		
DA-I							
1	D-16705	96.33	143.67	0	0	113.67	4886.01
2	D-16707	97.67	146.00	0	MS/MR	108.00	4858.02
3	D-16710	103.33	146.67	0	TMS/MR	108.00	5101.65
4	D-16715	98.00	138.00	0	0	105.33	4848.97
5	Durum 97	97	140	0	TMR	107	4788
DA-II							
1	D-16721	87.00	138.00	0	0	118.67	5054.32
2	D-16725	88.00	138.00	TMS/MR	0	111.00	4967.90
3	D-16726	95.50	139.00	0	100S	105.67	3223.46

5	D-16727	96.00	141.00	0	0	112.67	4774.07
6	D-16729	99.00	137.33	0	0	115.33	3998.35
7	D-16730	96.00	139.00	0	0	102.67	3748.15
8	Durum-97	98.00	140.00	0	TMR	110.00	4669.14
8	Wadanak-85	99.00	145.00	0	0	106.67	3300.00
9	Ujala-16	#DIV/0!	140.00	0	0	111.67	4282.30

Regular durum yield trial (B-Trial)

This year, two trials of durum wheat were conducted under normal conditions. Trials were planted with plot size of 6 m x 0.27 m using RCB design with three replications and harvested plot size was 5 m x 0.27 m. Each normal trial consisted of 15 test entries/lines with 3 check varieties (Durum-97, Wadanak-85 & Ujala-16). Promising lines that surpassed three check varieties are given in Table 2 with their respective data of days to heading, days to maturity, plant height, lodging %age, disease reaction and grain yield.

Table 31: Yield performance and related traits of promising Durum lines in regular yield trials

Sr. no.	Line/ Variety	Days to 50% heading	Days to maturity	Disease reaction		Plant height (cm)	Yield Kg/ha
				Leaf rust	Yellow rust		
1	D-15722	90.50	147.00	TMR	0	91.00	4613.58
2	D-15728	100.50	149.00	TMR	MS/MR	111.67	5277.37
3	D-15730	95.67	150.00	MS	MS	97.00	4897.94
4	D-15739	99.67	142.00	0	0	101.33	4747.74
5	D-15729	100.00	151.00	TMR	MS/MR	115.00	3856.38
6	D-16730	93.33	139.00	0	0	102.67	3834.57
7	D-16732	93.67	140.00	0	0	98.00	5230.45
8	D-16738	93.00	140.00	0	0	106.00	4923.05
9	D-16743	97.33	142.00	0	0	102.00	4695.06
10	D-16744	95.33	140.00	0	TMS/MR	103.33	4707.00

BARLEY(Hordeum vulgare L.)

Maintenance And Improvement Of Barley Germplasm

During the year, seventy eight genotypes were maintained. One line was rejected on the basis of poor performance and disease susceptibility. True to type heads from remaining entries were selected and threshed to maintain the genetic purity. Some important traits recorded are as under,

Table 32: Genetic diversity of different traits in germplasm during 2016-17

Sr. No.	Character	Range
1	Plant height	53-119 cm
2	Days to heading	88-116 days
3	Spike length	4.1-11.1 cm
4	No. of grains per spike	12-84

FILIAL GENERATIONS

F_3, F_4, F_5 & F_6 Generations

Five entries from F_3 were harvested for planting F_4 in next year. Desirable plants were selected from Seventeen entries of F_4, 09 F_5 and 16 F_6 entries and single heads from the selected plants were harvested. Heads of each entry were threshed in bulk to advance the generation.

PRELIMINARY BARLEY YIELD TRIALS (BA-TRIALS)

Thirty advanced lines of barley were sown in this experiment (A1 and A2) with check variety Haider-93, out of which 12 lines produced more grain yield than check variety as follows.

Table 33- Yield performance of promising lines in A-trials

A1			A2		
Ranking	**Entry Name**	**Yield (kg ha^{-1})**	**Ranking**	**Entry Name**	**Yield (kg ha^{-1})**
1	B-16012	3963	1	B-16020	3429
2	B-16009	3789	2	B-16021	3204
3	B-16003	3670	3	B-16029	3089
4	B-16011	3646	4	B-16026	3085
5	Haider-93	3551	5	B-16030	3061
6	B-16008	3511	6	B-16028	2993
7	B-16010	3238	7	B-16024	2970
8	B-16006	3147	8	B-16025	2942
9	B-16013	2938	9	Haider-93	2823
	LSD (0.05%)	483		LSD (0.05%)	268

REGULAR BARLEY YIELD TRIAL (BB-TRIAL)

Out of 15 advanced lines, 8 gave best grain yield against check variety (Haider-93). Maximum grain yield was shown by Entry No. B-15035 (3905 kg ha^{-1}) followed by Entry No. B-16045 (3731 kg ha^{-1}) and B-16043 (3441 kg ha^{-1}) while check variety Haider-93 could produce grain yield of 2900 kg ha^{-1} as follows

Table 34- Yield performance of promising lines in B-trial

Ranking	Entry Name	Yield (kg ha^{-1})
1	B-15035	3905
2	B-16045	3731
3	B-16043	3441
4	B-16038	3155
5	B-16039	3123
6	B-15029	3122
7	B-16037	3043
8	B-16042	2991
9	Haider-93	2900
	LSD(0.05%)	295

PUNJAB UNIFORM BARLEY YIELD TRIAL

On overall mean basis the advanced line B-09006 produced maximum grain yield (3364 kg ha^{-1}) followed by B-09008 (3324 kg ha^{-1}) and B-05011 (3308 kg ha^{-1}) while check variety Haider-93 could produce the grain yield of 2695 kg ha^{-1} as follows.

Table 35- Yield performance of promising lines in PUBYT trial

Ranking	Entry Name	Yield kg ha^{-1}					
		Dhakkar	Sahiwal	Gujranwala	K.S.K	Faisalabad	Average
1	B-09006	3526	3863	2716	3368	3349	3364
2	B-09008	4168	3022	2736	3097	3597	3324
3	B-05011	3916	3618	2464	3333	3209	3308
4	B-15006	4107	3296	3009	3303	2781	3299
5	B-14003	3822	3483	3084	2806	3289	3297
6	B-14011	3501	3451	2921	3061	2372	3061
7	B-15005	3841	3494	2264	3200	2022	2964

8	B-14007	3521	3507	2678	2826	1948	2896
9	Haider-93	2877	2969	2708	2528	2394	2695
10	Jau-83	3108	2494	2159	2587	2517	2573
11	B-15002	3380	2875	1456	2571	2476	2551
12	B-15003	2759	2116	2092	2267	1804	2208

DETERMINATION OF SUITABLE PLANTING TIME IN BARLEY CROP

Eleven advanced lines of barley alongwith check variety (Haider 93) were tested in this trial and results are as under:

Table 36- Yield performance of barley advanced lines sown at different times

Ranking	Entry Name	Yield kg ha^{-1}			
		D1	D2	D3	Average
1	B-05011	3183	3638	2546	3123
2	B-14035	2773	3194	2899	2955
3	B-14003	3198	3202	2376	2925
4	B-15009	2585	3338	2446	2790
5	B-14007	2653	3134	2511	2766
6	B-15010	2556	3239	2502	2766
7	B-14011	2864	3129	2292	2762
8	Haider-93	2807	2998	2242	2682
9	Jau-87	2991	2823	2088	2634
10	B-14038	2716	2723	2267	2569
11	Jau-83	2816	2651	2213	2560
12	B-14002	3066	2427	2061	2518

The advanced line B-05011 produced maximum grain yield of 3638 kg ha^{-1} at second planting (20th November). On overall mean basis, advanced line B-05011 produced maximum grain yield (3123 kg ha^{-1}) followed by B-14035 (2955 kg ha^{-1}) and B-14003 (2925 kg ha^{-1}) while check variety Haider-93 produced grain yield of 2682 kg ha^{-1}. Seven advanced lines performed better than check variety Haider-93. It is also revealed from the results that mid of November is suitable time for barley planting.

BARLEY RAINFED YIELD TRIAL

Fifteen advanced lines of barley along with check variety (Haider-93) were tested in this trial and results are as under:

Table 37- Yield performance of barley advanced lines under normal and rainfed conditions

Ranking	Entry Name	Yield kg ha^{-1}		
		Normal	Rainfed	Average
1	B-09008	3459	2811	3135
2	B-15018	3404	2829	3117
3	B-09006	3414	2748	3081
4	B-05011	3405	2548	2977
5	B-15012	3290	2448	2869
6	B-16031	3037	2517	2777
7	B-16035	3308	2120	2714
8	B-16033	3268	2102	2685
9	B-16034	2907	2415	2661
10	B-10007	3145	2016	2581
11	B-15016	2332	2596	2464
12	B-15013	2654	2159	2406
13	Haider-93	2454	2339	2397
14	B-16032	2483	2023	2253
15	B-16036	2323	2030	2177
16	B-15015	2467	1867	2167
Cd1 for Irrigation Level = 165, for Varieties = 260 and for Interaction = 382				

In this experiment twelve advanced lines performed better than check variety Haider-93. Maximum grain yield in rainfed conditions (2829 kg ha^{-1}) was obtained from advanced line B-15018. On overall mean basis B-09008 produced maximum grain yield of 3135 kg ha^{-1} followed by B-15018 (3117 kg ha^{-1}), B-09006 (3081 kg ha^{-1}) B-05011 (2977 kg ha^{-1}) while the check variety Haider-93 could produce grain yield of 2397 kg ha^{-1}.

RESPONSE OF SEED RATE ON GRAIN YIELD OF BARLEY

Five advanced lines along with check variety Haider-93 were sown in this experiment with three seed rates of (20, 25 and 30) kg/acre.

Table 38- Yield performance of barley at different seed rates during 2016-17.

Name	SR1	SR2	SR3	Average
B-05011	2291	3001	2744	2679
B-09006	2400	2518	2447	2455
B-14003	2332	2484	2482	2433
B-09008	2354	2471	2359	2395
Haider-93	1799	2270	2191	2087

The advanced line B-05011 produced maximum grain yield of 3001 kg ha^{-1} at second seed rate followed by B-09006 (2518 kg ha^{-1}). On overall mean basis also B-05011 produced maximum grain yield of 2679 kg ha^{-1} followed by B-09006 (2455 kg ha^{-1}) and B-14003 (2433 kg ha^{-1}) while check variety Haider-93 produced grain yield of 2087 kg ha^{-1}. It is also revealed from the experiment that both 25 and 30 kg/acre seed rate is suitable to get maximum grain yield of barley.

INTERNATIONAL NURSERIES/ YIELD TRIALS

Global Spring Barley Yield Trial

In this trial 25 entries were planted and among them 5 entries performed better than check variety Haider-93. The entry No. 10 produced maximum grain yield of 2583 kg/ha followed by Entry No. 5 (2238 kg/ha) and Entry No. 16 (2076 kg/ha).

International Barley Yield Trial

In this trial 25 entries were planted and among them 9 entries performed better than check variety Haider-93.The entry No. 5 produced maximum grain yield of 3440 kg/ha followed by Entry No. 11 (3038 kg/ha) and Entry No. 19 (2637 kg/ha).

International Naked Barley Yield Trial

In this trial 25 entries were planted and among them 6 entries performed better than check variety Haider-93. The entry No. 1 produced maximum grain yield of 3056 kg/ha followed by Entry No.23 (3009 kg/ha) and Entry No. 14 (2993 kg/ha).

International Naked Barley Observation Nursery

This observatory Nursery consisted of 100 entries of which 7 lines performed better than check variety Haider-93 and were selected for testing into next year trials.

International Barley Observation Nursery

This observatory Nursery consisted of 112 entries of which Entry No. 54 produced maximum grain yield of 3793 kg/ha followed by Entry No. 91 (3780 kg/ha) and Entry No. 16 with grain yield of 3767 kg/ha.

Global Spring Barley Screening Nursery

This observatory Nursery consisted of 150 entries of which Entry No. 65 produced maximum grain yield of 3727 kg/ha followed by Entry No. 47 (3267 kg/ha) and Entry No. 73 with grain yield of 3200 kg/ha.

SEED PRODUCTION OF BARLEY VARIETIES AND ADVANCED LINES.

Following quantity of seed of different barley varieties and advanced lines was produced for further studies.

Table 39- Quantity of barley seed produced during 2016-17.

Sr. No.	Varieties /lines	Quantity (kg)	Sr. No	Varieties/lines	Quantity (kg)
1	B-09006	200	16	B-16033	12
2	B-09008	175	17	B-16034	20
3	B-05011	182	18	B-16035	17
4	Haider-93	610	19	B-16036	12
5	Jau-87	21	20	B-15002	17
6	Jau-83	22	21	B-15003	10
7	B-15009	20	22	B-15005	17
8	B-15010	12	23	B-15006	9
9	B-14002	12	24	B-14003	15
10	B-14035	10	25	B-14007	17
11	B-14038	12	26	B-14011	10
12	B-15012	17	27	B-10007	11
13	B-15013	19	28	B-16031	11
14	B-15015	18	29	B-16032	14
15	B-15016	20	30	B-15018	9

WHEAT AGRONOMY

Effect of climate change on sowing time of wheat crop

The trial was conducted to expedite the best planting time for newly developed wheat lines under changed climate scenario. Nine new developed wheat lines viz. V-11098, V-12304, V-12066, V-13348, V-14154, V-14225, V-14227,V-14168 and V-14170 along with three check varieties i.e.Punjab-11, Galaxy-13 and Ujala-16 were planted on seven dates starting from 1st November to 30th December with ten days interval. Maximum grain yield of 6045 kg ha^{-1} was obtained from the 1st November planting on overall mean basis. However, 1st November to 30th December was the best planting time for wheat during the year 2016-17 due to prolonged cool weather conditions. Among varieties it was found that V-14170 produced maximum grain yield (5229 kg ha^{-1}) followed by V-14154 (5192 kg ha^{-1}) and V-14225(4865 kg ha^{-1}) and V-14168(4824 kg ha^{-1}).

Table 41 Effect of planting time on grain yield of wheat varieties

Advanced lines/Varieties	1st Nov.	10th Nov.	20th Nov.	30th Nov.	10th Dec.	20th Dec.	30th Dec.	Mean
Punjab-11	5597	6262	4942	4321	4386	3783	3152	4635cd
Galaxy-13	6132	5682	4599	4462	4270	2894	2596	4376e
Ujala-16	6139	5923	4818	4242	4263	3659	3340	4626cd
V-11098	6286	6091	4835	4691	4424	3611	3498	4777bc
V-12304	6262	6063	4712	4479	4379	3937	3543	4768bc
V-12066	5912	4877	4393	4492	4115	3659	3378	4404e
V-13348	6307	5586	4530	4252	4458	3995	3368	4642cd
V-14154	6910	6166	5357	5086	5147	4043	3635	5192a
V-14225	5953	5974	4825	4763	4739	4016	3786	4865b
V-14227	4931	5785	4750	4681	4414	4084	3361	4572d
V-14168	5737	5895	4890	4657	4654	4122	3810	4824b
V-14170	6375	6519	5528	5134	4873	4297	3879	5229a
Mean	6045a	5902a	4848b	4605c	4510c	3842d	3445e	
cd1 for dates 145 kg ha^{-1} , cd1 for varieties 160 kg ha^{-1} and for interaction 431								

Response of seed rate on grain yield of advanced wheat lines

Seven advanced lines i.e. V-13348, V-14154, V-14225, V-14227, V-14168, V-14170 and V-12066 with check variety viz. Fsd-08 along with four seed rates. Viz. 75, 100, 125, 150 kg ha^{-1} were tested. Statistical analysis of the data revealed that maximum grain yield of 6458 kg ha^{-1} was recorded when 100 kg ha^{-1} seed rate was

used which differed statistically from 75, 125 and 150 kg ha^{-1} seed rate by producing grain yield of 5907, 6229 and 6077 kg ha^{-1}, respectively. The advanced line V-14154 gave maximum grain yield of 6736 kg ha^{-1}.

Table 42 Effect of Seed Rate on Grain Yield of different wheat varieties/lines

Advanced lines/Varieties	Seed rate (kg ha^{-1})				Mean
	75	100	125	150	
V-Fsd-08	5768	6461	6259	6046	6133bc
V-13348	5370	5700	5511	5652	5558e
V-14154	5576	7260	7089	7020	6736a
v-14225	6101	6492	6399	6300	6323b
V-14227	6049	6121	5888	5796	5964cd
V-14168	6039	6530	6128	5799	6124bc
V-14170	6512	7099	6680	6348	6660a
V-12066	5840	6005	5881	5655	5845d
Mean	5907c	6458a	6229b	6077b	
cd_1 for varieties 220, for Seed rates 165 and for V ×S= 462					

Response of Fertilizer on grain yield of advanced wheat lines

The trial was conducted on mid-November to explore optimum fertilizer requirement of seven advanced lines of wheat namely V-13348, V-14154, V-14225, V-14227, V-14168,V-14170 and V-12066 with check variety viz. Fsd-08 along with four NPK levels (0-0-0, 90-60-60, 120-90-60, 150-120-60) kg ha^{-1}. The maximum grain yield of 5474 kg ha^{-1} was recorded where NPK fertilizer applied @ 120-90-60 kg ha^{-1} which was statistically different from 150-120-60 NPK kg ha^{-1} (5169 kg ha^{-1}). Among the advanced lines V-14154 gave the maximum yield of 5207 kg ha^{-1}.

Table 43 Effect of different levels of fertilizer on the yield different wheat varieties/line.

Advanced lines/ Varieties	Fertilizer levels NPK (kg ha^{-1})				Mean
	0-0-0	90-60-60	120-90-60	150-120-60	
Fsd-08	3292	5230	5340	5141	4751c
V-13348	3752	5216	5316	5213	4874bc
V-14154	3841	5593	5861	5532	5207 a
V-14225	2977	5511	5703	5408	4900 bc
V-14227	3570	4379	5069	4880	4474d
V-14168	3577	5065	5950	5278	4967b
V-14170	3350	5096	5600	5079	4781bc
V-12066	2860	4520	4955	4825	4290d
Mean	3402 c	5076 b	5474a	5169 b	
Cd_1 for varieties 198, for Fertilizer rates 125.12 and for V ×F 391.51					

Effect of irrigation scheduling on wheat yield under changing climate

Different combinations of plant stages were tested in treatments of irrigations. The maximum grain yield of 5442 kg ha^{-1} was recorded when applied three irrigations (1^{st} crown root, 2^{nd} at booting and 3^{rd} at grain filling), which is statistically differed with other treatments of three irrigations (1^{st} at crown root, 2^{nd} at booting and 3^{rd} at heading), three irrigations (1^{st} crown root, 2^{nd} at heading and 3^{rd} at grain filling), four irrigations (1^{st} at crown root, 2^{nd} at booting, 3^{rd} at heading and 4^{th} at grain filling) and five irrigations (1^{st} at crown root , 2^{nd} at stem elongation, 3^{rd} at booting, 4^{th} at heading and 5^{th} at grain filling) by producing grain yield of 5240 kg ha^{-1}, 5115 kg ha^{-1}, 5008 kg ha^{-1} and 5048 kg ha^{-1} respectively.

Table 44 water requirement and its time of application to fetch maximum yield wheat

Treatments	Mean
no irrigation	3160 f
1 irrigation (at crown root stage)	3990 e
2 irrigations (1^{st} at crown root and 2^{nd} at booting)	4483 cd
2 irrigations (1^{st} at crown root and 2^{nd} at heading)	4189 de
2 Irrigations (1^{st} at crown root and 2^{nd} at grain filling)	4934 bc
3 irrigations (1^{st} at crown root, 2^{nd} at booting and 3^{rd} at heading)	5240 ab
3 Irrigations (1^{st} crown root, 2^{nd} at booting and 3^{rd} at grain filling)	5442a
3 Irrigations (1^{st} at crown root , 2^{nd} at heading and 3^{rd} grain filling)	5115ab
4 irrigations (1^{st} at crown root , 2^{nd} at booting, 3^{rd} at heading and 4^{th} at grain filling)	5008 ab
5 irrigations (1^{st} at crown root , 2^{nd} at stem elongation, 3^{rd} at booting, 4^{th} at heading and 5th at grain filling)	5048 ab
Cd 1= 461	

SEED PRODUCTION

Single Head Progenies

For maintaining the purity of the variety/seed, breeder's nucleus seed, single head progenies of each variety were planted every year. For this purpose single head rows of four commercial varieties, thirty six advanced lines of NUWYT and PUWYT were planted in the 2nd week of November. The number of head rows varied from 40 to 200 per variety/line, head rows of each variety were observed at different stages of plant development and rows deviating from the original variety were discarded. Uniform, vigorous and disease resistant rows of each variety were harvested and threshed separately. The seed of each head row was also observed for grain characteristics. Selected entries were planted as breeder's seed to produce the pre-basic seed of commercial wheat varieties whereas the seed of head rows of candidate lines was kept separately for further study. The detail of selected heads is given in Table 54.

Table 54 No of heads taken for head row progeny

Sr. No.	Varieties/ lines	No. of heads	Sr. No.	Varieties/ lines	No. of heads
1.	Punjab-11	160	21.	V-15210	40
2.	Faisalabad-08	160	22.	V-15211	40
3.	Galaxy-13	160	23.	V-15235	40
4.	Ujalla-16	160	24.	V-15238	40
5.	V-11098	240	25.	V-15249	40
6.	V-12066	80	26.	V-15250	40
7.	V-12304	80	27.	V-13165	40
8.	V-14154	40	28.	V-13192	40
9.	V-14168	40	29.	V-14262	40
10.	V-14170	40	30.	V-14266	40
11.	V-14225	40	31.	V-14268	40
12.	V-14227	40	32.	V-14269	40
13.	V-13348	40	33.	V-14270	40
14.	V-14153	40	34.	V-14271	40
15.	V-14048	40	35.	V-14057	40
16.	V-14157	40	6.	V-60-5	40
17.	V-14122	40	37.	V-60-7	40
18.	V-14124	40	38.	V-60-57	40
19.	V-14143	40	39.	V-27-11	40
20.	V-15207	40	40	V-27-21	40

Table 55 Detail of single heads selected during 16-17

Sr. No.	Name of Variety	Single head selected	Sr. No.	Name of Variety	Single head selected
1	Faisalabad.08	250	8	V-14154	100
2	Punjab.11	250	9	V-14168	100
3	Galaxy.2013	250	10	V-14170	140
4	Ujalla.16	250	11	V-14225	100
5	V-11098	260	12	V-14227	100
6	V-12066	100	13	V-13348	100
7	V-12304	100	14		

Table 56 Detail of head rows selected from the single heads

Sr. No.	Name of Variety	Accepted progenies	Sr. No.	Name of Variety	Accepted progenies
1	Faisalabad.08	125	10	V-14170	35
2	Punjab.11	130	11	V-14225	32
3	Galaxy.2013	130	12	V-14227	30
4	Ujalla.16	130	13	V-13348	38
5	V-11098	20	14		
6	V-12066	15	15		
7	V-12304	69	16		
8	V-14154	37	17		
9	V-14168	25	18		

Pre-basic and certified seed production

Pure and true to type seed of a variety plays an important role in crop productivity. For maintaining the seed purity of commercial varieties and candidate lines, breeder's seed is produced from heads. From breeder's seed, pre-basic seed is produced every year, most of seed is being supplied to the Punjab Seed Corporation, Khanewal and other registered private seed companies.

Four commercial varieties of bread wheat were planted at low seed rate with self-propelled seed drill to produce the basic seed. The crop was kept under observation from tillering to maturity stages and deviating entries were discarded. As per instructions, the crop was inspected twice by the Deputy Director, FSC&RD to check the quality standards of pre-basic seed and crop purity. Besides producing the pre basic seed, a large quantity of basic seed of commercial varieties was also produced. The detail of pre-basic and basic seed production during 2015-16 is given in Table 80.

Table 57 Pre basic and basic seed produced during 2016-17

Sr. No.	Varieties	Pre Basic seed	Basic / Certified seed
1.	Faisalabad.08	1000	5700
2.	Punjab.11	2000	5200
3.	Galaxy.2013	1000	6100
4.	Ujalla.16	1000	4470
5	Haider (Barley)	780	

Table 58 BNS seed of new advanced lines 2016-17

Sr. No.	**Name of Variety**	**BNS seed**
1	V-11098	3900
2	V-12066	300
3	V-12304	300
4	V-14154	325
5	V-14168	226
6	V-14170	270
7	V-14225	300
8	V-14227	400
9	V-13348	307

WHEAT PATHOLOGY

Investigation on Newly Emerging Foliar Diseases of Wheat under Changing Climatic Conditions

A survey was conducted in twenty districts of Punjab for the prevalence/status of newly emerging foliar diseases of wheat particularly wheat blast in different agro ecological zones of Punjab. The result indicates that all the surveyed wheat fields were free from newly emerging disease wheat blast. However, the symptom of foliar blight was observed at scattered locations and disease suspected samples was collected and analyzed in seed Pathology Laboratory, PPRI. Faisalabad for pathogen identification. The lab analysis report revealed that none of the sample showed the presence of wheat blast pathogen (*Magnaporthe oryzae* Triticum pathotype).

Disease Trap Nurseries

To monitor the virulence pattern of rust resistant genes as well as for the observation of blast symptoms on foliar part of plant especially head/spike, trap nurseries were planted at eight different locations i.e. Faisalabad, Bahawalpur, Khanewal, Kala Shah Kaku, Kot Naina, Islamabad, Pirsabak and Peshawar. The data indicated that leaf rust was trapped on 28-01-2017 while yellow rust on 14-02-2017 in 1st trap nursery. But, all the entries were free from the symptoms of wheat blast pathogen at all locations. The results regarding virulence pattern indicated that the isogenic lines for leaf rust including Lr 19, Lr 25, Lr 27 +31, Lr 28, Lr 36 and Lr 23+Gaza and the isogenic lines for yellow rust including Yr 5, Yr 10, Yr 15, Yr 28 and Yr sp were found resistant (Table 1) and none of the tested entry showed the symptoms of stem rust during 2016-17.

Establishment of Host Resistance (Rusts) Pre-Breeding Nursery

To strengthen the rust resistant breeding program, host rust resistant nursery comprises of three hundred and thirty two entries were planted at research area of WRI, Faisalabad. Rust data was recorded on Modified Cobb's Scale and on

the basis of morphological markers i.e. Ltn1, Ltn2 & Psedu black chaff, the genotypes were marked for the suspected presence of resistant genes i.e. LR34, LR46 & SR2 respectively. Out of tested entries, twenty one entries showed pseudo black chaff and thirty six entries showed leaf tip necrosis at adult plant stage. While one hundred and forty six showed low infection type against leaf rust at seedling stage under glass house conditions (Table.59).

Table.59. Entries showing presence of pseudo black chaff, leaf tip necrosis as well as resistant response to rust diseases.

Parameters	**No of entries**
Pseudo black chaff	21
Leaf tip necrosis	36
Low infection type (LR)	146

Disease Screening Nursery

Advance bread wheat and barley lines were planted at Bahawalpur, Khanewal, Faisalabad, Kala Shah Kaku, Kot Nina, Islamabad, Pirsabak and Peshawar against leaf, yellow and stem rusts. At each location, the tested entries including susceptible check variety (Morocco) were sown in single row of two meters length. At Faisalabad and Bahawalpur material was tested under artificially rust conditions whereas at other locations screening was conducted under natural disease rust conditions. The rust severity and response was recorded according to the modified Cobb's scale described by Peterson *et al*. (1948). On the basis of rust data, it was found that among tested entries, sixty nine entries showed susceptible reaction to yellow rust, seventy nine entries showed susceptibility to leaf rust while eighteen entries showed susceptibility to both leaf and yellow rust (Table 3). The entries showing rust score upto 30 MRMS under stress conditions have been promoted/selected for further study.

Table 60. Final rust severity and virulence pattern of leaf, yellow & stem rust differentials of wheat, during 2016-17																	
S. No.	V. Code	Final Rust Response															
		Faisalabad		Khannewal		BWP		K. S. Kaku		Kot Nina		Islamabad		Peshawar		P. Sabak	
Leaf Rust Differential		LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR
1	Lr-1	80S	0	5S	10MSS	10guS	0	5MSS	10MSS	10S	60S	0	0	0	20S	0	30S
2	Lr-2A	50MSS	0	10MSS	10MSS	30MSS	0	5MSS	10MSS	10S	50S	0	0	0	30S	0	30S
3	Lr-2B	60S	0	10S	10MSS	20S	0	5MSS	10MSS	10MSS	40S	0	0	0	40S	0	50S
4	Lr-2C	80S	0	5S	30S	30S	0	5MS	30S	30S	80S	0	0	0	30S	0	20S
5	Lr-3	50MS	0	20MSS	30S	30S	0	10MSS	30S	40S	60S	0	0	0	30S	0	20S
6	Lr-3KA	50MS	0	10MSS	20S	30S	0	5MSS	20S	10MS	60S	0	0	0	30S	0	30S
7	Lr-3BG	80MSS	0	20MSS	30MSS	20MS	0	5MSS	30MSS	20S	60S	0	0	0	40S	0	30S
8	Lr-9	40M	0	0	30M	0	0	0	30M	0	50S	5MSS	0	0	20MSS	0	20MSS
9	Lr-10	60MSS	0	5S	10MSS	40S	0	10MS	10MSS	40S	50S	0	0	0	10S	0	20S
10	Lr-11	80S	0	0	60MSS	60S	0	0	60MSS	0	80S	TR	0	0	60S	0	30S
11	Lr-12	60M	0	0	10MSS	40S	0	0	10MSS	0	60S	0	0	0	60S	0	40S
12	Lr-13	60MSS	0	80S	0	10MSS	0	80S	0	0	40S	0	0	0	30S	0	20S
13	Lr-14A	90S	0	60S	0	80S	0	60S	0	0	80S	0	0	0	50S	0	40S
14	Lr-14B	90S	0	60S	0	100S	0	60S	0	0	60S	0	0	0	60S	0	50S
15	Lr-15	90S	0	5MS	10MSS	80S	0	5MS	10MSS	0	60S	0	0	0	50S	0	40S
16	Lr-16	50MSS	0	0	10MSS	100S	0	0	10MSS	0	50S	0	0	0	40S	0	20S
17	Lr-17	60S	0	5MS	10MSS	60S	0	5MS	10MSS	0	50S	0	0	0	60S	0	20S
18	Lr-18	60S	0	0	0	50S	0	0	0	0	40S	0	0	0	40S	0	30S
19	Lr-19	10M	0	0	0	0	0	0	0	0	60MSS	0	0	0	70MSS	0	50MSS
20	Lr-20	100S	0	0	5MSS	60S	0	0	5MSS	0	50S	0	0	0	30S	0	20S
21	Lr-21	100S	0	0	5M	50S	0	0	5M	0	50S	0	0	0	30S	0	20S
22	Lr-22A	30M	0	0	10MSS	30MSS	0	0	10MSS	0	60S	0	0	0	50S	0	30S
23	Lr-22B	40S	0	0	10M	60S	0	0	10M	0	40S	0	0	0	60S	0	40S
24	Lr-23	40S	0	0	0	20MS	0	0	0	0	60S	0	0	0	40S	0	20S

25	Lr-24	50S	0	0	0	20MSS	0	0	0	0	80S	0	0	0	40S	0	30S
26	Lr-25	30MS	0	5MS	10MSS	30MS	0	5MS	10MSS	0	50MS	0	0	0	40M	0	20M
27	Lr-26	60S	0	0	30MSS	60S	0	0	30MSS	0	40S	0	0	0	30S	0	20S
28	Lr-27+31	20R	0	0	0	20R	0	0	0	0	40S	0	0	0	30S	0	10S
29	Lr-28	0	0	0	0	0	0	0	0	0	10S	0	0	0	10M	0	5M
30	Lr-29	40M	0	0	5MSS	30M	0	0	5MSS	0	80S	0	0	0	20S	0	20S
31	Lr-30	50S	0	0	0	40S	0	0	0	0	50S	0	0	0	40S	0	30S
32	Lr-32	60M	0	0	0	40M	0	0	0	0	80S	0	0	0	30S	0	60S
33	Lr-33	60S	0	0	0	60S	0	0	0	0	80S	0	0	0	30S	0	70S
34	Lr-34	60MS	0	0	0	60MS	0	0	0	0	60S	0	0	0	40S	0	30S
35	Lr-35	50MS	0	0	30MS	50M	0	0	30MSS	0	80S	0	0	0	30S	0	10S
36	Lr-36	30M	0	0	10MSS	30M	0	0	10MSS	0	80S	0	0	0	30S	0	10S
37	Lr - 37	50M		0	0	60MSS	0	0	0	0	30M	0	0	0	10S	0	5S
38	Lr-B	80S		40S	10MSS	60S	0	40S	10MSS	0	80S	TS	0	0	80S	0	50S
39	WL711(Lr-13)	100S		0	30MSS	100S	0	0	30MSS	0	100S	5S	0	0	80S	0	40S
40	Lr-23^{+}Gaza	10M		0	0	10M	0	0	0	0	80S	0	10MS	0	20S	0	10S
	Morocco	100S	50S	30S	30S	40S	0	30S	30S	50S	50S	10S	100S	10S	60S	10S	100S
Yellow Rust Differential																	
1	AOC – Yr A	30MSS	0	5MSS	0	10MSS	0	0	0	0	0	0	0	0	30MSS	0	0
2	AOC + Yr A	40MSS	0	10MSS	0	10MSS	0	0	0	0	20S	0	0	0	40M	0	90S
3	*YR*1	0/30M	0	0	0	0	0	0	0	0	10MR	0	30MR	0	30MR	0	40MR
4	*YR*2	80MSS	5S	30MSS	10S	50MSS	5S	0	40MS	0	10M	0	40M	0	60S	0	100S
5	*YR*3	80MSS	0	20MSS	0	30MSS	0	0	0	0	0	0	0	0	0	0	0
6	*YR*5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	TMR
7	*YR*6	40S	5MSS	5S	0	10S	5MSS	0	20S	0	70S	0	100S	0	90S	0	100S
8	*YR*7	60S	10MSS	5S	10MSS	10S	10MSS	0	10MSS	0	80S	0	100S	0	80S	0	100S
9	*YR*9	40MSS	0	10MSS	0	20MSS	0	0	30MSS	0	40MSS	0	100S	0	70S	0	100S
10	*YR*10	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
11	*YR*15	0	0	0	0	0	0	0	0	0	0	0	0	0	10MR	0	0
12	*YR*17	40S	0	10S	0	20S	0	0	20MS	0	10S	0	100S	0	40S	0	100S
13	*YR18*	0	0	0	0	0	0	0	0	0	0	0	40MR	0	20M	0	30MS
14	*YR*24	60S	0	20S	0	30S	0	0	0	0	0	0	30S	0	10M	0	30M

15	*YR*26	40MSS	0	10MSS	0	20MSS	0	0	0	0	10R	0	30R	0	10MR	0	10M
16	*YR*27	40S	0	10S	0	20S	0	0	40MSS	0	60MS	0	100S	0	70S	0	100S
17	*YR*SP	0	0	0	0	0	0	0	0	0	TMR	0	0	0	5MR	0	0
18	PAVON-76	20S	TMS	5S	TMS	10S	TMS	0	0	0	0	0	30MRS	0	20M	0	20M
19	SERI	10MSS	TMS	TMSS	TMS	5MSS	TMS	0	0	0	0	0	40S	0	10M	0	50S
20	SUPER KAUZ	30MSS	0	5MSS	0	10MSS	0	0	0	0	0	0	5MR	0	5MR	0	5MR
21	*YR*CV	50MSS	0	10MSS	0	20MSS	0	0	0	0	0	0	100S	0	20S	0	10S
22	PBW-343	0	0	0	0	0	0	0	0	0	10MSS	0	20S	0	40S	0	80S
23	*YR*-28	0	0	0	0	0	0	0	0	0	0	0	40S	0	30S	0	40S
24	*YR*-29	20MSS	0	5MSS	0	10MSS	0	0	0	0	10M	0	30MS	0	40S	0	30MS
25	*YR-31*	10MSS	0	TMSS	0	TMSS	0	0	30MSS	0	40S	0	100S	0	60S	0	100S
	Morocco	100S	50S	30S	30S	40S	0	30S	30S	50S	50S	10S	100S	10S	60S	10S	100S

Table 61 Final rust Severity of disease Screening nurseries at multi locations during the year 2016-17

S. No.	V. Code	Faisalabad		Khannewal		BWP		K.S.Kaku		Kot Nina		Islamabad		Peshawar		P. Sabak	
		LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR	LR	YR
1	V-12066	10M	0	10M	0	10M	0	0	0	0	0	0	0	0	0	0	0
2	V-13348	30M	0	30M	0	30M	0	0	0	0	TMS	0	0	0	0	0	40M
3	V-14154	30M	0	30M	0	30M	0	0	0	0	20S	0	0	0	10M	0	5M
4	V-14168	10M	0	10M	0	10M	0	0	0	0	10S	0	5M	0	30M	0	20M
5	V-14170	20M	0	20M	0	20M	0	0	0	0	0	0	0	0	0	0	0
6	V-14225	0/20M	0	0/20M	0	0/20M	0	0	0	0	5S	0	0	0	0	0	0
7	V-14227	20M	0	20M	0	20M	0	0	0	0	0	0	0	0	0	0	10M
8	V-14057	20M	0	20M	0	20M	0	0	0	0	30S	0	0	0	0	0	30M
9	V-14084	80MS,S	0	80MS,S	0	80MS,S	0	0	0	0	0	0	TMS	0	5M	0	5M
10	Morocco	80S	0	80S	0	80S	0	0	20S	0	100S	0	80S	0	100S	0	100S

11	V-14117	20M	0	20M	0	20M	0	0	0	0	10MS	0	5M	0	5M	0	5M
12	V-14122	10M	0	10M	0	10M	0	0	0	0	0	0	0	0	0	0	0
13	V-14124	10M	0	10M	0	10M	0	0	0	0	10S	0	0	0	0	0	30M
14	V-14134	60S	0	60S	0	60S	0	0	0	0	5S	0	0	0	0	0	40M
15	V-15207	10MR	0	10MR	0	10MR	0	0	0	0	10S	0	0	0	0	0	10M
16	V-15210	40M	0	40M	0	40M	0	0	0	0	0	0	0	0	0	0	10M
17	V-15211	30M	0	30M	0	30M	0	0	0	0	20S	0	5M	0	10M	0	10M
18	V-15235	0	0	0	0	0	0	0	0	0	5S	0	5M	0	20M	0	10M
19	V-15238	0	0	0	0	0	0	0	0	0	0	0	30S	0	20S	0	20M
20	Morocco	80S	0	80S	0	80S	0	0	20S	0	100S	0	80S	0	80S	0	100S
21	V-15249	30MS,S	0	30MS,S	0	30MS,S	0	0	0	0	0	0	0	0	0	0	5M
22	V-15250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	V-13165	20MR	0	20MR	0	20MR	0	0	0	0	0	0	0	0	0	0	0
24	V-13192	30M	0	30M	0	30M	0	0	0	0	0	0	0	0	0	0	0
25	V-14270	100S	0	100S	0	100S	0	0	TMS	0	40S	0	30S	0	60S	0	80S
26	V-14271	100S	0	100S	0	100S	0	0	0	0	40S	0	50S	0	70S	0	70S
27	V-14266	100S	0	100S	0	100S	0	5S	5MS	0	40S	0	40S	0	80S	0	100S
28	V-14268	100S	0	100S	0	100S	0	0	10M	0	40S	0	60S	0	60S	0	80S
29	V-14268	100S	0	100S	0	100S	0	0	TMS	0	20S	0	50S	0	50S	0	100S
30	Morocco	80S	0	80S	0	80S	0	0	20S		100S	0	80S	0	100S	0	100S
31	V-14262	80S	0	80S	0	80S	0	0	10MR	0	40S	0	60S	0	70S	0	80S
32	HYT 60-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	HYT 60-7	0	0	0	0	0	0	0	0	0	10S	0	5M	0	10M	0	10M
34	HYT 60-57	20MS,S	0	20MS,S	0	20MS,S	0	0	0	0	30S	0	10MSS	0	10MSS	0	10M
35	HYT 27-21	5M	0	5M	0	5M	0	0	0	0	5S	0	0	0	0	0	10M
36	HYT 27-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	D- 13202	20R	0	20R	0	20R	0	0	0	0	0	0	0	0	0	0	0
38	D- 13206	50RMR	0	50RMR	0	50RMR	0	0	0	0	5MS	0	10M	0	0	0	10M
39	D- 13207	40RMR	0	40RMR	0	40RMR	0	0	0	0	0	0	0	0	0	0	0
40	Morocco	100S	0	100S	0	100S	0	0	20S	0	100S	0	80S	0	90S	0	100S
41	D- 13219	0	0	0	0	0	0	0	0	0	10MS	0	0	0	0	0	0
42	NR-448	20RMR	0	20RMR	0	20RMR	0	0	0	0	0	0	0	0	0	0	5M
43	NR-488	30MS,S	0	30MS,S	0	30MS,S	0	0	0	0	0	0	0	0	0	0	10M
44	NR-491	20M	0	20M	0	20M	0	0	0	0	0	0	0	0	0	0	TMR

45	NR-499	30MR MS	0	30MR MS	0	30MR MS	0	0	0	0	0	0	0	0	0	0	5M
46	NR-505	30MR MS	0	30MR MS	0	30MR MS	0	0	0	0	0	0	0	0	0	0	TR
47	NS-13	20RM R	0	20RM R	0	20RM R	0	0	0	0	20S	0	20M	0	30M	0	30M
48	NS-14	40MS ,S	0	40MS ,S	0	40MS, S	0	0	0	0	0	0	0	0	0	0	0
49	WV-1038	50MS ,S	0	50MS ,S	0	50MS, S	0	10MS	0	0	0	0	0	0	10M	0	20M
50	Morocco	100S	0	100S	0	100S	0	0	20S	0	100S	0	70S	0	80S	0	100S
51	V-9515	80MS ,S	0	80MS ,S	0	80MS, S	0	0	0	0	0	0	0	0	0	0	10M
52	13FJ20	10M	0	10M	0	10M	0	0	0	0	0	0	10M	0	0	0	5M
53	13FJ29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	13FJ35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	15CO42	0	0	0	0	0	0	0	0	0	10MS	0	0	0	0	0	0
56	15CO44	0	0	0	0	0	0	0	0	0	10MS	0	0	0	0	0	0
57	TWS-1351	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	TWS-1334	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	TWS-1335	10M	0	10M	0	10M	0	0	0	0	0	0	0	0	0	0	0
60	Morocco	100S	0	100S	0	100S	0		20S	0	100S	0	80S	0	80S	0	100S
61	TWS-1355	20M	0	20M	0	20M	0	0	0	0	5S	0	0	0	0	0	TMS
62	14BT016	60S	0	60S	0	60S	0	0	0	0	30S	0	40MSS	0	30S	0	40S
63	14BT022	40M	0	40M	0	40M	0	0	0	0	0	0	5M	0	5M	0	50S
64	14BT004	30M	0	30M	0	30M	0	0	0	0	0	0	0	0	0	0	5M
65	15B1131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5M
66	15B1116	80S	0	80S	0	80S	0	0	0	0	5S	0	20M	0	20M	0	5M
67	14B1572	100S	0	100S	0	100S	0	0	0	0	20S	0	40MSS	0	10M	0	50M
68	14B1005	30M	0	30M	0	30M	0	0	0	0	5S	0	0	0	10M	0	0
69	13B3044	20M	0	20M	0	20M	0	0	0	0	0	0	5M	0	0	0	80S
70	Morocco	100S	0	100S	0	100S	0	0	30S	0	100S	0	70S	0	80S	0	0
71	Rustum 2012	100S	0	100S	0	100S	0	0	5MS S	0	40S	0	70S	0	80S	0	10M
72	Rustum Naaz 2016	20M	0	20M	0	20M	0	0	0	0	30S	0	0	0	10M	0	100S
73	KANZO-1201	50S	0	50S	0	50S	0	0	0	0	10S	0	20S	0	20S	0	80S
74	NIAB-317	0	0	0	0	0	0	0	0	0	10S	0	20S	0	10S	0	0
75	Jhang A-24	50MS ,S	0	50MS ,S	0	50MS, S	0	0	0	0	5S	0	0	0	5S	0	0

76	V-1136	50MS,S	0	50MS,S	0	50MS,S	0	0	0	0	0	0	10S	0	5S	0	20S
77	Lasani-08	80S	0	80S	0	80S	0	TMS		0	40S	0	10M	0	20S	0	30M
78	Fsd-08	50M	0	50M	0	50M	0	0	0	0	0	0	0	0	10M	0	10M
79	Millat-110	50M	0	50M	0	50M	0	0	0	0	10S	0	5M	0	10M	0	30M
80	Morocco	100S	0	100S	0	100S	0		20S	0	100S	0	80S	0	90S	0	100S
81	Punjab-11	20M	0	20M	0	20M	0	0	TMS	0	40S	0	50S	0	40S	0	60S
82	AARI-11	80S	0	80S	0	80S	0	5MS	0		40S	0	30S	0	50S	0	60S
83	Galaxy-13	80S	0	80S	0	80S	0	TMS	TMS	0	70S	0	50S	0	70S	0	70S
84	Ujala-16	5M	0	5M	0	5M	0	0	0	0	0	0	0	0	0	0	5M
85	Inq-91	80MS,S	0	80MS,S	0	80MS,S	0	10MS	0	0	50S	0	60S	0	70S	0	80S
86	Durm-97	30R	0	30R	0	30R	0	0	0	0	0	0	0	0	0	0	0
87	SA-75	80S	0	80S	0	80S	0	Mature		0	20S	0	10MSS	0	10MSS	0	40S
88	PB-76	100S	0	100S	0	100S	0	Mature		0	50S	0	60S	0	50S	0	30S
89	PAVAN-76	80S	0	80S	0	80S	0	0	0	0	60S	0	10M	0	20M	0	20S
90	Morocco	100S	0	100S	0	100S	0				100S	0	70S	0	80S	0	100S
91	PAK-81	30RMR	0	30RMR	0	30RMR	0	Mature		0	50S	0	60S	0	70S	0	70S
92	SH-88	100S	0	100S	0	100S	0	10ms		0	60S	0	50MSS	0	60MSS	0	40S
93	PASBAN-90	30M	0	30M	0	30M	0	0		0	10S	0	10M	0	0	0	10M
94	SEHER-06	90S	0	90S	0	90S	0	10ms		0	40S	0	60S	0	70S	0	30MSS
95	CHAKWAL-50	10M	0	10M	0	10M	0	0	5MS	0	5S	0	20M	0	20M	0	10M
96	V-87094	80S	0	80S	0	80S	0		5MS	0	50S	0	50M	0	50M	0	60S
97	B-15002	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
98	B-15003	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
99	B-15006	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	B-14003	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	B-14007	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103	B-14011	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
104	B-05011	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	B-09006	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
106	B-09008	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
107	JAU-83	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	HAIDER-93	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	V-15261	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

111	V-15262	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112	V-15263	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
113	V-15264	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	V-15265	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115	V-15266	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
116	V-15267	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117	V-15268	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
118	V-15269	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
119	V-15278	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	V-15280	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
122	V-15286	60S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
123	V-15289	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
124	V-15290	30S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125	V-15291	10MS	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
126	V-15295	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
127	V-15296	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
128	V-15302	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
129	V-15304	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
131	V-15306	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	V-15307	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	V-15309	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
134	V-15311	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	V-15316	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
136	V-15321	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
137	V-15327	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
138	V-15329	80S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
139	V-15331	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
141	V-15332	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
142	V-15337	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
143	V-15343	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
144	V-15006	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145	V-15012	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
146	V-15014	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
147	V-15026	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
148	V-15039	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
149	V-15044	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

151	V-15046	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
152	V-15049	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
153	V-15051	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
154	V-15055	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155	V-15065	80S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
156	V-15067	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
157	V-15070	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
158	V-15078	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
159	V-15079	80S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
161	V-15080	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
162	V-15081	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
163	V-15082	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
164	V-15084	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
165	V-15090	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
166	V-15091	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
167	V-15092	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
168	V-15093	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
169	V-15095	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
171	V-15096	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	V-15097	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
173	V-15098	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	V-15099	20R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175	V-15100	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
176	V-15101	60S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
177	V-15102	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
178	V-15110	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
179	V-15112	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
181	V-15113	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
182	V-15114	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
183	V-15115	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	V-15119	30MS,S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185	V-15120	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186	V-15121	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
187	V-15123	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188	V-15127	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
189	V-15128	30S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

190	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
191	V-15142	10M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	V-15144	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
193	V-15145	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
194	V-15147	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
195	V-15150	10MR	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	V-15151	30S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
197	V-15152	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
198	V-15153	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199	V-15156	20S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201	V-15161	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
202	V-15162	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
203	V-15165	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
204	V-15166	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
205	V-15168	10MR	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
206	V-15173	20M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207	V-15174	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	V-15175	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
209	V-15177	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
211	V-15179	20M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
212	V-15180	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
213	V-15181	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	V-15182	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
215	V-15189	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	V-15190	20M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
217	V-15192	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
218	V-15193	10M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
219	V-15195	30M	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	Morocco	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221	V-15197	20MR	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
222	V-15198	50MS ,S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
223	V-15202	10R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
224	V-15203	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
225	V-15204	30R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
226	PBGM-18	100S	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
227	B – 14010	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
228	B – 5011	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

229	Haider – 93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
230	Morocco	100S	0	100S	0	100S	0		20S	0	100S	0	80S	0	90S	0	100S
231	Johar-16	50M	0	50M	0	50M	0	0	0	0	0	0	0	0	0	0	0
232	Gold-16	80M	0	80M	0	80M	0	0	0	0	0	0	0	0	0	0	0
233	NEBGI GUNDUM 3	80M	0	80M	0	80M	0	0	0	0	0	0	0	0	0	0	0
234	NIBGI GUNDUM 4	20R	0	20R	0	20R	0	0	0	0	0	0	0	0	0	0	0
235	Morocco	100S	0	100S	0	100S	0		20S	0	100S	0	80S		90S		100S

Inoculums Multiplication

Inoculum was collected from Murree during summer season and multiplied at Faisalabad on Morocco (spreader). The rust spores trapped on early planted nursery was also multiplied and disseminated on filial generation (F_1-F_6) and on local & exotic nurseries for screening / selection of resistant wheat materials.

Evaluation of advanced lines/varieties for seedling and adult plant resistance (APR) to Leaf Rust

For the evaluation of wheat advance material at seedling stage, the seed of fifty six advanced lines along with commercial varieties of breed wheat were sown in pots as well as in field for identification of adult plant resistance. The results indicates that among tested advanced lines, the twenty four entries i.e. V-12066, V-14168, V-14057, V-14122, V-15235, V-15238, V-15249, V-15250, V-13165, V-13192, NR-448, Ns-13, WV-1038, 13FJ20, 13FJ29, 15CO42, 15CO44, TWS1351, TWS-1334, TWS-1335, 15B1131, and 13B3044 showed low infection type (score 0, ; ,1 & 2) at seedling stage. While the fifteen entries i.e. V-11098, V-12304, V-13005, V-13016, V-14154, TWS12155, V-13348, V-14B1028, V-13167, 9496, 14CO36, 12FJ-26, V-14168, TWS112464, and V-14154 showed resistant to moderately resistant response in field. The lines, which showed the resistant to moderately resistant response in field and high infection type at seedling stage indicates the presence of APR genes.

Karnal Bunt Study

This trial was conducted in collaboration with Plant Pathology Section and Wheat Research Institute, Faisalabad. The diseased seed samples were collected, isolation were made, identified and multiplied the culture of karnal bunt for artificial screening. During cropping season, 84 advance lines /varieties of bread wheat were studied and among tested entries, 10 lines/varieties shown highly resistant, 15 resistant, 11 moderately resistant, 17 moderately susceptible, 12 susceptible and 19 highly susceptible reaction against karnal bunt. The detailed results are given in the following table

Table. 62. Reaction of various varieties/lines of wheat against Karnal or Partial Bunt (*Tilletia indica*)				
Scale		Reaction	No. of lines/varieties	No. of Entries
0	No Symptoms of bunt on head and grains	HR	V-13372, V-12066, V-14227, 12FJ01, CDRI-pv-1, 14B1028, NR453, FSD-08, 14B1030, NR443, 13BT034, CDRI-SA, 12B2511, UJALLA-16, MILLAT-11 & SEHER-06	10
1	1% or less grains bunted	R	V-13016, V-12120, CDRI-PV-2, 14CO36, GALAXY-13, NR457, TWS-112464, V-13325, SHAFAQ-06 & MH-97	15
3	1-2 % of grains bunted	MR	TWS12155, 11FJS-309, 13BT016, NW-1-9-47, AARI-11, AaS-11, LASSANI-08, UQAB 2000 & INQILAB-91	11
5	2-5 % of grains bunted	MS	V-11098, V-13167, V-13338, V-13348, V-14152, V-14225, UOS-2, HYT-80-44, V-14152, 13BT017, 14CO040, UOS-1, GANDUM-4, 12FJ-26, WATTAN, PASSBAN-90, BLUE SILVER & PAK-81	17
7	5-10 % of grains bunted	S	V-12304, V-14168, V-14170, HYT-08-07, HYT-80-34, 13B3146, 9496, NR-487, TWS-12-245, Punjab-11, Fsd-08 & Lyalpur-73	12
9	More than 10% of grains bunted	HS	V-13005, V-14151, V-14153, V-14154 & AS-02	19
Total				84

Survey for karnal bunt and black point diseases of wheat

Survey was conducted to find out the prevalence of karnal bunt and black point diseases in different districts of Punjab. The seed samples (250 grams) was collected from PWYT & NUWYT trials planted at different locations including Kot Nina, Kala Shah Kaku , Rinal Kurd, Gujjarwala , Khannewal, Karoor, Kaloor Kot, Sahiwal, Faisalabad, Sargodha, Pakpattan and Bahwalnigar. These samples was analyzed in Wheat Pathology Lab. to record the percentage incidence of Karnal Bunt and Black point in wheat in Table 51.

Table 63. Karnal bunt and black point infestation and disease prevalence (%age) in seed samples of NUWYT & MWYT,2016-17 received from twelve (10) locations of Punjab								
Locations	**Infected Samples**							
	NUWYT (out of 60 samples)				**PWYT (out of 60 samples)**			
	Karnal Bunt		Black Point		Karnal Bunt		Black Point	
	Infected	Prevalence (%)	Infected	Prevalence (%)	Infected	Prevalence (%)	Infected	Prevalence (%)
Kot Nina	46	76.6	33	55.0	19	31.6	28	46.6
K.S. Kaku	14	23.3	21	35.0	11	18.3	14	23.3

R.Khurd	06	10.0	23	38.3	02	3.3	13	21.6
Gujjarwala	04	6.6	11	18.3	04	6.6	06	10.0
Khannewal	0	0	18	30.0	0	0.0	11	18.3
Sahiwal	0	0	13	21.6	0	0.0	09	15.0
Faisalabad	03	5.5	17	28.3	01	1.6	08	13.3
Sargodha	0	0	29	48.3	0	0.0	13	21.6
Pakpattan	04	6.6	18	30.0	01	1.6	10	16.6
Bahwalnagar	07	11.6	12	55.0	03	5.0	09	15.0
Total	**84**	**14.0**	**195**	**32.5**	**41**	**6.8**	**121**	**20.1**
Note: Disease prevalence (%age) = No. of infected samples/total X 100								

Wheat Entomology

The experimental trial was conducted at the research area of wheat Research Institute, Faisalabad during 2016-17. Three Moericke Yellow-water-tray-traps (75cm high from the ground level) were fixed at 200ft distance in three different fields of wheat crop. Alate aphid population was recorded on daily basis from tray-traps and later on data was transformed into weekly basis. The weekly data of trapped alate aphids were correlated with abiotic factors. The tabulated results are as under.

Table:49 Average Aphid Population per Trap per week

Month	Temperature* C^0		Humidity* (%)	Rainfall* (mm)	Aphid population
	Max C^0	Min C^0			
January, 2017					
1st week	18.75	10.17	91.43	0	98.28
2nd week	18.06	4.16	84.37	4.8	140.00
3rd week	18.70	4.97	86.87	0	203.96
4th week	18.76	8.42	88.50	7.1	250.80
February, 2017					
1st week	20.83	6.97	85.43	3.7	314. 37
2nd week	24.28	5.60	76.14	0	333.90
3rd week	26.95	12.28	76.71	0	361.76
4th week	27.14	8.78	71.43	0	458.71
March, 2017					
1st week	26.44	11.54	75.29	1.7	1229.90
2nd week	22.03	10.93	78.12	14.4	1636.32
3rd week	30.41	14.36	72.75	0	1882.24
4th week	35.82	19.44	62.25	0	1178.80
April, 2017					
1st week	33.75	19.44	58.57	9.0	135.94

(* shows average value during the week)

Data showed that Aphid population appeared during 1st week of January, 2017 with aphid population of 98.28 per trap per week. Aphid population gradually increased during subsequent weeks and its peek (1882.24) was observed during 3rd week of March. Aphid population was decreased and became very low (135.94) during 1st week of April, 2017. Aphid population was observed maximum when maximum temperature was 30.41 C^0 and minimum temperature was 14.36 C^0 with relative humidity 72.75 %. Aphid population was positively correlated with maximum temperature, minimum temperature and rainfall whereas negatively correlated with relative humidity but both were non-significant (correlation table given below).

Table:50

Aphid Population	Max Temp. C^0	Min Temp. C^0	R.H (%)	Rainfall (mm)
	0.4267 (0.1459)	**0.405** (0.1698)	**-0.3518** (0.2385)	**0.2692** (0.3737)
	NS	NS	NS	NS

1. VARIETAL SCREENING OF WHEAT VARIETIES/ ADVANCE LINES AGAINST APHID

Twelve wheat varieties/advance lines were sown on Nov 20, 2016, following RCB design in triplicate, at research area of WRI, Faisalabad. Ten tillers were randomly selected from each plot to record average aphid population per tiller. The lowest aphid population per tiller (12.61) was found on variety V-11098 followed by V- 12066, Galaxy-13, V-12304 and V-14170 respectively while highest aphid population per tiller (43.32) was recorded on V-13348 followed by V-14168, V-14154, V-14227, Punjab-11, Ujala-16 and V-14225, respectively. V-11098, V-12066 and Galaxy-13 are statistically at par and least attacked by aphids than other wheat varieties.

Table:51 Average Aphid Population Per Tiller On Different Wheat Varieties / dvance Lines

Sr.	Varieties /Lines	Aphid population per tiller
1	V-11098	12.610 F
2	Punjab-11	29.410 C
3	Galaxy-13	15.590 EF
4	Ujala-16	24.487 D
5	V-12304	17.087 E
6	V-12066	13.933 EF
7	V-13348	43.320 A

8	V-14154	33.900 B
9	V-14225	24.023 D
10	V-14227	31.030 BC
11	V-14168	34.400 B
12	V-14170	17.410 E
LSD Value @ 0.05		3.746

2. SCREENING OF WHEAT GERMPLASM AGAINST APHIDS

Experiment was conducted in the research area of Wheat Research Institute, Faisalabad. Six hundred and fifty eight wheat varieties/lines of crossing block 2016-17 were tested against aphid attack. The data of aphid population were recorded at 10 days interval during the month of March, 2017 from 10 randomly selected tillers of each variety/line. The aphids were dislodged on white paper sheet with the help of camel hair brush and then counted. The results are presented in table below.

Table:52 Average Aphid Population / Tiller on wheat Germplasm

Entries studied	Average Aphid population/ Tiller on each variety/line (Mean values)										
658	0-5	6-10	11-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	>86
	0	51	180	281	76	36	16	11	4	2	1

The aphid population ranged from 7.8-100 aphids/tiller. Only 51 varieties/lines had upto 10 aphids per tiller and they showed tolerance/resistance against aphids. These lines/varieties are CB-26(Lasani-08), 27(Miraje-08),38(Cm 5995), 39(TD-2), 299(Wblli/V-04022), 300(Attila/Pastar), 305(Milan/Kauz/Rayon/Kingbird#1),317,318(NRL-1130), 323(Fret2/Trap/ Kauz/ Trap/Onix),324(NW-5-20-1,Niab),336(V-13372), Similarly rest of the verities/lines had the lowest rate of population per tiller than others, 349,350,351,362,366,368,369,383,390,400,407, 409,418,427,432, 441,452, 453, 457,461, 494,497,501,506,511,537,552,555,556,566,568,573,604,619, 620,633, 634 and 656. The above mentioned varieties / lines are proposed to breeding programme for variety evolving process regarding in corporating aphid tolerance. While the following liens / varieties are CB-13, 43,81,88,134,142 and 143 had more than 66 aphids per tiller, respectively.

Survey of Aphid Population on wheat Crop in Different Ecological Zones of the Punjab

The Survey of wheat crop for aphid infestation was conducted at Sargodha, Chinniot, Lahore, Sheikhupura, Narowal, Sialkot, Gujranwala, Hafizabad, Okara, Sahiwal, Pakpattan, Bahawalnagar, Khanewal, and

Faisalabad. Aphid population was recorded per tiller basis by selecting 10 tillers randomly from each variety/ lines. The results are given as under:

Table:53 Average Aphid Population /Tiller on Different Wheat Verities.

Varieties	Sargodha,	Chinniot	Lahore	Sheikhupura	Narowal	Sialkot	Gujranwala,
	19.02.2017	19.02.2017	24.02.2017	13.03.2017	13.03.2017	13.03.2017	14.03.2017
Faisalabad-08	9.0	8.0	12.0	9.0	10.0	10.0	4.0
Lasani-08	10.0	9.0	8.0	7.0	8.0	11.0	9.0
Galaxy-13	18.0	17.0	21.0	15.0	10.0	12.0	10.0
Punjab-11	16.0	12.0	22.0	16.0	22.0	18.0	20.0
Johar-16	14.0	13.0	12.0	16.0	15.0	11.0	14.0
Gold-16	13.0	14.0	17.0	17.0	14.0	11.0	13.0
Ujala-16	12.0	12.0	15.0	14.0	20.0	18.0	17.0

Varieties	Hafizabad	Okara,	Sahiwal	Pakpattan	Bahawalnagar	Khanewal	Faisalabad
Date	14.03.2017	09.03.2017	09.03.2017	10.03.2017	11.03.2017	12.03.2017	18.03.2017
Fsd.08	8.0	08.0	9.0	11.0	8.0	10.0	9.0
Lasani-08	9.0	13.0	10.0	14.0	10.0	11.0	8.0
Galaxy-13	16.0	16.0	17.0	12.0	13.0	13.0	16.0
Punjab-11	17.0	17.0	14.0	15.0	18.0	20.0	16.0
Johar-16	16.0	19.0	18.0	17.0	9.0	15.0	13.0
Gold-16	17.0	16.0	20.0	16.0	18.0	12.0	15.0
Ujala-16	15.0	17.0	14.0	15.0	9.0	12.0	14.0

The survey revealed that the aphid population ranged from 4.0-22.0 aphids/tiller on different wheat varieties in the Punjab. While on varietal basis, aphid population remained in the range 4-12,7-14,10-21,12-22,9-19,11-20 and 9-20 per tiller on Faisalabad-08, Lasani-08, Galaxy-13,Punjab-11 , Johar-16, Glod-16 and Ujala-16, respectively. So aphid population was recorded more in Narowal on Punjab-08 and low in Gujranwala on Faisalabad- 08. Therefore, the aphid population during the season was not so alarming and the predators (Coccinellids, Chrysoperlla Spp. and Syrphid flies) controlled the pest naturally and therefore no pesticides should be recommended for aphid control.

Cereal Technology

Estimation Of Acryllamide Compound In Various Baked Products Of Wheat Flour

Wheat grains of two promising varieties Ujala-16 and Galaxy-13 were collected after harvest and were further proceeded for preparation of biscuits, cake and bread. Products were further analyzed for their acrylamide content in the High Performance Liquid Chromatograph (HPLC). The acrylamide concentration in baked itemed gave a range of 250 to 300 ppb. The following table gives the detail of the results.

Table:64 Concentration values of acrylamide in mentioned products by given varieties

Products	Acryl amide Concentration (ppb)	
	Ujala-16	Galaxy-13
Biscuit	287	275
Bread	249	267
Cake	255	263

Effect Of Packaging Material On Quality Of Stored Wheat Grain

Wheat grains were stored in three different packaging materials i.e. Jute bag, Polypropylene bag and Grain pro super grain bag and stored for three months.

Stored samples were analyzed for moisture, protein, gluten, starch, alpha-amylase activity, water absorption, dough development time, dough stability and softening of dough at fortnightly interval.

Wheat grains packed in Grain Pro Super grain bag showed low difference in studied quality parameters values while Jute bag revealed higher difference in values during storage.

Table:65 Detailed results of mentioned quality parameters at fixed intervals of wheat grain storage

Quality parameter	Packaging material	Storage (days)						
		0	15	30	45	60	75	90
Moisture (%)	Jute bag	10.78	10.88	10.98	11.05	11.00	11.20	11.15
	Polypropylene bag	10.78	10.77	10.92	11.20	11.14	11.10	11.20
	Grain Pro Super grain bag	10.78	10.90	10.80	10.95	11.12	11.75	11.00
Protein (%)	Jute bag	13.50	13.70	13.60	13.45	13.35	13.22	13.44
	Polypropylene bag	13.50	13.75	13.55	13.55	13.40	13.33	13.42

	Grain Pro Super grain bag	13.50	13.78	13.80	13.74	13.55	13.65	13.68
Starch (%)	Jute bag	55.98	56.00	56.10	56.10	56.20	56.10	55.40
	Polypropylene bag	55.98	56.30	56.35	56.10	56.22	55.85	55.65
	Grain Pro Super grain bag	55.98	56.55	56.35	56.75	56.25	56.35	56.30
Gluten (%)	Jute bag	32.00	31.35	31.72	30.50	30.05	30.10	30.00
	Polypropylene bag	32.00	31.90	31.65	31.35	31.35	30.85	30.20
	Grain Pro Super grain bag	32.00	32.02	31.85	31.25	31.74	31.00	31.00
Alpha amylase activity (sec)	Jute bag	615	590	565	500	490	435	420
	Polypropylene bag	615	595	560	510	500	475	435
	Grain Pro Super grain bag	615	602	597	580	565	533	525
Water absorption (%)	Jute bag	61	58	56	55	53	52	52
	Polypropylene bag	61	59	57	56	55	54	54
	Grain Pro Super grain bag	61	59	58	57	56	56	56
Dough development time (min)	Jute bag	6.71	6.85	7.00	7.65	7.95	8.00	8.10
	Polypropylene bag	6.71	6.74	6.95	7.10	7.55	7.20	7.40
	Grain Pro Super grain bag	6.71	6.72	6.70	6.77	6.80	6.80	6.95
Dough stability (min)	Jute bag	7.75	7.60	7.53	7.35	7.15	6.66	6.20
	Polypropylene bag	7.75	7.55	7.54	7.37	7.15	7.95	6.80
	Grain Pro Super grain bag	7.75	7.70	7.65	7.42	7.33	7.17	7.10
Softening of dough (BU)	Jute bag	46	50	57	62	70	72	78
	Polypropylene bag	46	50	53	58	58	60	65
	Grain Pro Super grain bag	46	47	50	50	51	51	55

Impact Of Sowing Time On Phytic Acid, Iron And Zinc Contents In Wheat Grain

Grains of four promising bread wheat varieties i.e. Millat-11, Punjab-11, Galaxy-13 and Ujala-16 were collected from three planting dates i.e. 1st November, 30th November and 30th December. Collected samples were analyzed to determine their phytic acid, iron and Zn contents.

There was no significant difference among varieties but sowing date impact on iron was significant. As it is evidently revealed in the following table:

Table:66 Iron, Zinc and phytic acid concentrations in the given varieties at different planting dates

Varieties	Iron Content (ppm)			Zinc Content (ppm)			Phytic Acid Content (%)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
Millat-11	137	141	144	31.0	31.0	33.2	1.72	1.86	1.96
Punjab-11	135	142	142	32.5	32.2	32.7	1.82	1.90	1.97
Galaxy-13	136	142	143	30.2	33.0	33.0	1.83	1.78	2.05
Ujala-16	137	142	143	31.5	33.7	32.9	1.87	1.88	2.00

Comparison Of Bread And Durum Wheat For Preparation Of Value Added Products

Wheat varieties\advanced lines (Ujala-16, Galaxy-13, Durum-97 and D-12306) were analyzed for rheological properties using Farinograph and Extensograph. Protein and gluten contents were also determined. Value added products i.e. chapatti, muffins, biscuits and pizza were prepared and evaluated to determine their suitability. In case of biscuits the difference in textural characteristics was not too significant but in case of volume raising products like muffins etc, the durum wheat proved to be poor.

Table 67 Comparison Of Bread And Durum Wheat For Preparation Of Value Added Products

Varieties	Wet Gluten (%)	Protein (%)	Chapatti Quality	Muffin Quality	Biscuit Quality	Pizza Quality
Ujala-16	31.7	15.7	Excellent	Excellent	Excellent	Excellent
Galaxy-13	28.7	14.7	Excellent	Excellent	Excellent	Excellent
D-97	13.2	16.54	Poor	Poor	Good	Poor
D-12306	13.5	16.20	Poor	Poor	Good	Poor

Quality Evaluation Of Bread Wheat Advanced Lines/Varieties

Sixty entries in National Uniform Wheat Yield Trials were analyzed for their qualitative and quantitative potential. The average values for thousand grain weights and test weight were 37 g and 70 kg/hl respectively. Whereas, average values for protein and gluten contents were 14.5% and 28%, respectively.

Table:68 Results of quality parameters of NUWYT (Irrigated)

	Irrigated					Rain fed				
Entry Number	1000 KW (g)	Test Weight (kg/hl)	Starch (%)	Protein (%)	Gluten (%)	1000 KW (g)	Test Weight (kg/hl)	Starch (%)	Protein (%)	Gluten (%)
1	38.55	69.5	53.4	15.4	30.0	40.35	73.1	55.4	13.4	23.0
2	38.40	69.9	52.8	15.4	34.0	40.40	75.6	54.5	14.6	27.0
3	35.20	71.3	55.0	14.9	29.5	36.90	77.5	55.1	14.0	25.5
4	35.70	69.5	53.7	15.4	31.5	38.50	72.0	53.9	14.3	29.0
5	34.65	68.2	53.7	15.0	29.5	34.70	77.0	53.7	14.6	27.5
6	33.75	64.9	54.9	14.7	28.5	36.45	75.4	53.8	14.3	26.5
7	46.15	68.1	53.3	15.9	29.0	40.80	76.0	53.3	14.8	24.5
8	37.60	70.3	55.1	14.2	26.5	40.70	74.6	54.5	14.2	25.0
9	33.05	68.6	54.5	15.3	28.5	33.65	73.3	53.9	14.9	27.0
10	36.55	69.7	55.1	14.1	26.5	37.15	77.5	54.8	14.1	25.5
11	41.00	66.9	54.9	14.4	26.5	36.35	69.1	52.7	15.9	33.0
12	38.60	71.2	54.6	14.7	29.0	36.00	74.1	53.2	15.5	30.5
13	34.95	68.4	54.4	14.5	27.0	33.70	74.5	53.0	15.2	28.0
14	37.80	72.5	56.0	14.8	29.5	36.80	76.1	54.6	14.9	28.5
15	38.20	73.0	55.6	14.2	26.0	40.55	77.4	54.9	13.9	24.0
16	35.30	70.5	55.8	13.6	24.5	36.10	74.4	55.4	13.9	25.0
17	36.05	69.0	56.0	13.6	25.5	36.70	78.4	54.7	14.8	27.0
18	36.00	69.3	54.6	13.3	30.0	40.35	79.0	54.3	15.1	28.0
19	37.10	70.3	54.8	14.1	27.0	40.20	79.4	54.9	13.9	25.5
20	34.85	68.7	54.2	14.8	28.5	39.50	75.6	53.0	15.9	31.5
21	35.20	72.4	54.8	14.8	27.5	34.00	76.5	53.1	15.8	31.5
22	31.70	67.0	53.7	14.4	28.0	36.30	75.4	55.5	14.0	25.0
23	33.95	68.3	54.9	14.8	28.5	33.35	74.3	54.1	15.4	30.0
24	35.30	67.7	54.6	15.0	28.5	35.70	75.8	53.3	15.1	30.5
25	38.75	70.3	54.4	14.1	26.5	35.00	72.4	54.6	14.8	28.5
26	36.10	69.6	54.6	14.4	28.0	33.70	78.7	54.2	14.4	27.0
27	37.15	67.6	54.6	13.7	25.5	36.95	70.3	52.2	16.1	35.5
28	40.10	70.8	55.2	13.3	22.5	40.60	73.0	54.6	14.4	26.0
29	39.90	69.7	56.5	15.3	29.0	39.55	76.6	54.5	15.0	28.0
30	37.85	71.0	54.0	15.5	30.0	38.10	75.2	53.6	14.9	28.5
31	34.60	72.6	56.6	13.9	27.0	33.70	73.8	55.7	14.5	27.0
32	34.25	68.8	54.5	13.9	27.0	35.30	75.1	53.9	15.0	30.5
33	37.65	70.0	54.6	14.9	28.0	38.90	77.1	53.6	15.3	29.5
34	41.05	72.9	54.3	13.7	26.5	39.20	76.4	54.0	14.6	28.0

35	38.30	71.1	55.2	14.9	29.5	38.25	75.3	54.2	14.6	27.5
36	37.45	71.7	55.0	14.7	29.5	37.00	76.2	53.8	15.2	30.0
37	41.45	70.6	55.4	13.8	27.0	40.20	77.5	53.4	15.6	32.0
38	36.20	68.6	53.9	15.0	28.5	38.90	75.8	54.6	14.5	26.5
39	35.95	72.1	55.1	14.8	28.5	33.50	78.2	55.7	15.0	28.5
40	37.80	71.1	55.9	14.1	27.0	37.50	76.4	53.7	15.6	28.5
41	35.30	70.0	55.1	15.1	30.0	36.50	75.1	53.9	15.6	30.0
42	37.10	67.9	54.5	15.3	29.5	35.35	74.5	54.2	15.1	28.0
43	34.60	69.8	54.7	13.8	27.0	35.95	74.4	55.6	14.1	25.0
44	35.85	67.7	54.8	14.7	27.5	39.20	77.1	54.8	14.2	26.0
45	33.45	73.6	55.4	14.3	28.0	31.85	76.7	54.2	15.6	32.0
46	39.90	67.9	53.7	15.1	31.5	34.60	75.7	54.2	14.8	28.0
47	36.65	69.1	54.4	14.7	29.0	37.15	76.4	54.8	14.9	27.5
48	41.10	69.1	55.0	13.5	25.0	37.90	78.1	54.5	14.0	25.5
49	41.35	71.0	55.9	12.9	25.5	39.30	74.4	55.8	12.9	25.0
50	33.95	70.6	54.1	15.7	30.5	35.50	71.9	55.2	14.9	28.0
51	33.20	71.0	55.6	13.6	24.5	39.30	71.2	54.4	14.6	26.0
52	32.27	66.3	56.1	15.7	32.5	35.00	71.4	52.6	15.6	30.5
53	38.35	68.2	54.7	14.6	28.0	35.60	75.4	53.8	15.2	29.5
54	38.10	70.5	54.9	14.7	27.0	39.50	76.0	54.0	15.4	33.0
55	28.35	70.3	55.0	14.1	27.5	35.00	75.2	54.3	15.0	29.0
56	37.20	68.8	54.3	14.9	29.0	37.85	76.3	52.6	16.1	32.0
57	37.05	68.7	55.6	13.5	24.5	39.55	75.5	54.1	14.6	27.0
58	42.70	71.6	54.8	14.2	26.5	39.60	74.9	52.7	15.4	28.5
59	35.10	70.6	54.7	13.4	26.0	37.60	73.7	53.7	14.1	27.0
60	33.05	66.6	55.2	14.5	27.0	41.20	72.7	54.0	14.8	29.0

Table:69 Results of quality parameters of PUWYT

Entry Number	Irrigated					Rain Fed				
	1000 KW(g)	Test Weight (kg/hl)	Starch (%)	Protein (%)	Gluten (%)	1000 KW (g)	Test Weight (kg/hl)	Starch (%)	Protein (%)	Gluten (%)
15C042	35.90	74.0	55.9	13.3	26.5	41.00	70.8	54.8	13.7	24.0
9515	39.45	75.5	53.4	15.5	31.0	37.10	72.8	54.0	14.4	27.0
14BT016	39.85	69.9	54.7	15.1	29.0	40.65	77.2	55.6	13.9	26.0
WV-1038	35.15	70.4	55.0	14.9	29.5	33.20	71.9	54.1	14.9	29.0
13-3044	34.25	66.4	52.9	15.8	30.5	29.00	60.5	50.6	14.8	39.5
14B-1005	40.80	78.4	55.3	15.8	30.5	40.40	70.8	55.0	15.6	29.5
V-14270	38.85	70.5	53.6	15.1	28.5	37.35	69.6	54.2	14.6	28.5
13FJ20	39.90	69.3	54.6	15.1	32.0	34.20	67.5	51.5	14.4	32.0

V-15211	38.45	72.9	54.5	15.3	29.0	40.55	70.4	55.1	14.5	27.5
A-24	39.35	71.2	54.8	15.0	29.0	38.85	69.7	53.4	15.3	28.5
Johar-16	39.15	73.3	54.2	14.5	30.0	40.85	72.9	55.1	14.1	24.5
NS-14	34.45	72.0	55.4	14.9	29.5	36.25	71.9	55.6	13.7	24.0
V-14057	40.10	72.6	56.0	14.7	28.0	40.90	71.1	54.2	15.0	28.0
NS-13	40.50	75.8	56.5	13.5	25.0	39.60	70.0	54.9	14.0	25.0
14BT022	40.30	68.1	54.8	14.1	29.0	37.80	66.0	54.1	15.2	30.5
V-14262	40.75	71.8	55.9	14.4	29.0	40.30	68.2	54.4	14.2	25.5
V-14271	40.70	69.9	54.5	13.8	25.0	40.40	67.5	54.6	15.0	29.5
HYT-60-7	40.25	70.2	56.0	13.6	25.5	40.85	72.6	55.2	14.7	26.5
Rustam Naz-2016	39.40	74.4	55.9	14.7	30.0	39.45	71.7	54.2	14.7	27.5
V-13165	39.75	72.4	55.3	14.5	29.0	39.65	71.2	53.9	15.2	29.5
HYT-27-21	38.00	70.0	54.7	14.5	30.5	37.65	68.2	54.5	14.9	29.5
V-13192	37.55	74.4	55.8	14.2	29.0	37.60	70.7	54.8	14.2	27.0
V-15210	39.30	75.0	55.0	15.0	29.5	40.40	69.4	56.3	15.3	30.0
V-14124	40.55	72.3	55.3	14.1	29.0	38.90	69.3	55.1	14.8	28.5
V-15235	39.70	73.2	54.3	13.5	25.0	40.80	71.6	54.4	13.6	24.5
TWS1334	39.20	71.3	55.7	14.7	29.0	40.70	70.3	54.3	14.9	28.5
13FJ29	39.90	73.0	55.1	15.0	27.5	39.00	69.6	54.7	14.2	25.5
V-14117	39.50	68.5	54.6	14.4	28.0	38.35	70.8	55.2	14.6	27.0
V-15207	41.20	72.7	54.8	16.1	33.5	40.45	72.0	54.9	15.4	30.0
V-14084	40.50	72.9	55.4	14.3	28.5	36.75	65.9	53.6	15.4	33.5
TWS1351	38.75	70.7	56.0	14.3	28.0	40.65	68.8	54.3	15.3	30.5
V-15238	38.45	73.3	56.4	14.6	28.5	38.65	70.4	54.1	15.1	28.5
14BT004	38.05	73.0	55.0	13.8	25.5	37.35	70.4	54.7	14.4	26.0
13FJ35	40.05	73.6	56.4	13.8	26.5	40.85	71.4	54.2	13.6	24.0
V-14122	39.95	73.1	56.3	13.3	25.5	38.00	70.7	55.4	14.4	27.0
14B-1572	40.90	75.3	55.7	14.2	27.5	38.80	72.1	54.5	14.3	27.5
TWS1335	40.30	73.1	55.2	14.7	30.0	40.60	71.0	54.2	14.5	28.0
V-14269	40.30	71.5	54.4	13.7	28.0	38.30	70.2	53.8	14.7	27.0
NR-491	40.55	72.5	55.7	14.3	27.5	38.35	70.2	55.5	14.8	28.5
HYT-60-5	37.55	72.8	55.2	15.8	27.5	41.20	76.3	55.1	15.1	30.0
HYT-60-57	39.90	73.7	55.9	14.5	27.5	40.35	71.7	54.5	14.6	26.5
15C044	40.55	73.3	54.9	15.0	31.0	40.60	72.4	54.9	14.0	25.5
V-14266	40.10	72.2	54.5	14.1	29.0	40.70	67.8	53.9	14.5	26.0
18V-4	37.70	70.8	54.1	15.6	32.0	38.30	67.0	53.4	15.1	28.0
Kanzo-1201	40.10	68.1	55.1	15.6	31.5	39.65	71.1	53.7	15.0	28.5

V-15249	37.50	71.3	55.5	15.1	28.5	40.60	72.8	54.4	14.4	27.0
TWS1355	40.55	67.7	53.9	14.4	28.5	38.55	67.8	54.8	14.4	26.0
V-14268	40.20	67.9	54.9	14.5	29.0	40.75	63.7	54.4	14.3	26.5
HYT-27-11	34.90	70.1	54.9	14.6	28.0	36.60	69.9	55.5	14.0	27.0
NR-505	38.35	68.6	55.2	14.4	30.5	36.00	67.7	53.2	15.8	32.5
NR-499	34.80	73.9	56.1	15.3	31.5	32.65	70.6	55.1	14.9	30.0
15B-1131	36.85	71.5	53.3	16.2	33.5	38.15	67.8	54.4	14.6	27.5
NR-448	38.25	69.4	53.9	16.1	32.5	37.30	69.2	53.8	15.6	31.0
NR-488	36.75	76.8	55.6	15.5	30.0	34.30	71.8	54.9	15.1	28.5
15B-1116	40.20	69.3	53.4	15.2	29.0	37.20	63.6	53.4	15.6	27.5
Galaxy-13	37.85	68.7	53.8	15.1	29.5	40.35	69.1	54.5	14.6	28.0
PGBM-18	38.85	69.2	55.3	14.2	27.5	38.55	69.5	55.2	14.6	27.0
NIAB-317	40.50	71.0	56.8	12.3	22.5	40.70	70.7	55.9	13.4	24.0
V-15250	38.65	72.9	54.5	14.6	28.5	40.75	69.8	53.7	14.9	29.0
Rustam-2012	37.60	73.4	54.7	14.3	28.5	37.05	70.3	54.0	15.5	29.0

Effect Of Planting Time On Grain Quality Traits

Twelve advanced lines/varieties with three replications were planted at seven different dates (252 samples) to check their potential. Regarding thousand grain weight Ujala-16 was the topper with 44.03 g weight in first sowing date i.e. 1st November, which was the most favorable planting date in regards to 1000 grain weight, followed by D2. Whereas, D7 scored the least in this regard.

In case of test weight, it has shown promising results in all sowing dates except D7. Punjab-11 got highest test weight value (77.3 kg/hl) followed by V-12066 (76.7kg/hl) both in D2 (Nov. 10). Faisalabad-08 remained ever green regarding chapatti quality scoring highest marks in wet gluten content (33.7 % in D3 i.e. Nov. 20). Protein content was the highest in D3 and D4, but the overall results of the protein percentage were quite acceptable. V-14225 gave the highest protein score on average of all sowing dates and individually at D3, i.e. 15.1% and 15.8%, respectively

The mentioned tables give a comprehensive description of the results that were analyzed:

Table:70 Different parameter of Wheat Sowing Dates Trial 2016-17

		D1	D2	D3	D4	D5	D6	D7
FSD-08	1000 KW	41.60	36.27	29.10	28.47	31.00	25.53	23.67
	Test Weight (kg/hl	75.4	74.6	72.0	74.7	73.5	68.9	62.9
	Starch Content (%)	55.4	53.5	53.5	53.9	53.4	53.1	52.4
	Protein Content (%)	14.0	14.4	15.6	15.3	14.9	15.1	15.1
	Gluten Content (%)	28.3	29.0	33.7	31.7	30.7	31.0	29.7
Punjab-11	1000 KW	38.13	41.73	33.20	31.60	32.30	30.67	29.33
	Test Weight (kg/hl	76.5	77.3	74.2	72.8	73.9	74.1	71.7
	Starch Content (%)	55.6	54.9	53.7	53.7	54.0	54.3	53.2
	Protein Content (%)	14.8	14.4	15.0	15.1	15.2	14.8	14.7
	Gluten Content (%)	30.3	27.5	30.5	30.3	29.7	28.7	28.3
Galaxy-13	1000 KW	40.20	36.07	34.03	31.00	29.27	23.93	25.60
	Test Weight (kg/hl	73.8	73.3	71.3	69.5	69.2	65.7	65.3
	Starch Content (%)	56.0	54.2	54.3	54.2	55.3	54.8	55.5
	Protein Content (%)	13.8	13.9	14.7	14.6	13.4	13.1	12.7
	Gluten Content (%)	26.7	26.0	28.7	31.0	23.3	25.0	22.5
Ujala-16	1000 KW	38.03	37.50	33.37	32.17	31.57	26.93	27.87
	Test Weight (kg/hl	76.4	74.1	72.8	73.8	71.9	68.6	64.7
	Starch Content (%)	56.0	55.2	53.2	54.9	55.3	54.5	54.5
	Protein Content (%)	14.0	14.6	15.7	14.3	14.2	14.4	14.1
	Gluten Content (%)	26.3	26.3	31.7	26.7	25.3	25.7	24.7
V-12304	1000 KW	44.03	37.50	33.37	32.17	31.57	26.93	27.87
	Test Weight (kg/hl	76.1	76.2	74.6	74.1	75.7	73.8	67.3
	Starch Content (%)	56.2	54.9	54.2	53.9	55.3	55.6	54.6
	Protein Content (%)	14.3	14.2	15.7	15.5	14.3	14.2	14.4
	Gluten Content (%)	28.0	26.3	33.0	34.0	27.3	27.7	27.0
V-12066	1000 KW	40.13	35.23	29.50	29.35	31.43	27.67	25.20
	Test Weight (kg/hl	75.4	76.7	74.0	73.8	72.6	76.0	71.1
	Starch Content (%)	56.1	53.9	53.8	53.8	55.4	54.7	53.9
	Protein Content (%)	13.8	14.8	15.2	14.7	13.2	14.0	13.8
	Gluten Content (%)	27.7	29.7	31.3	30.0	24.0	27.5	27.7
V-13348	1000 KW	33.40	31.67	27.93	28.67	26.70	24.15	24.57
	Test Weight (kg/hl	76.3	74.0	71.7	73.3	72.4	73.9	70.3
	Starch Content (%)	56.1	54.5	54.0	54.8	54.5	55.2	54.0
	Protein Content (%)	13.2	14.1	15.5	14.2	14.1	13.8	14.2
	Gluten Content (%)	24.7	27.0	30.7	26.3	26.0	25.7	27.0
V-14154	1000 KW	44.13	37.53	31.67	33.33	33.87	29.87	28.27
	Test Weight (kg/hl	76.4	73.3	71.2	73.5	72.0	69.7	67.2
	Starch Content (%)	55.8	55.1	54.4	54.6	55.5	54.3	54.2
	Protein Content (%)	13.2	13.5	14.9	14.3	13.5	14.1	13.8
	Gluten Content (%)	26.0	26.0	30.0	28.7	25.7	27.3	25.7
V-14225	1000 KW	42.00	36.43	30.35	27.37	32.17	29.20	27.53
	Test Weight (kg/hl	76.3	75.0	73.8	72.9	74.3	71.4	70.3

	Starch Content (%)	56.2	54.8	54.4	53.9	55.2	55.0	54.7
	Protein Content (%)	14.2	15.4	15.8	14.6	15.5	15.3	14.7
	Gluten Content (%)	29.7	30.3	32.0	28.0	30.7	27.0	28.7
V-14227	1000 KW	39.47	37.65	33.17	28.73	33.10	30.33	28.13
	Test Weight (kg/hl	72.4	73.1	70.4	71.7	71.0	70.9	66.7
	Starch Content (%)	55.0	54.5	54.3	54.0	55.3	54.7	54.6
	Protein Content (%)	14.5	14.5	15.0	14.9	14.0	14.2	13.9
	Gluten Content (%)	29.7	27.0	28.7	29.3	25.7	26.3	24.7
V-14168	1000 KW	39.55	38.65	33.90	32.00	33.57	30.20	29.53
	Test Weight (kg/hl	75.7	75.4	74.2	72.7	74.5	70.1	68.1
	Starch Content (%)	55.9	54.9	54.2	53.7	54.1	54.5	54.3
	Protein Content (%)	14.6	14.4	15.2	15.2	14.5	14.5	14.0
	Gluten Content (%)	28.5	26.5	29.3	30.0	26.0	27.0	24.3
V-14170	1000 KW	40.37	39.80	34.03	32.55	37.57	29.87	29.23
	Test Weight (kg/hl	74.9	73.3	70.4	71.3	73.1	70.5	66.8
	Starch Content (%)	56.5	56.0	54.8	53.4	56.4	55.8	55.2
	Protein Content (%)	13.6	13.0	14.2	15.6	12.2	13.2	13.0
	Gluten Content (%)	25.0	23.3	26.3	31.3	20.0	23.7	22.7

Impact Of Different Fertilizer Treatments On Wheat Grain Quality

The effect of four different fertilizer treatments and combinations at a specific planting date were studied on wheat grain quality of eight different advanced lines and varieties, totally consisting of ninety-six (96) grain samples. They were tested for grain quality parameters, especially grain weight (using seed counter & electric balance), test weight (through test weight/bushel weight apparatus), starch, gluten and protein, contents (using Omeg Analyzer) and chapatti quality.

Fertilizer Levels NPK (kg/ha)

F_1 =0 – 0 – 0 F_2 = 90 – 60 – 60 F_3 = 120 – 90 – 60 F_4= 150 – 120 – 60

Table:71 Impact Of Different Fertilizer Treatments On Wheat Grain Quality

Varieties/ Lines	Parameters	Treatment				Varietal Average
		F1	F2	F3	F4	
Faisalabad-08	1000KW	40.2	38.2	35.6	37.4	37.8
	Test Weight (kg/hL	70.7	76.6	71.3	71.9	72.6
	Starch (%)	56.1	56.6	56.1	55	56
	Protein (%)	9.9	12.1	12.9	13.6	12.1
	Gluten Content (%)	16	24	26.3	28	23.6
V-13348	1000KW	41.4	38.2	39.1	36.9	38.9

	Test Weight (kg/hL	71.3	71	72.6	71.3	71.6
	Starch (%)	56.1	56.7	55.8	56.1	56.2
	Protein (%)	10	11.6	13.2	13.1	12
	Gluten Content (%)	14.3	19.3	23.7	24.3	20.4
V-14154	1000KW	42.4	40.2	40.2	39.3	40.5
	Test Weight (kg/hL	70.8	73.2	69.2	72.8	71.5
	Starch (%)	56.1	55.3	55.3	56	55.7
	Protein (%)	10	11.6	12.7	12.3	11.7
	Gluten Content (%)	15.7	22.3	21	23	20.5
V-14225	1000KW	36.7	35.1	38	35.1	36.2
	Test Weight (kg/hL	72.5	72	71.3	73	72.2
	Starch (%)	56.7	56	55.8	55.6	56
	Protein (%)	10.9	14.2	13.8	15.1	13.5
	Gluten Content (%)	15.7	27.7	27.7	30.3	25.4
V-14227	1000KW	40.8	37.8	38.1	37.1	38.4
	Test Weight (kg/hL	71.1	71	70.8	70.4	70.8
	Starch (%)	56.8	55.4	56	55.7	56
	Protein (%)	9.8	11.6	12.9	13.5	12
	Gluten Content (%)	12.3	18.3	22.7	24	19.3
V-14168	1000KW	41.2	40.1	38.6	39.6	39.9
	Test Weight (kg/hL	69.8	70.7	73	73.3	71.7
	Starch (%)	56.7	56.5	55.8	56.4	56.4
	Protein (%)	10.6	11.6	12.8	12.7	11.9
	Gluten Content (%)	14.7	17.3	20.7	22	18.7
V-14170	1000KW	41.5	40.9	43	40.2	41.4
	Test Weight (kg/hL	70.2	71.8	70.6	71.2	71
	Starch (%)	54.7	56.7	56.5	56.4	56.1
	Protein (%)	10.8	10.9	12.1	12.1	11.5
	Gluten Content (%)	17.3	15.3	20	18.3	17.7
V-12066	1000KW	33.8	32.3	38.9	32.3	34.3
	Test Weight (kg/hL	74	75.2	74.2	75.7	74.8
	Starch (%)	57.1	56.5	55.8	55.5	56.2
	Protein (%)	10.6	11.9	12.9	12.6	12
	Gluten Content (%)	18	21.3	23	23.3	21.4
	Treatment Average	15.5	20.7	23.1	24.2	20.9

Evaluating the results considering the 1000 kernel weight, F_1 treatment contributed the topmost average followed by F3. The prominent variety with the highest average scores in 1000 grain weight in all treatments was V-14170, followed by V-14154 having maximum count of 42.4 g.

Test weight has mostly excelled in the F_2 treatment. V- 12066 have shown promising results regarding test weight, by having a good average score of 74.8 kg/hL with the fertilizer treatments and varietal comparison. Fsd-08 revealed the highest test weight 76.6 kg/hL with the application of F_2.

On an average the higher scoring Starch percentages was of V-14168, while V-14170 gave prominent results at individual treatments i.e. F_2, F_3 and F_4. Top starch percentage was 56.7% found in V-14170 and V-13348 with the application of F_2.

F_4 revealed the highest protein and gluten range. V-14225 excelled in all four fertilizer treatments with the highest protein and gluten content on average basis and giving the topmost protein and gluten content, i.e. 15% and 30.3%, respectively.

Assessing the fertilizer combinations, it has been concluded that maximum quality parameters showed their best potentials and indicated visibly better averages at F_3 treatment.

Determination Of Quality Traits In Advanced Lines Of Barley

One hundred and eight (108) samples of twelve advanced lines and varieties of barley, with three replicates, at three Planting Dates were selected and analyzed for their quality traits (test weight, 1000 kernel weight and protein content).

Planting Dates of barley:

D1- 5th November,

D2- 20th November & D3- 5th December

The following tables give a detailed numeric description of the results that were analyzed:

Table:72 Different parameter of Barley Sowing Dates Trial 2016-17

		1000 KW			Test Weight			Protein content		
		D1	D2	D3	D1	D2	D3	D1	D2	D3
1	B-15009	30.7	28.5	31.6	54.5	54.5	51.6	12.8	13.1	12.3
2	B-15010	36.0	33.4	38.5	58.3	54.0	54.4	14.3	13.6	13.1
3	B-05011	39.5	39.0	32.7	59.4	58.1	57.7	13.3	13.8	13.9
4	B-14002	35.6	40.1	36.5	54.2	47.3	49.0	14.1	14.5	13.3
5	B-14003	33.8	35.3	30.8	51.4	51.6	46.0	13.4	14.4	13.9
6	B-14007	38.6	39.3	32.0	52.2	51.9	52.1	12.9	14.0	13.8
7	B-14011	41.9	38.0	38.1	53.3	50.6	49.3	12.1	13.1	12.9
8	B-14035	35.6	35.4	33.9	50.2	50.3	49.7	13.5	14.6	13.9
9	B-14038	39.9	40.3	38.5	50.6	49.3	45.3	13.5	14.0	13.3
10	Jau-83	34.7	34.9	38.7	51.4	53.3	50.5	11.3	13.4	13.6
11	Jau-87	33.7	33.8	30.5	56.7	51.4	51.7	11.8	13.3	13.4
12	Haider-93	31.2	33.6	32.3	56.2	58.3	52.4	12.5	12.5	13.7

Results reveal that among the three sowing dates, the 1st and the 2nd planting dates have given good outcomes in case of 1000 grain weight, where the 2nd sowing date has given the highest scores. B-14011 has excelled in all three sowing dates with the highest 1000 grain weight, i.e. 41.9g, followed by B-14038 recording the highest average of all three sowing dates. B-15009 unfortunately scored the lowest 1000 grain weights in all planting dates.

Reviewing the test weight results, the 1st sowing date has revealed promising values, gradually declining the succeeding sowing dates. B-05011 gave the best values in all planting dates, revealing maximum test weight (59.4 kg/hl). Haider-93 and B-15010 followed, having the second highest score of 55.6 kg/hl on an average of all planting times.

Maximum records of the protein content were found in the 2nd sowing date followed by the 3rd one. Minimum scores fell in the 1st planting date. B-14035 has shown the top most protein content i.e. 14.6%, whereas 14% was recorded in B-14002 on an average of all planting dates.

Considering the average results of the check varieties in all sowing dates, Haider-93 gave better results in protein percentage and test weight, whereas Jau-83 gave promising results in 1000 grain weight.

Influence Of Different Tempering Conditions On Milling Yield Of Current Wheat Varieties

Four promising varieties i.e., Punjab-11, Millat-11. Galaxy-13 & Ujala-16 were selected for the study at four moisture levels. The most suitable moisture to get maximum flour yield during milling was 15% at 16 hours for Punjab-11 and 15.5% for Ujala-16 soaked for the same time duration i.e. 16 hours.

Table:73 Tempering results in the form of Flour Yield percentage

Time (hours)	Moisture (%)	Flour Yield (%)			
		Punjab-11	**Millat-11**	**Galaxy-13**	**Ujala-16**
16	14.5	67	67	67	68
	15.0	71	69	68	69
	15.5	69	68	70	71
	16.0	68	65	66	67
24	14.5	67	66	68	66
	15.0	67	68	68	67
	15.5	70	68	69	70
	16.0	67	66	68	68
32	14.5	67	68	66	66
	15.0	70	68	68	69
	15.5	68	68	66	68
	16.0	65	65	65	67
48	14.5	66	66	64	66
	15.0	68	67	67	69
	15.5	67	68	68	68
	16.0	67	68	67	68

KALA SHAH KAKU TRIALS

Demonstration

The demonstration consisted of 24 lines/genotypes (V-11160, V-13001, V-08086, AB-16, CD-16, EF-16, GH-16, IJ-16, KL-16, MN-16, OP-16, , Galaxy-13, Aas-11, Fsd-08, AARI-11, Millat-11, Punjab-11, Lasani-11, Johar-16, Gold-16, Zincol, Borlaug, Ujala-16 and CK-50). Five lines (Galaxy-13, CK-50,

Ujala-16, Lasani-11 and AARI-11 gave maximum yield (3146, 2968, 2962, 2849 and 2849 kg ha-1).

Filial Generations

Under artificial rusts epidemic condition, 206 entries of F2, 167 entries of F3, 76 entries of F4 and 41 enteries of F5 generations were studied. Out of them, 114, 102, 66 and 36 entries were selected, respectively.

Local Disease screening nursery (LDSN).

Out of 209 tested entries, advanced lines from NUWYT, PUWYT, A, B trials as well as commercial varieties showed resistant to moderate suseptible disease reactions.

International trials at Kala shah kaku

International wheat yield trials were received from CIMMYT and sown at RRI; KSK Summary of all trials is given below

Sr.No.	Name of the trial	Entries	
		Studied	Selected
1	HYT-20	20	5
2	Genetic Gain Trial	35	10
3	HYT-55	55	14

Exotic/ non Exotic trials

25 genotypes were evaluated at kala shah kaku in which all lines showed resistant to moderate resistant disease reaction and eight genotypes gave higher yield than check variety Ujala-2016