

ANNUAL DETAILED TECHNICAL REPORT FOR THE YEAR 2015-16



**REGIONAL AGRICULTURAL RESEARCH
INSTITUTE, BAHAWALPUR**

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1. INTRODUCTION

Regional Agricultural Research Institute, Bahawalpur is entrusted the research work of evolution of new varieties of Wheat, Pulses, Oilseeds, Millets and Vegetables possessing desirable traits with higher yield level and development of crop production and protection technologies suitable for the specific agro-climatic conditions of Southern Punjab.

Presently, the institute is comprised of three major divisions viz. Crop Breeding, Agricultural Chemistry and Plant Protection. The sole aim of the Institute is to undertake research and development efforts on evolution of new varieties of Wheat, Pulses, Oilseed, Sorghum and Millet crops possessing high yield, heat, salt and moisture stress tolerance, disease and pest resistance and ecologically well suited for Bahawalpur region. Also developing awareness among farming community of the region through evolution of high yielding, better fertilizer responsive, pest and disease resistant varieties of various crops.

According to the priorities of the institute, it is mainly working on wheat improvement i.e. all the breeding activities regarding wheat improvement, continued during 2014-15. Historically, breeding department of this Institute had participated in green revolution in the past. Blue silver (1971) was the first wheat variety of this institute, which got maximum penetration to the farming community being a short duration variety. Up till now, this institute had evolved twelve wheat varieties, out of which three varieties i.e. Mairaj-08, Fareed-06, and Aas-11, are the cultivars being cultivated in the farmer's fields during 2014-15.

Aas-11 is considered among top five wheat varieties in the province during 2014-15. Two new wheat strains (076346 and 099172) gave better performance regarding grain yield. These two strains will be promoted further.

As for other crops, one strain of chickpea (BRC-390), three strains of mungbean (BRM-311, BRM-353, BRM-357) two strains of mustard (BRJ-7052 & BRJ-7057), two strains of millets (Composite-1 & Composite-7) and two strains of sorghum (RARI-S-4 & S-10) , have been promoted further on the basis of their high yield potential and other relative traits. These struggles will be more useful for the nation with respect to food security of Pakistan.

2. ORGANIZATION

2.1 Head of the Institute : Director Agriculture (Research)

2.2 Technical/Research Staff :

S. No.	Designation	Name	Period
1	Director Agriculture Research	Ghulam Hussain	17.01.2014 to date
A. CROP BREEDING DIVISION			
a. ECONOMIC BOTANY SECTION			
2	Economic Botanist	Dr. Manzoor Hussain	06.05.2014 to date
3	Assistant Botanist Economics	Dr. Khalid Mahmood	13.05.2014 to date
4	Assistant Research Officer	Dr. Imtiaz Ali	30.06.2014 to date
	Assistant Research Officer	Muhammad Kashif Aziz	10.07.2012 to date
	Assistant Research Officer	Ali Ammar	10.07.2012 to date
	Assistant Research Officer	Natasha Kanwal	17.12.2015 to date
5	Assistant Research Officer	Aakash Zafar	24.07.2014 to date
b. PULSES SECTION			
6	Assistant Botanist Pulses	Dr. Muhammad Faheem Khan	24.07.2014 to date
c. VEGETABLE SECTION			
7	Vegetable Botanist	Dr. Ghulam Abbas	12.08.2016 date
8	Assistant Botanist Vegetables	Muhammad Zahid Aslam	29.05.2010 to date
d. MILLET SECTION			
9	Assistant Botanist Millets	Muhammad Safdar	15.12.2007 to date
e. OIL SEED SECTION			
10	Assistant Botanist Oilseeds	Dr. Muhammad Masood Akhtar	17.10.2005 to date
f. AGRONOMY DIVISION			
11	Assistant Agronomist	Dr. Liaquat Ali	13.06.2016 to date
12	Assistant Research Officer	Arshad Hussain	01.08.2003 to date
13	Assistant Research Officer	Wajiha Anum	28.07.2016 to date
B CHEMISTRY/SOIL SCIENCE DIVISION			
14	Agricultural Chemist	Vacant	01.04.2016 to date
15	Assistant Agricultural Chemist	Muhammad Iqbal Shahid	02.08.2011 to date
16	Assistant Research Officer	Dr. Muhammad Rashid Farooq	31.12.2005 to date
17	Assistant Research Officer	Post abolished	01.11.2012

C. PLANT PROTECTION DIVISION			
a. PLANT PATHOLOGY SECTION			
18	Plant Pathologist	Saeed Ahmad	18.06.2012 to date
19	Assistant Plant Pathologist	Dr. Muhammad Arshad Hussain	16.07.2012 to date
20	Assistant Research Officer	Muhammad Sajjad	07.02.2014 to date
21	Assistant Research Officer	Vacant	01.04.2016
b. ENTOMOLOGY SECTION			
22	Entomologist	Muhammad Younus	13.10.2008 to date
23	Assistant Entomologist	Imran Akhtar	02.11.2016 date
24	Assistant Research Officer	Syed Waqar Hussain Shah	07.08.2009 to date
25	Assistant Research Officer	Madiha Mobeen Khan	10.11.2016 to date
D. STATISTICS SECTION			
26	Assistant Statistician	Vacant	21.02.1999 to date

3. BUDGET/EXPENDITURE AND INCOME (Rs. IN MILLIONS)

3.1 EXPENDITURE

3.1.1 NON-DEVELOPMENT

Grant No. 18-Agriculture	Allocation	Expenditure
1. Pay of Officers	11.687	11.378
2. Pay of Establishment	10.478	10.213
3. Regular Allowances	25.938	25.442
4. Other Allowances	0.320	0.320
5. Contingencies	7.287	7.284
Total	55.710	54.637

4. CROP BREEDING DIVISION

4.1 ECONOMIC BOTANY, WHEAT BREEDING SECTION

WHEAT (*Triticum aestivum* L.)

All the activities regarding wheat breeding programme continued during 2014-15. Among these activities, hybridization, study of filial generation (F1-F6), evaluation of wheat genotypes in various categories of wheat trials i.e. Preliminary wheat yield trial, Regular wheat yield trials, Regional wheat yield trials, Micro wheat yield trials and National uniform wheat yield trials are included. Exotic material received from National Coordinator Wheat, was also tested under local condition, some what detail about these activities are given as.



1. HYBRIDIZATION OF WHEAT FOR GENETIC IMPROVEMENT

In November 2014, 02 wheat crossing blocks were planted and in February March, 2015, crossing among the suitable parents was attempted. During this season, more than 1000, crosses were attempted of which 570 were got successful.

S. No.	Purpose	No. of crosses	
		Attempted	Successful
1	High yield	452	290
2	Resistant to disease	330	160
3	Heat and drought	210	100
4	Quality	60	25
		1052	570

2. STUDY OF FILIAL GENERATIONS (F1-F6)

After crossing, plants/lines with new gene combinations selected and promoted to next generation/trials.

S. No.	Generation	Evaluation studied	Selection for study	Bulked for
1	F1	689	474	-
2	F2	446	1905	-
3	F3	341	1245	-
4	F4	284	243	35
5	F5	241	55	18
6	F6	112	-	22
	Total:-			62

Sixty two genotypes were put up in yield testing/trials.

3. WHEAT YIELD TRIALS

Selected entries are put up into different yield trials according to the status.

Sequence of testing is from preliminary to national uniform wheat yield trials.

A. PRELIMINARY WHEAT YIELD TRIALS

One hundred forty entries were tested in three “A” trials. Better performing entries are given as under:-

S.No.	Trial	V-Code	Yield Kg/ha
1	A1	14B-1504	5487
	A1	Mairaj-08 (B. Check)	5459
2	A2	14B-1549	6185
3	A4	14B-1569	7037
4		14B-1583 Mairaj-08 (Best check)	6337

B. REGULAR WHEAT YIELD TRIAL

Forty eight entries (including checks) were tested in six trials under two environments i.e. normal and late. Net plot size was kept as 5mx 1.2m (6m²) with 3 replications under RCBD, layout. The strains possessing better yield are given as under:-

Sr.No.	Strain	Trial	Yield kg/ha (Avg N & L)
1	14B-1028	B1	5046
2	14B-1029	B1	4884
3	14B-1001	B1	4861
4	14B-1002 (Sehar-06 best check)	B1	4861 4630
5	14B-1004 (Sehar-06 best check)	B2	5139
6	14B-1005 (Sehar-06 best check)	B2	4954

		B2	4838
7	14B-1007	B3	4236
8	13B-3020	B3	3958
9	14B-1023 (Sehar-06 best check)	B3	3866
		B3	3426
10	13B-3086	B4	4213
11	14B-1010 (Sehar-06 best check)	B4	3981
		B4	3843
12	14B-1013	B5	4236
13	13B-3033 (Fsd-08 best check)	B5	4120
			3889

C. REGIONAL WHEAT YIELD TRIALS

The trials was planted on 6 locations in Southern Punjab. One location was selected in these districts i.e. Rahim Yar Khan, Bahawalpur, Lodhran, Muzaffargarh, Khanewal and Bahawalnagar. The trial was laid out following RCBD with 3 replications. Keeping plot size of 5mx1.2m (6m²). Better performing strains are as under:-

S.No.	V. Code	Av. Yield Kg/ha Av. Of 6 trials
1	13B-2567	4463
2	12B-2506	4068
3	12B-2511	3945
4	Aas-1 (Best check)	3939

D. MICRO WHEAT YIELD TRIALS

The trial composed by Director, Wheat Research Institute, Faisalabad was consisted of 44 strains. This trial was planted through Punjab, five sets are received and planted on 5 locations in southern Punjab. The results are given as under:-

S.No.	V. Code	Av. Yield Kg/ha Av. Of 5 trials
1	NR-449	4586
2	122559	4551
3	TWX-424	4364
4	UAF-9394	4307
5	NR-429	4306
	(FSD-08 Check)	4077

E. NATIONAL UNIFORM WHEAT YIELD TRIAL

This trial is composed by National Coordinator (Wheat), NARC, Islamabad, consisted of new strains from all over the country. The trial is planted throughout country. Regional Agriculture Research Institute, share trials on seven locations in southern Punjab. Results are given as under:-



S.No.	V. Code	Av. Yield Kg/ha Av. Of 6 trials
1	SRN-0911	4885
2	PR-12	4794
3	NIA-CM-4-10	4703
4	CT-09137	4651
5	TW-1510	4647

4. STUDY OF EXOTIC MATERIAL

Various exotic nurseries received from Natural Coordination (Wheat) NARC , Islamabad were planted at RARI, Bahawalpur, relevant data were collected and sent back to the concerned quarter. Hence better performing strains were selected for further studies.

Sr #		Total	Selected
01	4-SATYN	28	05
02	22-SAWYT	50	06
03	6-HPAN	100	13
04	15-ESBWYT	24	04
05	15-ISBWYT	24	05
06	35-ESWYT	50	06
07	46-IDYN	50	06
08	6-CSISA-SB	52	09
09	47-IBWSN	304	17
10	9-STEMRRSN	250	14
11	SABWGPYT-04	60	-
12	13-HTWYT	50	-
13	W-PEP Nursery	80	-
14	W-PEP seed increase	335	-
	Total	1457	85

5. WHEAT YIELD TRAILS UNDER MOISTURE STRESS

Two trails were studied under moisture stress conditions, plantation was done after application of soaking dose of irrigation, after that no irrigation was applied while rainfall was recorded as such. Plot size was kept 5m×1.2m (6m²)–under RCBD fashion with 3 replications. Relevant data were recorded. Grain yield data of outstanding genotypes are given as under:

Sr#	V. Code	Trail	Yield(kg/ha)
01	14B1512	A-MS	4429
	Aas-11 (check)	A-MS	4123
02	076346	B-MS	4151
03	11B2095	-do-	3831
	Ch.50(check)		3768

Note: Rainfall received during wheat season was 42 mm.

6. HEAT TOLERANCE STUDY IN WHEAT

Planting of selected material was done under too late condition i.e. 23rd January, 2014 in field area of RARI, BWP. Purpose of late planting was to expose maximum stages to high temperature At grain filling maximum temperature was touching 36-40^oc.

- A. Only 4 strains i.e. 2567,2507,2509 and 2511, out of 100 strains, out yielded all the checks i.e. Inq-91, Sehar-06 and Aas-11
- B. Selected entries from F₂ and F₃ were planted and studied under natural heat stress conditions. Results are given below.

Sr#	Generations	No. of families/entries	Selection made
01	F ₂ HT	75	92
02	F ₃ HT	50	73

7. GENETIC RESISTANCE AGAINST DISEASE

New genotypes developed at RARI, BWP are sent to other concerned departments for disease screening purpose . Data is received from concerned quarters every year. Data recorded during 2014-15 is given as under:

Sr#	Locations	Disease	Source	Resistant	Susceptible
01	KARI, Kenya	Stem Rust Ug-99	Wheat Screening nursery, Kenya	18	17
02	All over the country	Leaf, Yellow, Stem Rust	NWDSN	08	22

8. SHUTTLE BREEDING:

To reduce evolution period of newly evolved material, off season planting is done at kaghan and harvested germplasm is again planted at RARI, BWP, in normal season. Selected material during 2014-15 at kaghan are given here:

Sr#	Generation	Extra	Extra selected
01	F ₂	280	195
02	F ₃	90	55
03	F ₄	92	60
Total		462	310

7. **SEED PRODUCED**

17.5 tons Wheat seed of different categories was produced during 2014-15, detail is given bellow:

S. No	Varieties	Seed Quantity (kg)			
		BNS	Pre-Basic	Basic	certified
01	Aas-11	900	650	1500	3000
02	Mairaj-08	400	150	200	1000
03	Fareed-06	350	300	1200	3500
04	099172	800	-	-	-
05	076346	2500	-	-	-
06	076422	1100	-	-	-
	Total	6050	1100	2900	7500

4.2 PULSES SECTION

A. MUNG [*Vigna radiate* L. (Wilzeck)]

1. COLLECTION AND MAINTENANCE OF GERMPLASM OF MUNG

Mung germplasm consisted of 51 entries were sown following simple method on 26.06.2014, keeping plot size of 2.4m². The entries were harvested on 25.09.2014. Observation regarding days taken to 50% flowering, 90% pod maturity and yield were recorded and are presented as under:-

Traits	Minimum	Maximum
Days to 50% flowering	42	53
Days to 90% maturity	63	75
Yield (g/plot)	60	519



2. HYBRIDIZATION OF MUNG

Two crosses were attempted during Kharif-2014 for further evaluation. Detail of crosses is given as under:-

1. 98CMO16 X NM-2006
2. 3CMG507 X BRM-303
3. 2CMG527X BRM-307
4. 3CMG512X CH-M-06
5. BRM-303X NM-2011

Only three crosses (2, 3 & 5) were successful and F₀ seed was collected to raise F₁ during next year.

3. PRELIMINARY YIELD TRIAL OF MUNG

A trial of mung consisting of 12 entries along with two checks was conducted with 03 replications and a plot size of 4.8m². The trial was sown on 26.06.2014. The recommended agronomic practices were followed throughout the growing season. The trial was harvested on 25.09.2014. The performance of strains is given as under:-

S. No	V. Code	Yield (Kg/ha)	% ± Over checks	
			CH-M-06	NM-2011
1	BRM-343	1528	+09	+15
2	BRM-345	2049	+46	+55
3	BRM-349	2048	+46	+54
4	BRM-350	1666	+19	+26
5	BRM-353	1358	-03	+03
6	BRM-354	1319	-06	+01
7	BRM-365	1528	+09	+16
8	BRM-366	1632	+16	+23
9	BRM-378	486	-64	-63
10	BRM-382	1423	+02	+08
11	NM-2011	1319		
12	CH-M-06	1401		
LSD= (0.5)=89				

It is evident from the results that 07 strains out yielded both the checks and 03 strains showed less yields from the checks.

4. ADVANCE YIELD TRIAL OF MUNG

A trial of mungbean consisting of 05 entries along with 02 checks was conducted in RCBD fashion with 3 replications and a plot size of 4.8 m². The trial was sown on 26.06.2014. The recommended agronomic practices were followed throughout the growing season. The trial was harvested on 25.09.2014. The performance of strains is given as under:-

S. No	V. Code	Yield (Kg/ha)	0/0 over checks	
			Azri-M-06	CH-M-06
1	BRM-312	1423	+23	+27
2	BRM-321	1180	+02	+06
3	BRM-348	1042	-10	-07
4	BRM-356	1250	+08	+12
5	BRM-364	1218	+06	+09

6	AZRI-06(check)	1154		
7	CH-M-06(check)	1115		

Yield data in above table shows that four strains gave higher yield than both the checks, respectively while BRM-348 was low yielder than both the checks.

5. ADAPTATION YIELD TRIAL OF MUNG

A trial of mung consisting of 04 entries along with 2 checks was conducted in RCBD fashion with 03 replications at 03 locations of Punjab with a plot size of 4.8m². The recommended agronomic practices were followed throughout the growing season. The trial was sown on 26-06-2014 and harvested on 24-09-2014. The performance of strains is given as under:-

S. No	V. Code	Yield (Kg/ha)	0/0 over checks	
			CH-M-06	NM-2011
1	BRM-351	1493	+15	+22
2	BRM-352	1403	+08	+15
3	BRM-355	1354	+04	+11
4	BRM-367	1319	+01	+09
5	CH-M-06(check)	1301		
6	NM-2011 (Check)	1215		

This yield data were subjected to analysis of variance. The results revealed significant differences among mean values of various strains.

6. MUNG NATIONAL UNIFORM YIELD TRIAL 2014

A trial of mung consisting of 20 entries was conducted in RCBD with 03 replications and plot size of 4.8m². The trial was sown at 26-06-2014 and harvested at 23-09-2014. The recommended agronomic practices were followed throughout the growing season. The performance of strains is given as under:-

Entry No.	Yield (Kg/ha)
1	1458
2	1389
3	1042
4	1042

5	1389
6	1180
7	764
8	1562
9	1458
10	903
11	1493
12	1666
13	798
14	798
15	1285
16	1250
17	1250
18	1285
19	1285
20	1701

CV% =14.1

The results revealed significant differences among means values of various strains.

7. **BNS PRODUCTION OF ADVANCE LINES**

Single plant rows of BRM-311, BRM-353 and BRM-357 were selected. The progenies selected were bulked to produce BNS. 511 Kg pre basic seed of BRM-353, 457 kg pre basic seed of BRM-357 and 88 kg basic seed of BRM-311 was produced during 2014.

B. CHICKPEA (*cicer arietinum* L.)

1. COLLECTION AND MAINTENANCE OF GERMPLASM OF CHICKPEA

Germplasm consisted of 80 entries of chickpea. These lines were sown following by simple method with 2 replications keeping plot size of 2.4m². The entries were kept under constant observation and similar agronomic practices were applied to all the entries. Data on days taken to 50% flowering, 90% pod maturity, 100-seed weight were recorded. The compiled results are given as under:-

Traits	Minimum	Maximum
Days to 50% flowering	81	129
Days to 90% maturity	134	142
100-Seed weight (g)	13.2	26.5



2. HYBRIDIZATION OF CHICKPEA. The following crosses were attempted during Rabi-2014-15.

<u>S.No.</u>	<u>Name of Crosses</u>			<u>Successful crosses</u>
		-		
1.	3cc116	x	BHK-2011	unsuccessful
2.	BRC-390	x	Noor-2009	successful
3.	BRC-452	x	Pb-2008	unsuccessful
4.	BRC-450	x	BHK-2011	successful

Only 2 crosses (cross No.2, and 4) were successful and harvested for raising F₁, during 2015-16.

3. STUDY OF FILIAL GENERATION OF CHICKPEA

F1, F5, & F6, segregating generations of Desi & Kabuli chickpea were raised during Rabi-2014-15. Different segregates from each generation with desirable characters were selected on single plant basis for further study. The detail is as under:-

Generation	No. of entries studied	Plot size
F-1 (Desi)	02	4mx1.2m
F-5 (Desi)	10	4mx1.2m
F-5 (Desi, NIAB)	10	4mx1.2m
F-6 (Desi, PRI)	08	4mx1.2m
F-6 (kabuli, NIAB)	05	4mx1.2m

4. CHICKPEA PRELIMINARY YIELD TRIAL (DESI)

13 entries selected from local nursery were evaluated including two local checks. These entries were sown in a plot size of 4.8m² on 11.11.2014. Normal/recommended agronomic practices were applied as and when required. The entries were kept under constant observation throughout the growth period. The trial was harvested on 08.04.2015. 09 entries were selected for future studies, performance is given as under:-

S. No	V. Code	Kg/ha	%± over check Pb-2008	%+over check BHK-11
1	BRC-449	1500	+20	+28
2	BRC-450	1458	+16	+24
3	BRC-451	1146	-09	-03
4	BRC-452	1875	+50	+60
5	BRC-453	1887	+50	+61
6	BRC-454	1291	+03	+10
7	BRC-455	1708	+36	+45
8	BRC-456	1562	+24	+33
9	BRC-457	1293	+03	+10
10	BRC-458	1458	+16	+24
11	BRC-459	1157	-05	-02
12	Pb-2008(check)	1250		
13	BHK-11(check)	1171		

LSD (0.5) =103

CV=6.05%

A perusal of the data revealed that 09 entries out yielded both the checks. Entry BRC-453 stood 1st in the trial which gave more yield than both the check followed by BRC-452 with more yield than both the checks.

5. CHICKPEA REGULAR YIELD TRIAL (DESI)

A trial consisting of 16 entries including 02 checks was sown on 11.11.2014. It was laid out in RCBD with 3 replications and a plot size of 7.2m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 08.04.2015 and yield data of the entries were recorded and given in the following table:-

S. No.	V. Code	Kg/ha	%± over check	
			Pb-2008	BHK-2011
1	BRC-431	1111	-07	+11
2	BRC-432	1083	-09	+9
3	BRC-436	875	-27	+7
4	BRC-437	1014	-15	+7
5	BRC-438	1250	+05	+6
6	BRC-439	1083	-19	+5
7	BRC-440	1320	+10	+5
8	BRC-441	1117	-17	+4
9	BRC-442	1042	-13	-7
10	BRC-443	1181	-02	
11	BRC-444	1111	-13	
12	BRC-445	1181	-01	
13	BRC-446	1542	+29	
14	BRC-447	1333	+12	
15	BHK-11(check)	972		
16	Pb-2008(check)	1195		

LSD (0.5) =97

CV=5.0%

Analysis of variance of the yield data revealed significant differences among mean values of various strains. Only 04 strains named BRC-438, BRC-440, BRC-446 and BRC-447 gave more yield than both the checks.

6. CHICKPEA ADVANCE VARIETAL YIELD TRIAL (DESI)

A trial consisting of 14 entries including 02 checks was sown on 11.11.2014. It was laid out in RCBD with 3 replications and a plot size of 4.8m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 09.04.2015. The data are given in the following table.

S. No	V. Code	Kg/ha	%± over check	
			Pb-2008	BHK-2011
1	BRC-417	1479	-17	+16
2	BRC-428	1562	-13	+15
3	BRC-419	1479	-17	+12
4	BRC-426	1833	+2	+10

5	BRC-429	1687	-16	
6	BRC-412	1937	+08	
7	BRC-423	1062	-40	
8	BRC-421	1521	-15	
9	BRC-424	1937	+08	
10	BRC-420	1250	-30	
11	BRC-418	1875	+05	
12	Pb-2008(check)	1789		
14	BHK-2011(check)	1379		

LSD (0.5) =119

CV=6.02%

Yield data showed that 04 entries out yielded both the check varieties. Analysis of variance showed highly significant differences among the genotypes.

7. CHICKPE MICRO YIELD TRIAL (DESI), FAISALABAD

A trial consisting of 12 entries was sown on 12.11.2014. It was laid out in RCBD with 3 replications having a plot size of 4.8m². Normal/ recommended agronomic practices were applied as and when required. The trial was harvested on 09.04.2015 and yield data were recorded. The yield data of entries are presented as under:-

S. No	V. Code	Yield kg/ha
1	A	1896
2	B	2312
3	C	1583
4	D	1771
5	E	1562
6	F	2000
7	G	1979
8	H	2812
9	I	2729
10	J	2833
11	K	1875
12	L	2400

LSD (0.5) =64

CV=9.00%

Analysis of variance of the yield data revealed highly significant differences among mean values of various strains. The data were sent to Director, Nuclear Institute for Agriculture and Biology, Faisalabad.

08. COOPERATIVE YIELD TRIAL OF KABULI CHICKPEA (PRI FAISALABAD)

A trial consisting of 18 entries was sown on 12.11.2014. It was laid out in RCBD with 3 replications and a plot size of 4.8m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 09.04.2015 and yield data were recorded. The yield data entries are presented as under:-

S. No	Varieties/ strains	Yield (kg/ha)
1	Coop-1	1687
2	coop-2	542
3	coop-3	1271
4	coop-4	1312
5	coop-5	1146
6	coop-6	1771
7	coop-7	1479
8	coop-8	2041
9	coop-9	1521
10	coop-10	1771
11	coop-11	729
12	coop-12	1666
13	coop-13	1042
14	coop-14	1896
15	coop-15	854
16	coop-16	1937
17	coop-17	2104
18	coop-18	1000
CV= 6.77%		LSD=106.31

The yield data in above table revealed significant differences among mean values of various strains. The compiled data sent to Director, Pulses Research Institute, Faisalabad.

10. CHICKPEA MICRO YIELD TRIAL (DESI)

A trial consisting of 12 entries was sown on 12.11.2014. It was laid out in RCBD with 3 replications and a plot size of 4.8m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 09.04.2015 and yield data of the entries were recorded and presented as under:-

S. No	V. Code	Kg/ha
1	A	1896
2	B	2312
3	C	1583
4	D	1771
5	E	1562
6	F	2000
7	G	1979
8	H	2812
9	I	2729
10	J	2833
11	K	1875
12	L	2500

LSD (0.5) =197

CV=11.00%

The yield data revealed significant differences among mean values of various strains. The compiled data sent to Director, Pulses Research Institute, Faisalabad.

11. CHICKPEA NATIONAL UNIFORM YIELD TRIAL (DESI)

A trial consisting of 19 entries was sown on 10.11.2014. It was laid out in RCBD with 3 replications and a plot size of 7.2m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 06.04.2015 and yield data of trial were recorded. This institute shared one strain named as BRC-390.

Entry No.	Yield (kg/ha)
1	1806
2	1806
3	1778
4	1778
5	1917
6	1917
7	2334
8	2028
9	1472
10	2236
11	1875
12	1806
13	2084
14	181
15	1611
16	1806
17	1042
18	1917
19	1639
CV= 5.55% LSD=137.18	

The compiled data were sent to the Coordinator Pulses, NARC, Islamabad.

12. CHICKPEA NATIONAL UNIFORM YIELD TRIAL (KABULI) 2014-2015

A trial consisting of 14 entries was sown on 10.11.2014. It was laid out in RCBD with 3 replications and a plot size of 7.2m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 06.04.2015 and yield data of trial were recorded. The consolidated yield data of 14 entries are presented as below:-

Entry No.	Yield (kg/ha)
1	1320
2	1639
3	1292
4	1361
5	1361
6	1500
7	1222
8	1111
9	1431
10	1570
11	1222
12	1431
13	1361
14	139

The compiled yield data were sent to the Coordinator Pulses, NARC, Islamabad.

15. **BREEDER NUCLEUS SEED PRODUCTION**

76 kg BNS of promising strain BRC-390 was produced along with the 74 kg BNS of strain BRC-61 and 21kg of Kabuli strain BRC-408, during the year 2014-15.

4.3 VEGETABLE SECTION

1. EVALUATION OF DETERMINATE TOMATO ADVANCED LINES UNDER BAHAWALPUR AGRO-CLIMATIC CONDITIONS.

Eight advance lines of determinate type of tomato were tested by sowing in randomized complete block design with plot size specifications i.e 5.6 m x 1.25m. It was found that line 10139 and line 10137 out yielded the other varieties significantly in yield parameter. Total yield of lines 10139 and 10137 for per plot size were 09.00 kg and 07.00 Kg respectively. Naqeeb and Rio grande were commercial check in this trial.



2. EVALUATION OF DETERMINATE HYBRID TOMATO ADVANCED LINES UNDER BAHAWALPUR AGRO-CLIMATIC CONDITIONS.

Seven advance lines of determinate type of Hybrid tomato were tested by sowing in randomized complete block design with plot size specifications i.e. 5.6 m x 1.25m. It was found that line LTH-218 and LTH-08 were differ significantly in yield. The yield of LTH-218 and LTH-08 for per plot size were 11.00 Kg and 08.00 Kg respectively.

3. EVALUATION OF ONION GERMPLASM UNDER BAHAWALPUR AGRO-CLIMATIC CONDITIONS.

18 entries of onion were sown under Bahawalpur conditions to check their adoptability and it was found that VRIO-02, VR-10-03, Dsei-red , Pk-10321, Robina, Red imposta , Meerpurkhas, Desi large and red nasik were the entries that performed better against disease and pest attack under Bahawalpur conditions, the sets harvested of these entries have been stored and will be planted next for further testing.

4. SEED PRODUCTION

Quality seed of selected vegetables was produced to maintain the purity of vegetable varieties and to supply the seed public /private seed companies and vegetable growers in the region. Seed of Carrot (var. T-29=50 kg), Turnip (var. Golden ball=15 Kg , var. purple top= 20 Kg) , Redish (var. mino= 40 Kg and var. 40-days= 20 kg), Spinach (var. local desi= 30 kg) and onion (var. phulkara =20 kg) pure seed was produced.

4.4 OILSEED SECTION

1. COLLECTION AND MAINTENANCE OF GERMPLASM OF RAPESEED AND MUSTARD

190 entries were studied and maintained and their seed was collected for sowing in next season.

2. UTILIZATION OF GENEPOOL FOR HYBRIDIZATION.

Five crosses were attempted for high yield potential and canola quality characteristics.

3. STUDY OF FILIAL GENERATIONS OF MUSTARD

Following breeding material/filial generations were received from Oilseed Research Institute, Faisalabad

F2= 34 single plants were selected
 F3= 30 Progenies
 F4= 24 Progenies
 F5= 18 Progenies
 F6= 10 Progenies

4. PRELININARY YIELD TRIAL BRASSICA JUNCEA 2014-15

Ten entries/varieties were tested. Yield results are given below:-



S. No	Variety	Yield (kg/ha)
1.	BRJ-1458	2300
2.	BRJ-1452	2291
3.	BRJ-1457	2289
4.	Bahawalpur Raya (Check)	2275
5.	BRJ-1451	2211
6.	Khanpur Raya (Check)	2103
7.	BRJ-1454	2025
8.	BRJ-1453	2011
9.	BRJ-1456	2005
10.	BRJ-1455	1878

LSD (0.05) =384.9

5. REGULAR YIELD TRIAL OF BRASSICA JUNCEA 2014-15

Ten entries/varieties were tested. Yield results are given below:-

Sr.No.	Variety	Yield (kg/ha)
1.	BRJ-1307	2419
2.	BRJ-1305	2394
3.	BRJ-1306	2314
4.	Bahawalpur Raya (Check)	2308
5.	Khanpur Raya (Check)	2261
6.	BRJ-1304	2236
7.	BRJ-1302	2214
8.	BRJ-1101	2128
9.	BRJ-1205	2122
10	BRJ-1301	2061
LSD (0.05)		= 106.8

6. ADVANCE YIELD TRIAL OF BRASSICA JUNCEA 2014-15

Eight entries/varieties were tested. Yield results are given below:-

S. No.	Variety	Yield (Kg/ha)
1.	BRJ-1104	2614
2.	Bahawalpur Raya (Check)	2547
3.	BRJ-1201	2539
4.	BRJ-1102	2464
5.	BRJ-1105	2453
6.	Khanpur Raya (Check)	2353
7.	BRJ-1003	2283
8.	BRJ-1005	2219
LSD (0.05)		=171.6

7. MICRO YIELD TRIAL OF MUSTARD (B.Juncea).

Nine Varieties / Strains received from ORI, Faisalabad were sown under RCBD layout having three replications. Fertilizers were applied at @ 75: 75 N P kg/ha. Yield results are given below:

Brassica juncea (seed yield in kg/ha)-2014-15

Rank	Line/Variety	FSD	B/pur	BHAKAR	K/PUR	F/JG	CHKWAL	KARORE	PIPLAN	Avg.
3	BRJ-1004	1688	3019	1093	2500	897	1179	683	502	1445
5	RBJ-08015	1990	2852	1521	2099	636	1312	589	440	1430
2	KJ-224	1605	2426	1158	2145	1225	1413	603	417	1374
7	RBJ-10001	1765	2333	1240	2269	1253	942	610	494	1363
4	BRJ-1103	1817	2693	1218	2068	628	1297	585	517	1353

9	Khanpur Raya	1765	2444	486	2191	1517	1399	436	548	1348
8	RBJ- 10018	1765	2056	871	2068	1603	1178	519	532	1324
1	KJ-218	1534	2159	848	1960	1157	1607	460	486	1276
6	RBJ-09016	1656	2400	868	2160	958	1006	434	417	1237
LSD5%		150	90	67	194	110	155	88	87	

8. MICRO YIELD TRIAL OF RAPESEED (B.Napus). (Seed Yield Kg/ha 2014-15)

Eight Varieties / Strains received from ORI, Faisalabad were sown under RCBD layout having three replications. Fertilizer was applied at @ 75: 75 N P kg/ha. Yield results are given below

Rank	Line/Variety	FSD	B/pur	BHAKAR	K/PUR	F/JG	CHK	KARORE	PIPLAN	Avg.
G	RBN-13018	2504	2363	1241	2037	592	1718	750	417	1453
H	Faisal canola	1941	2322	1265	2145	653	2026	746	509	1451
F	RBN-09038	2230	2389	1335	1806	667	1700	856	502	1435
A	KN-263	1733	2759	1157	1744	767	2022	638	571	1424
B	KN-265	2015	2115	1249	1929	661	2137	737	509	1419
D	RBN-04021	2059	2296	1120	1960	694	1712	691	787	1415
E	RBN-04725	2059	2056	1117	1944	669	1615	797	478	1342
C	12CBN001	1874	1876	1231	1790	606	1638	757	571	1293
LSD5%		166	214	81	153	68	265	62	64	

9. NATIONAL UNIFORM YIELD TRIAL OF MUSTARD

Seed of eighteen entries supplied by the National Coordinator Oilseed NARC, Islamabad was sown under RCBD layout having four replications. Data was recorded according to the instruction of National Coordinator (Oilseeds). The results are given below:

Seed Yield (kg ha⁻¹) of mustard entries in National Uniform Mustard Yield Trial conducted at different locations during Rabi 2014-15													
Entry Code	Entry Name	NARC Islamabad	BARI Chakwal	ORI Faisalabad	RARI B-pur	ORS K-pur	BARS Kohat	AZRI DIKhan	ARI Tarnab	NIFA Peshawar	ARI Swat	ARI T-jam	Mean
1	MS/4	2091	2002	1142	2286	2354	1179	2026	2729	2556	1323	2142	1985
2	KJ-228	2023	2126	1244	2467	2229	1013	1989	2279	3444	1587	1954	2032
3	BRJ-9070	1939	1672	1214	2306	2313	1250	1909	1812	2889	1568	2667	1958
4	NARC Raya	2028	1622	1064	1961	1646	950	1882	1878	2278	1382	2563	1750
5	Khanpur Raya (C)	1970	2038	1019	2597	2229	1017	1901	2340	2333	1817	2221	1953
6	RBJ-10786	1956	2019	1308	2492	2708	1086	1815	2262	1944	1490	2167	1931
7	Rachna-3051	1565	1965	1233	2825	2813	780	2007	2133	2972	1850	2283	2039
8	MS/1	1947	1630	1053	2211	2250	1109	1873	2642	2500	1763	2196	1925

9	Rachna-743	1828	2109	1203	2742	2542	867	1815	2880	2389	1719	2546	2058
10	BRJ-9072	1838	1823	1292	2461	2208	809	2027	2978	2472	1298	2100	1937
11	EMH-274	1795	1697	1339	2532	2592	1125	1948	2146	2167	1252	2292	1899
12	KJ-148	1614	1697	1200	2057	2063	763	2036	2104	2667	1392	2738	1848
13	M-5666	2027	1692	1264	2425	2521	1101	2271	2228	2361	1174	1954	1911
14	MS/2	1918	1864	1058	2089	2021	1025	1980	1489	2556	1632	2038	1788
15	M-5222	1722	1970	1083	2956	2583	850	1814	1441	2583	1283	2188	1861
16	Coral-432 (C)	2525	2169	1356	3264	2375	950	1903	2283	2889	1535	2050	2118
17	11CBJ-004	1604	1789	908	2006	1604	1684	1920	1758	2361	1477	1833	1722
18	M-5121	1805	1797	1264	2319	2250	1008	2003	2525	2833	1483	1988	1934
Location average		1900	1871	1180	2444	2294	1031	1951	2217	2566	1501	2218	

10. NATIONAL UNIFORM YIELD TRIAL OF RAPESEED

Seed of twenty two entries was supplied by the National Coordinator Oilseed NARC, Islamabad was sown under RCBD layout having four replication and data was recorded according to the instruction of National Coordinator (Oilseeds). The results are given below

Seed Yield (kg ha ⁻¹) of rapeseed entries in National Uniform Rapeseed Yield Trial conducted at different locations during Rabi 2014-15												
Entry Code	Entry Name	1 NARC Islamabad	2 BARI Chakwal	3 ORI Faisalabad	4 RARI B-pur	5 ORS K-pur	6 BARS Kohat	7 AZRI Dikhan	8 NIFA, Peshawar	9 ARI Swat	10 ARI Tandojam	Mean
1	HOP-9	2985	2884	1481	1592	1708	1013	2801	2667	2053	1354	2054
2	CRH-119	3043	2482	1106	892	1417	1049	2447	2806	1992	1238	1847
3	CRH-131	2645	2187	1111	953	1063	1071	1829	2472	1997	1325	1665
4	CRH-148	2776	2153	1106	886	1229	1221	2614	2333	2315	1300	1793
5	HBO-63	3242	2978	1192	636	688	1709	2946	-	2663	1213	1919
6	KN-253	2050	2701	1419	1867	1646	1301	2722	2889	2108	1446	2015
7	Rustam Canola	3348	2964	1406	942	2000	1596	3058	3833	3267	1225	2364
8	Faisal Canola(C)	1975	2219	1539	1597	1771	830	2538	3333	1363	1433	1860
9	KN-256	1952	2670	1358	2222	2104	1305	2629	3611	2320	1467	2164
10	SONG-1	2708	2862	1394	483	1708	1205	2586	3139	2817	1275	2018
11	Mohsin 2012	1634	1893	1214	1583	979	830	1964	2250	1482	1546	1537
12	RBN-08004	2127	2226	1389	1644	1479	896	2611	2583	1757	1358	1807
13	ECH-386	1937	2154	1172	1881	1625	1175	2767	2833	1662	1396	1860
14	11CBN-006	1833	2246	1247	1636	1208	1042	2353	2083	1477	1258	1638
15	KS-2	2434	2290	1236	1261	1604	1317	2397	2472	1277	1329	1762
16	Hyola- 401(C)	2049	1961	1267	1781	979	1276	2606	2861	2312	1508	1860
17	SONG-2	2984	2553	1514	456	1708	1092	2952	3111	2852	1558	2078
18	08-1/2-7	1910	2312	1242	1122	1125	2013	2667	3222	1388	1333	1833
19	KS-1	2025	2385	1169	1178	1417	2021	2613	2389	1329	1279	1781
20	ROO- 125/12	1629	2133	903	1119	1292	2051	1998	1944	757	1371	1520
21	DNC-23	1695	2066	1122	1272	979	1175	2703	2556	1329	1500	1640
22	RM-1/08-39	2248	2241	1150	1081	1188	1017	2593	2833	1828	1579	1776
Location Average		2329	2389	1261	1277	1405	1282	2563	2772	1925	1377	

11. PRODUCTION OF QUALITY SEED OF BAHAWALPUR RAYA

The following quantity of quality seed of Bahawalpur Raya was produced.

Sr. No	Category	Seed Quantity (Kg)
1	BNS	22
2	Pre-basic	165
Total		187

12. NATIONAL UNIFORM YIELD TRIAL ON SUNFLOWER (SPRING)2015

Seed of eighteen sunflower hybrid entries was supplied by the National Coordinator Oilseed NARC, Islamabad were conducted under RCB layout having four replications and data was recorded according to the instruction of National Coordinator (Oilseeds). The results of three trials conducted during spring 2015 at Bahawalpur are given below:-

S. No	Entry Name	Yield (kg/ha)
1	SFS-15001	2564
2	SFS-15007	2311
3	SFS-15015	2977
4	SFS-15022	3231
5	SFS-15029	2791
6	SFS-15034	3164
7	SFS-15042	2663
8	SFS-15049	2836
9	SFS-15055	3009
10	SFS-15062	2373
11	SFS-15067	2840
12	SFS-15073	2831
13	SFS-15078	2876
14	SFS-15088	2889
15	SFS-15095	2337
16	SFS-15096	2463
17	SFS-15097	2600
18	SFS-15099	2609

4.5 MILLET SECTION

A. SORGHUM (*Sorghum bicolor* L. Moench)

1. COLLECTION AND MAINTENANCE OF THE GERMPLASM

42 entries of sorghum and Eighteen entries of Millet Bajra collected during 2014 were maintained. Fifteen genotype of sorghum and ten entries of Bajra were collected during 2015 for further study.

2. VARIETAL TRIAL OF SORGHUM.

Nine promising strains of sorghum alongwith check (Jowar-86) were tested for grain yield. The trial was sown in RCBD, having three replications and plot size of 2.4m x 5m. Fertilizers @ 150-115-60 NPK kg/ha were applied. Yield data were recorded and are presented in the following table:

Sr.No.	Entries	Grain yield kg/ha
1	RARI-S-4	2444
2	RARI-S-10	2361
3	PARC-SS-1	2222
4	RARI-S-3	2194
5	PARC-SS-II	2167
6	YSS-98	1722
7	RARI-S-5	1667
8	RARI-S-16	1611
9	Jowar-86	1583
10	BR-19	1306

CV%=12

LSD at 5%=255

The results show that the strain RARI-S-4 performed well and gave maximum yield of 2444 kg/ha followed by RARI-S-10 which gave yield of 2361 kg/ha.



B. BAJRA (*Pennisetum americanum*)

VARIETAL TRIAL

Ten promising strains of Bajra alongwith two checks Barani Bajra & Cholistani Bajra were tested for grain yield. The trial was sown in RCBD with 3 replications and plot size of 2.4m x 5m. Fertilizers @ 80-57-57 NPK kg/ha were applied. Yield data were recorded and are presented as under:

Sr.No.	Entry No.	Grain yield kg/ha
1	Cholistani Bajra	2333
2	Composite-7	2306
3	Barani Bajra	2250
4	Composite-1	2083
5	Composite-4	1972
6	Composite-4	1583
7	Composite-5	1556
8	Composite-3	1528
9	Composite-6	1500
10	MS-1	1472



CV%=12

LSD at 5%=245

Cholistani Bajra gave maximum grain yield of 2333 kg/ha followed by Composite-1 with 2306 kg/ha.

4.6 AGRONOMY SECTION

1. YIELD POTENTIAL CUM VARIETAL TRIAL ON MUNG BEAN

The experiment was conducted to evaluate the yield performance of various mung strains/varieties, under the agro-ecological conditions of Bahawalpur. The trial was laid out in RCBD with three replication having a plot size of 1.8 x 6m. Results are given in the following table.

Table No.1 Grain yield kg/ha

Varieties/Strains	Grains Kg/ha	Yield	Maturity Days
V1=BRM-310	1256c		68
V2=BRM-311	1404a		63
V3=BRM-325	1322bc		66
V4=BRM-331	1350ab		62
V5=BRM-334	1341 b		66
V6=BRM-335	1288bc		67
V7=CHM-06	1386ab		68
V8=Mung-11	1401a		62



Fig: BRM-311

LSD [at 0.05=67.13](#)

It is revealed that BRM-311 produced the maximum grain yield as 1404 kg/ha and reached to physiological maturity in 63 days, however it was statistically at par to Mung-11 as 1401 Kg/ha followed by Chakwal Mung as 1386 and BRM-331 as 1350 Kg/ha with 68 and 62 maturity days respectively.

2. EFFECT OF TOPPING ON YIELD PERFORMANCE OF DIFFERENT COTTON VARIETIES

The trial was conducted to know the effect of topping on the performance of different cotton varieties. It was laid out in split plot arrangements with three replications and a plot size of 3 x 8m. Fertilizer was applied @ 175-90-60 NPK kg/ha and sown on 30.06.2014 after wheat. It comprises of the following treatments.

(A) Varieties

V1 =MNH-986



V2 =BH-178

(B) Topping/Spray

T1 = No topping (control)

T2 =Topping at four feet height

T3 =Topping at five feet height

T4 = M. Chloride (pix) 2 sprays at 4 and 5 feet height.

Seed cotton yield data are presented in the following table.

Grain yield kg/ha

Table No.2

Varieties	T1	T2	T3	T4	Mean
V1 (178)	2670	2960	3355	3405	3098 N.S.
V2 (986)	2510	2920	3341	3392	3041 N.S.
Mean	2590c	2940b	3348a	3399a	

LSD for varieties= 261.74

LSD for treatment= 236.53

Seed cotton yield data given in table-2, showing that the maximum yield was given by V1 (BH-178) as 3405 kg/ha when M. Chloride was sprayed twice (T4) however it was statistically at par to T3 where topping was done at 5 feet height.

3. SOWING DATE CUM VARIETAL TRIAL ON Bt. COTTON

The trial was laid out in split plot arrangement to find the most suitable sowing times for Bt. Cotton under the climatic condition of Bahawalpur region. It comprised of 9 promising Bt. Cotton strains/varieties, tested against four sowing dates started from 5th of March with 15 days interval. Seed cotton yield data is presented in the following table.

Seed cotton yield kg/ha

Table No.3

Varieties/Strains	D1 5 March	D2 20 March	D3 5 April	D4 20 April	Mean
SG-1	3073	2619	2624	2747	2766 abc
IUB-252	3322	2642	2716	2907	2897ab
FH-142	2753	2420	2688	2648	2628bc
BH-178	2627	2770	2764	3295	2864ab
BH-184	2558	2693	2588	2704	2637bc
IUB-222	2295	2546	2635	2687	2541c
MNH-886	2687	2631	2730	3044	2773abc
MNH-986	3267	2725	2672	2934	2900ab
IUB-2013	3072	2755	2920	3184	2983a
Means	2851 ab	2645 b	2705 b	2908 a	
BCR	1: 1.84	1: 1.87	1: 1.94	1: 2.15	

LSD for sowing date =201.76 LSD for varieties =272.35

It was evaluated that the most suitable time was the 20th of April, however it was statistically at par to 5th of March but 5th of March was not profitable with lesser benefit cost ratio (BCR) as 1: 1.84 (due to additional cost on irrigations, pesticide sprays and labour charges) while it was maximum with 20th of April as 1: 2.15. Therefore for obtaining maximum benefit from Bt. Cotton the suitable sowing time is 20th of April in this region.

4. **SOWING DATE CUM VARIETAL TRIAL ON RAYA**

The study was conducted to evaluate most suitable planting time for maximum grain yield production from locally developed raya strains/varieties under Bahawalpur conditions. The experiment was laid out in split plot arrangements with three replications having a plot size of 1.8x7m. Treatments and grain yield data are given in following table.

Table No.4 Grain yield kg/ha

Strain/varieties	SD-1 1st Oct.	SD2 15 th Oct.	SD3 1st Nov.	SD4 15 th Nov.	Means
BRJ-1043	2044	1803	1180	745	1443b
BRJ-7052	2007	1720	1460	772	1490b
BRJ-7255	1831	1989	1435	717	1493b
BRJ-7257	2016	2045	1022	597	1420b
BWP Raya	2295	2278	1598	902	1769a
Khanpur Raya	2138	2110	1394	791	1609a
Means	2056a	1991a	1349b	754c	

LSD for strains/varieties=173.7
LSD for interaction=231.62

LSD for sowing dates (SD)=187.35

Grain yield data presented in above table-4, revealed that the most suitable time for sowing raya strains/varieties was 1st to 15th of October. Late sowing (15 November) reduces grain yield significantly. As for as strains/varieties are concerned, Bahawalpur raya gave better performance as 2295 kg/ha on 1st October & 2278 kg/ha on 15th of October.

5. **ADOPTION OF NEWLY DEVELOPED WHEAT STRAINS/VARIETIES TO CLIMATIC VARIATIONS UNDER BAHAWALPUR CONDITIONS**

The experiment was conducted in order to find out the optimum planting time and yield response of various newly developed wheat strains/varieties to climatic variations i.e. temperature, rainfall humidity etc., under Bahawalpur conditions. The trial was laid out in split plot arrangement with three replications and a plot size of 1.2x6m. Wheat grain yield and experimental treatments are presented in table No.5.



Wheat grain yield kg/ha

Table No.5

Varieties/Strains	D1 1st Nov.	D2 15 th Nov.	D3 1st Dec.	D4 15 th Dec.	D5 1st Jan.	D6 15 th Jan.	Mean
V1=099114	4167	4628	3867	3779	2759	2448	3610 b
V2=099172	3318	4444	3932	4001	2546	2351	3438 bc
V3=099346	3380	4495	4025	3788	2500	1766	3326 c
V4=099384	5298	4179	3961	3935	2546	1442	3560 b
V5=Punjab-11	3948	4150	3919	3686	2592	1396	3282 c
V6=Fareed-06	3341	3993	4021	3786	2931	1892	3327 c
V7=Aas-11	4465	5070	4127	4087	2639	2135	3754 a
Means	3997 b	4423 a	3919 b	3866 b	2646 c	1915 d	

LSD for sowing dates at 0.5 =217.36

LSD for varieties at 0.5 =122.77

LSD for interaction D x V =231.52

Wheat grain yield data presented in table No. 5 revealed that the suitable planting time for all the strains/varieties was the 15th of November under Bahawalpur conditions. Late sown reduced grain yield significantly. As for as varieties are concerned Aas-11 produced the maximum while remaining all have gone to “B and C” category. As for as the climate is concerned the rise of temperature in 1st week of March affected badly on grain yield of early sown crop, however late sown performed well due to continuity of average temperature at the time of seed setting (1st week of April). Rainfall also gave bad effect on early sown wheat crop due to lodging, while late sown crop performed well.

**ADOPTION OF NEWLY DEVELOPED WHEAT STRAINS/VARIETIES TO
CLIMATIC VARIATIONS UNDER BAHAWALPUR CONDITIONS (2014-15)**

(Phenological Data)

DOS/Year	Days to Booting	Days to Heading	Days to Fertilization	Days to Dough	Days to Phy. Maturity	Sun Shine Hours
01.11.2014						
099114	78	85	96	124	147	1176
099172	79	85	92	127	150	1200
099346	70	84	88	122	149	1192
099384	81	89	96	127	154	1232
Punjab-11	69	83	91	123	151	1208
Fareed-06	61	68	87	110	140	1120
Aas-11	77	84	92	121	151	1208
15.11.2014						
099114	88	97	104	127	139	1112
099172	86	93	100	124	140	1120
099346	84	93	101	124	142	1136
099384	93	98	107	129	144	1152
Punjab-11	83	92	104	127	142	1136
Fareed-06	76	88	97	122	138	1104
Aas-11	85	94	102	127	140	1120
01.12.2014						
099114	89	94	100	120	130	1040
099172	89	95	102	122	132	1056
099346	87	97	103	123	132	1056
099384	90	99	106	128	133	1064
Punjab-11	86	94	100	120	130	1040
Fareed-06	81	90	96	116	126	1008
Aas-11	86	95	100	120	130	1040
15.12.2014						
099114	77	86	92	117	121	968
099172	76	82	89	116	121	968
099346	79	88	94	117	121	968
099384	83	90	98	119	123	984
Punjab-11	82	89	95	118	123	984
Fareed-06	75	81	89	115	120	960
Aas-11	81	87	94	118	123	984
01.01.2015						
099114	72	77	83	104	113	904
099172	71	74	80	101	112	896
099346	72	76	82	102	112	896
099384	75	79	84	104	113	904
Punjab-11	73	78	82	102	112	896
Fareed-06	71	74	80	101	112	896
Aas-11	73	78	84	104	113	904
15.01.2015						
099114	61	66	73	94	103	824
099172	60	64	71	92	101	808
099346	59	64	71	92	101	808
099384	63	68	75	95	104	832
Punjab-11	62	68	75	95	104	832
Fareed-06	58	63	71	91	101	808
Aas-11	62	66	73	93	103	824

6. STUDIES ON PHOSPHORUS APPLICATION METHODS AND OPTIMAL DOSE IN WHEAT CROP

This study was taken out to evaluate the most suitable method and optimum dose of phosphorus fertilizer application to wheat crop under Bahawalpur conditions. The trial was laid out in split plot arrangement with three replications and a plot size of 1.8x7m. The experimental treatments and wheat grain yield data is presented as below:-

(A) Application methods	(B) Fertilizer doses
M1= Line sowing with band application	F1=150-00-60
M2=Broadcast of P and line sowing	F2=150-30-60
M3=Line sowing and P broadcast at 1st irrigation	F3=150-60-60
	F4=150-90-60
	F5=150-120-60

Wheat grain yield data are given in table No.6.

Wheat Grain Yield kg/ha

Table No.6

Methods	F1	F2	F3	F4	F5	Mean
M1 (Band)	3927	4403	4998	5236	5355	4784 A
M2 (B.C)	3499	4046	4522	4641	5117	4365 B
M3 (1st Irri.)	3331	3451	4046	4165	4403	3879 C
Mean	3586 D	3967 C	4522 B	4681 B	4959 A	

LSD for methods =361.84

LSD for fertilizer =247.36

LSD for M x F =392.70

It is clear from the grain yield data given above (Table-6) that the methods of P. application have a significant effect on wheat grain yield, band application (M1) produced the maximum grain yield as 4784 Kg/ha followed by 4365 Kg/ha in broadcast of P and line sowing (M2) while M3 produced the minimum. As for as the fertilizer is concerned F5 (150-120-60) gave the maximum grain yield as 4959 Kg/ha.

7. STUDIES ON PLANTING TECHNIQUES AND VARIETIES IN LATE SOWN WHEAT UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to evaluate the most suitable planting technique and suitable variety for late sown wheat crop under the agro-ecological conditions of Bahawalpur region. It was laid out in RCBD factorial with three replication having a plot size of 3 x 8m. Treatments are as under:-



(A) Planting Techniques (Methods)	(B) Wheat Varieties
T1= Broadcast	V1= Freed-06
T2= Line Sowing	V2= Aas-11
T3= Ridge Sowing	V3= 076346

Table No.7

Wheat Grain Yield kg/ha

Varieties	T1	T2	T3	Mean
V1 (Fareed)	3879	3643	4629	4051 B
V2 (Aas-11)	4158	4172	5227	4519 A
V3 (6346)	3920	4110	4115	4048 B
Mean	3986 B	3975 B	4657 A	
CBR	1:7.72	1:7.27	1:8.40	

LSD for varieties =271.62

LSD for Technique =287.12

LSD for V x T =326.23

Wheat grain yield data revealed that the most suitable technique was the ridge sowing(T3) with maximum yield as 4657 kg/ha and 1: 8.40 Cost benefit ratio (CBR). As for as the varieties are concerned, Aas-11 gave the maximum production as compare to other two varieties.

8. RELAY VS CONVENTIONAL SOWING OF WHEAT UNDER BAHAWALPUR CONDITIONS.

The trials was conducted for the purpose of demonstration and evaluation of relay cropping of wheat in standing cotton , comparison with the conventional sowing with broadcast of seed after the harvest of cotton crop.

Sowing Time =Ist fortnight of November for relay crop
=2nd fortnight of December for conventional

Wheat Variety =076346
Area of Trial =2000m²
Fertilizer =150-115-60 NPK, Kg/ha

Wheat Grain Yield kg/ha

Relay	Conventional	% Increase/Decrease
5037	4982	+0.11
CBR 1:31.6	CBR 1:4.9	

It is clear from the above table that relay crop of wheat in standing cotton crop proved suitable with maximum cost benefit ratio (CBR) as 1: 31.6 as compare to 1: 4.9 in conventional sowing after the harvest of cotton crop.

5. CHEMMISTRY/SOIL SCIENCE DIVISION

1. SCREENING OF WHEAT STRAINS AGAINST SALINITY (HYDROPONIC STUDY)

This experiment was done in solution culture to select the resistant wheat strains against salinity. In this study eighteen wheat strains were sown in sand culture and seedlings were transplanted in four water tubs having different salinity level (Fit water, 5 EC (dSm^{-1}) water, 10 EC (dSm^{-1}) water and 15 EC (dSm^{-1}) water. Salinity levels were developed by using NaCl salt. Each treatment has three repeats of strains. pH of solutions was maintained at 6.0-6.5 on daily basis. Seedling was harvested after 30 days of salinity stress. Data of growth parameters (plant shoot & root length, plant shoot & root weight, root shoot ratio). Results revealed that five strains (0882000, 099346, 099172, 076346 and 133065) performed best in physical parameters (Plant height, Root length, Fresh shoot weight, fresh root weight and number of tillers/plant) as compared to others under high salinity (EC 10 and EC 15). These strains are selected for next pot experiments. The data of physical parameters is given below:



Table # 1: Effect of salinity levels on shoot length (cm) of wheat strains.

S. No.	Varieties/Strains	T1 (Fit water)	T2 (EC =5 dSm^{-1})	T3 (EC =10 dSm^{-1})	T4 (EC =15 dSm^{-1})
1	Fareed -06	61.67	59.67	58.00	44.00
2	12B-2095	55.67	54.67	54.67	45.33
3	11B-2809	61.67	59.33	53.33	45.00

4	132526	58.00	56.67	55.00	44.67
5	132017	63.00	61.33	60.00	46.33
6	0882000	62.67	61.00	51.33	49.83
7	Aas-11	67.33	64.67	60.00	47.00
8	099346	62.00	61.00	57.00	49.00
9	133070	63.33	59.67	56.33	44.33
10	133065	68.67	64.00	60.33	49.67
11	109384	60.67	59.33	54.67	47.00
12	12B-2503	53.67	47.33	43.33	37.00
13	099172	67.00	62.00	60.33	50.67
14	122601	57.67	56.33	53.00	49.00
15	13B-30010	53.00	48.00	44.00	40.67
16	076346	63.67	58.67	51.40	48.67
17	13B-5013	60.00	59.33	57.67	39.33
18	076422	53.67	51.67	41.67	36.33

Table # 2: Effect of salinity levels on root length (cm) of wheat strains.

S. No.	Varieties/Strains	T1 (Fit water)	T2 (EC =5 dSm ⁻¹)	T3 (EC =10 dSm ⁻¹)	T4 (EC =15 dSm ⁻¹)
1	Fareed -06	35.00	34.00	30.67	23.67
2	12B-2095	58.67	40.67	39.33	33.33
3	11B-2809	55.00	38.33	32.33	23.00
4	132526	49.00	41.00	38.33	35.33
5	132017	61.00	50.33	36.67	30.33
6	0882000	45.67	36.33	35.67	30.67
7	Aas-11	55.00	41.33	35.33	25.00
8	099346	57.00	37.33	34.33	32.33
9	133070	55.33	39.33	36.00	30.67
10	133065	45.00	35.67	30.00	25.33
11	109384	55.67	35.33	30.00	26.00
12	12B-2503	53.67	36.33	34.00	30.67
13	099172	68.33	42.33	38.00	33.33
14	122601	45.33	35.00	33.00	29.67
15	13B-30010	49.67	34.33	31.00	28.00
16	076346	47.33	39.67	33.33	30.33
17	13B-5013	47.67	38.00	34.67	31.67
18	076422	57.33	38.33	28.33	26.67

Table # 3: Effect of salinity levels on shoot fresh weight (g) of wheat strains.

S. No.	Varieties/Strains	T1 (Fit water)	T2 (EC =5 dSm ⁻¹)	T3 (EC =10 dSm ⁻¹)	T4 (EC =15 dSm ⁻¹)
1	Fareed -06	28.38	21.04	19.24	16.72
2	12B-2095	38.94	34.21	27.60	15.08
3	11B-2809	41.85	36.70	31.63	20.87
4	132526	44.13	33.75	31.44	20.59
5	132017	45.10	39.54	33.29	18.72
6	0882000	45.21	34.50	32.83	25.57
7	Aas-11	39.78	28.01	22.69	15.28
8	099346	34.13	32.09	26.39	21.53
9	133070	34.41	24.94	20.29	18.07
10	133065	35.85	24.67	22.07	18.74

11	109384	37.34	31.69	27.12	22.04
12	12B-2503	32.64	25.36	19.43	14.49
13	099172	47.34	35.93	34.08	25.34
14	122601	28.13	15.39	14.63	10.09
15	13B-30010	23.78	16.58	15.97	14.56
16	076346	41.34	32.22	28.36	21.41
17	13B-5013	44.05	42.03	30.47	19.84
18	076422	33.67	32.47	30.47	16.79

Table # 4: Effect of salinity levels on root fresh weight (g) of wheat strains.

S. No.	Varieties/Strains	T1 (Fit water)	T2 (EC =5 dSm ⁻¹)	T3 (EC =10 dSm ⁻¹)	T4 (EC =15 dSm ⁻¹)
1	Fareed -06	10.39	9.51	8.81	8.03
2	12B-2095	16.18	15.87	14.17	8.69
3	11B-2809	22.40	17.73	13.57	11.21
4	132526	21.07	15.99	15.29	11.63
5	132017	22.89	21.39	12.25	10.08
6	0882000	16.85	14.08	11.70	11.27
7	Aas-11	15.53	12.31	10.07	9.31
8	099346	13.35	9.73	9.25	8.74
9	133070	16.47	10.73	8.67	8.38
10	133065	10.65	9.81	9.45	7.57
11	109384	17.43	14.32	12.00	10.59
12	12B-2503	13.45	12.29	10.15	7.70
13	099172	19.91	15.09	14.38	10.68
14	122601	11.20	10.31	9.92	7.98
15	13B-30010	14.03	10.14	9.62	8.54
16	076346	20.69	13.92	9.80	8.64
17	13B-5013	22.61	15.12	13.03	9.77
18	076422	18.73	17.53	15.00	10.77

Table # 5: Effect of salinity levels on number of tillers per plant of wheat strains.

S. No.	Varieties/Strains	T1 (Fit water)	T2 (EC =5 dSm ⁻¹)	T3 (EC =10 dSm ⁻¹)	T4 (EC =15 dSm ⁻¹)
1	Fareed -06	5	4	4	2
2	12B-2095	5	4	4	2
3	11B-2809	5	5	4	4
4	132526	5	5	5	4
5	132017	5	5	4	3
6	0882000	5	5	4	4
7	Aas-11	4	4	4	2
8	099346	4	4	4	3
9	133070	4	3	3	2
10	133065	4	4	3	2
11	109384	5	5	5	4
12	12B-2503	4	4	3	3
13	099172	6	5	5	4
14	122601	4	4	3	3
15	13B-30010	5	5	4	3

16	076346	5	5	4	3
17	13B-5013	5	5	4	4
18	076422	5	5	4	3

2. FERTILIZER REQUIREMENTS OF PROMISING WHEAT STRAIN 076346 UNDER BAHAWALPUR CONDITIONS

This study was done to determine most suitable NPK dose for new wheat cultivar 076346. The trial was sown with eleven treatments and three replications. All P, K & 1/2N, was applied at seedling stage whereas the remaining 1/2 N was applied at 1st irrigation. Yield parameters and yield data was recorded.. The results of experiment are tabulated below (Table # 6 and Fig. # 2).

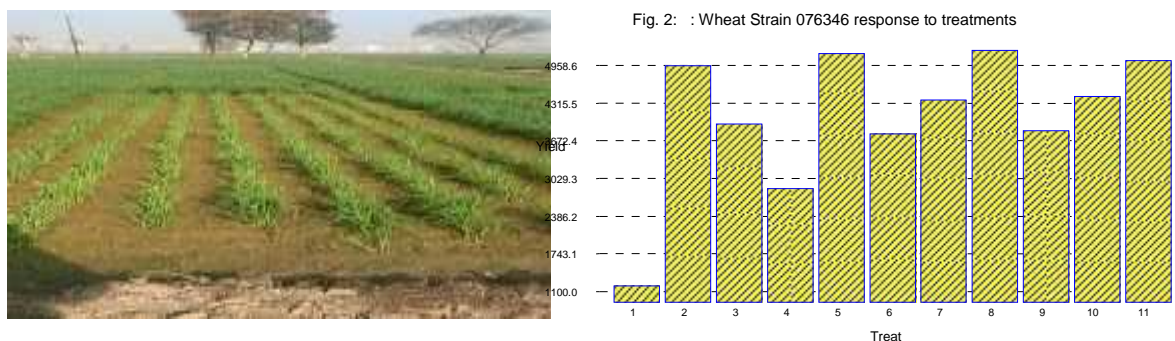


Table # 6: Effect of different fertilizer levels on yield and yield parameters of wheat strain 076346.

Tr. No	Nutrients (Kg/ha)			Plant Height (cm)	No. of tillers/m ²	1000 grain Weight (g)	Yield (kg/ha)
	N	P ₂ O ₅	K ₂ O				
1	0	0	0	71.33	110	29.24	1198.52
2	150	120	60	98.93	320	45.76	4954.33
3	75	120	60	92.80	263	38.67	3959.67
4	0	120	60	78.67	205	32.00	2857.00
5	225	120	60	100.00	337	47.67	5160.72
6	150	0	60	82.13	242	32.67	3786.54
7	150	60	60	88.13	267	41.92	4368.40
8	150	180	60	99.53	340	48.67	5210.00
9	150	120	0	87.53	230	38.16	4139.00
10	150	120	30	93.13	287	41.28	4427.33
11	150	120	90	102.00	333	46.52	4987.62
LSD				10.3	37.2	7.5	616

According to results the strain highly responded to nutrient doses. Minimum yield was noted in control in which no nutrient was added. The maximum tillers (340), 1000 grain weight (48.67 g) and yield (5210 kg ha⁻¹) was found in T₈ which is statistically at par with T₂, T₅ & T₁₁. Results indicated that T₂ (150-120-60) is the best economical dose for this wheat strain as no other treatment have significant increase in yield as compared to T₂.

3. RESPONSE CURVE STUDIES FOR PROMISING WHEAT STRAIN 076422 UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to investigate the optimum dose of N, P and K for promising wheat strain 076422 developed at the institute under Bahawalpur conditions. Promising wheat strain 076422 was subjected to eleven treatments in RCBD with four replications. All P&K along with half N was applied at sowing while remaining half N with first irrigation. Plant growth, yield parameters and yield data was recorded and represented in table # 7.

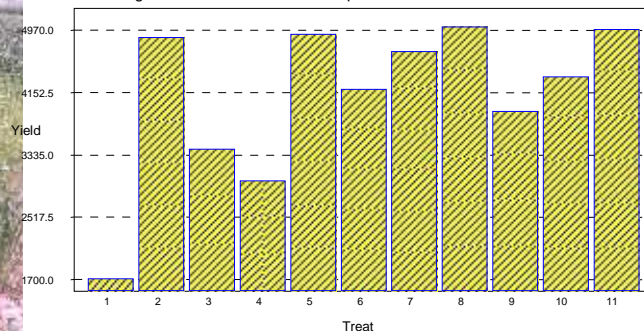
Table # 7: Effect of different fertilizer levels on yield and yield parameters of wheat strain 076422

Tr. No	Nutrients (Kg/ha)			Tiller	1000 Grain 1000 weight (g)	Plant height (cm)	Yield kg/ha
	N	P ₂ O ₅	K ₂ O				
1	0	0	0	110	37.18	62.07	1710
2	150	120	60	315	47.19	91.27	4877
3	75	120	60	220	42.12	85.0	3410
4	0	120	60	193	39.19	78.20	2997
5	225	120	60	317	48.98	92.27	4919
6	150	0	60	292	42.49	77.67	4531
7	150	60	60	320	45.22	84.60	4950
8	150	180	60	330	49.77	90.47	5110
9	150	120	0	252	42.30	82.87	3906
10	150	120	30	281	44.82	88.27	4361
11	150	120	90	340	47.88	91.07	5275
LSD				26	4.5	4.8	817

The results of experiment revealed that maximum 1000 grain weight (49.77 g) was in T₈, plant height (91.27) was in T₂, tillers (340) and yield 5275 kg ha⁻¹ was found in T₁₁. The statistical analysis showed that four treatments T₂, T₅, T₈ & T₁₁ are at par with each other. Results indicated that T₂ (150-120-60) is the best economical dose. LSD value for yield data was 817 and using LSD interval graphical representation of data is given in following Fig.3.



Fig. 3: Wheat Strain 076422 response to treatments.



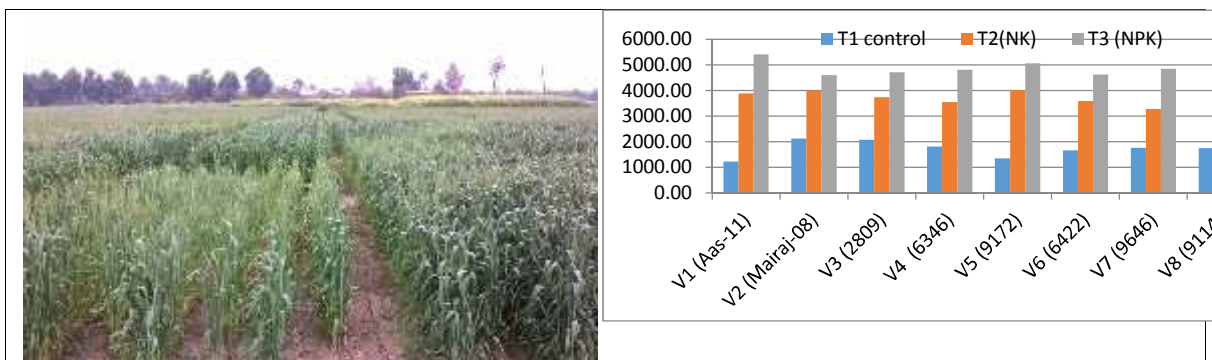
4. PHOSPHORUS EFFICIENCY OF NEW WHEAT STRAINS

The study was done to compare different strains under no P conditions and to select the phosphorus efficient strain developed at this institute. The trial was laid out in split plot design using 8 strains/varieties along with 3 treatments (control, NK and NPK recommended) with three replications. All P,K & 1/2N, were applied at seedling stage and the remaining 1/2 N was applied at 1st irrigation. Yield parameters and yield data was recorded. The results of experiment revealed that Mairaj-08 (3997 kg/ha), Aas 11 (3894 kg/ha) and 9172 (4011 kg/ha) performed best at no phosphorus treatment as compared with other strains/varieties. The tabulated results are represented in table # 8 and Fig 4.

Table # 8: Response of different wheat strains under different P levels.

Varieties/Strains		T1(control)	T2 (NK) Recommended	T3 (NPK) Recommended
V1	Aas-11	1233	3894	6416
V2	Mairaj 08	2129	3997	4608
V3	2809	2081	3744	4712
V4	6346	1821	3560	4816
V5	9172	1351	4011	5069
V6	6422	1672	3590	4631
V7	9646	1763	3276	4850
V8	9114	1755	3551	4713

Fig. 4: Wheat strains/varieties response to P doses.



5. RESPONSE OF WHEAT TO SPLIT APPLICATION OF POTASH UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to study the response of split application of potash to wheat. The trial was laid out in RCBD using five treatments and three replications. All P & 1/2 N, were applied at seedling stage and the remaining 1/2 N was applied at 1st irrigation. Potash was applied at different growth stages according to sowing plan. The results of experiment revealed that maximum plant height (94.27 cm), No. of tillers/m² (301) 1000 grain weight (51.50) and yield (4754 kg/ha) was obtained in T3 (1/2 K at sowing +1/2 K at 1st irrigation) that is at par with T2 (full K at sowing) and T4 (1/2 K at sowing +1/2 K at booting). According to results T3 is best pattern of K application. Data regarding treatment X yield interaction was represented in following Table 9 and Fig.5 having LSD interval 222 on Y-axis.

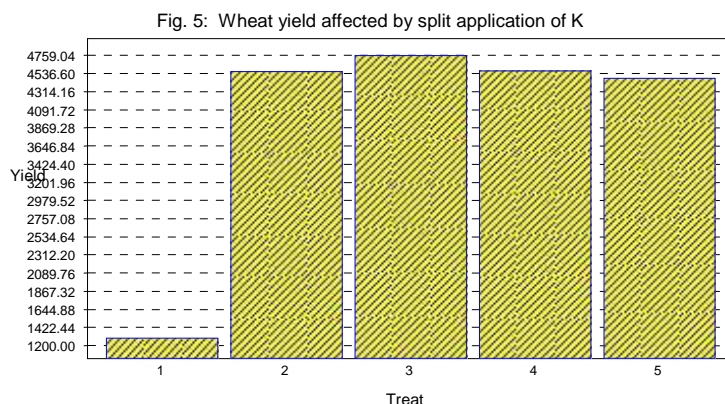
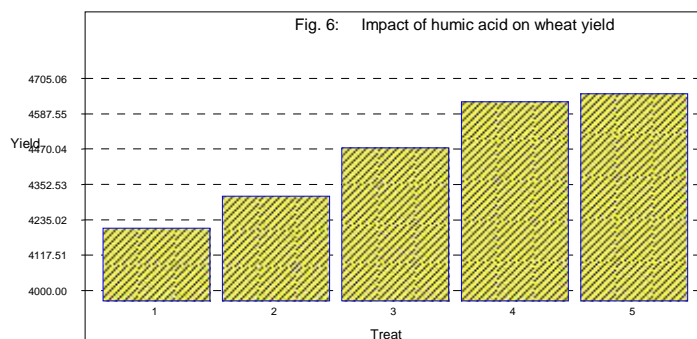


Table # 9 : Effect of split application of K on yield and yield parameters of wheat.

Treatments	Plant height (cm)	No. of Tillers/m ²	1000 grain weight (g)	YIELD (kg/ha)
control	78.53	261	28.50	1293.33
Full K at sowing	93.93	284	47.90	4558.33
<i>1/2 at sowing+1/2 at 1st irri</i>	94.27	301	51.50	4754.00
1/2 at sowing+1/2 at booting	93.67	295	47.00	4564.33
1/3 at sowing+ 1/3 at 1st irri + 1/3 at booting	91.13	281	45.50	4481.33
LSD	8.02	29	6.75	222

6. IMPACT OF HUMIC ACID ON GROWTH AND YIELD OF WHEAT

This experiment was laid out to select the best dose of humic acid for wheat under Bahawalpur condition and its effect on yield and yield components of wheat crop. In this study five humic acid doses were applied along with recommended NPK in RCBD layout with three replications. All P, K& humic acid along with half N was applied at sowing while remaining half N with first irrigation. Plant growth, yield parameters and yield data was recorded. According to results of experiment maximum plant height (102.67 cm), number of tillers (313), 1000 grain weight (49.23 g) and yield (4653.33 kg/ha) was obtained from T5 (16 kg/ha) that is at par with T4 (12 kg/ha). According to results the best dose of humic acid for wheat is 12 kg/ha under Bahawalpur condition. The results represented below in Fig.6 and table # 10.

**Table # 10 : Effect of humic acid on yield and yield parameters of wheat.**

Treatments	Plant Height (cm)	Number of Tillers/m ²	1000 grain weight(g)	YIELD (kg/ha)
NPK	86.73	258	44.00	4206.67
NPK+ HA (4 kg/ha)	91.67	279	46.30	4313.33
NPK+ HA (8kg/ha)	93.87	309	46.77	4473.33
NPK+ HA (12 kg/ha)	100.53	310	48.43	4626.67
NPK+ HA (16kg/ha)	102.67	313	49.23	4653.33
LSD	14.66	33.7	4.9	117.5

7. RESPONSE CURVE STUDIES FOR NEW PROMISING RAYA STRAINS BRJ-7052 AND BRJ-7057 UNDER BAHAWALPUR CONDITIONS

This study was done to develop a response curve of NP & K for promising Raya strain BRJ-7052 and 7057 under Bahawalpur conditions. The newly evolved promising Raya strain BRJ-7052 and 7057 were subjected to eleven treatments in RCBD with three replications. All NP&K was applied at sowing. Yield data was recorded at maturity that is represented in table# 11 and Fig 7)

Table # 11 : Effect of fertilizer doses on yield of Raya strains.

Tr. No	Nutrients (Kg/ha)			Yield kg/ha	
	N	P2 O5	K2O	BRJ-7052	BRJ-7057
1	0	0	0	606	701
2	0	60	60	1817	2040
3	60	60	60	2199	2295
4	90	60	60	2295	2455
5	120	60	60	2327	2550
6	90	0	60	1721	1785
7	90	30	60	2104	2136
8	90	90	60	2295	2460
9	90	60	0	1944	1929
10	90	60	30	2168	2231
11	90	60	90	2359	2557

The results of experiment showed that maximum yield of both strains BRJ 7052 and BRJ 7057 was 2359 kg/ha and 2557 kg/ha respectively that were found in T₁₁. The statistically analysis showed that for both strains T₄, T₅, T₂, & T₈ were at par with each other. So T₄ (90-60-30) is the best economical dose.

8. FERTILIZER REQUIREMENTS OF PROMISING MUNG STRAIN BRM-334 UNDER BAHAWALPUR CONDITIONS

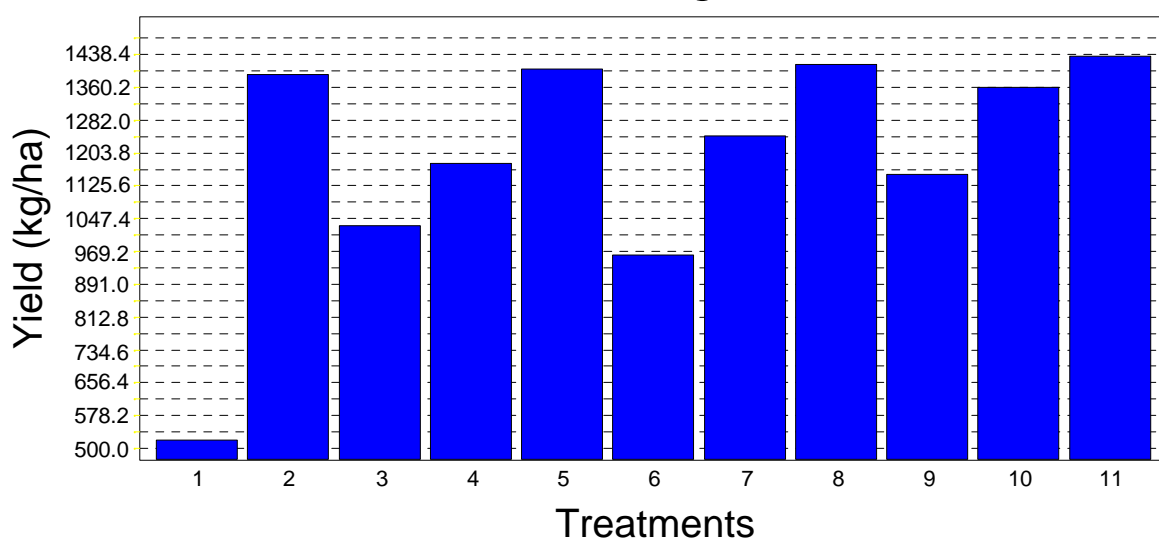
This experiment was designed to find out the most suitable fertilizer dose for new mung cultivar BRM-334 under Bahawalpur conditions. In this experiment RCBD layout was followed with three replication and eleven different nutrient combinations. According to treatments all N, P & K was applied at sowing, Cultural practices and plant protection measures were adopted as per recommendation for all the plots. Yield data was recorded and tabulated as following (Table-12) to observe the response of different treatments on mung strain.

Table 12:-Effect of different nutrient combinations on yield

Treatment	Nutrients (Kg/ha)			Yield (Kg/ha)
	N	P ₂ O ₅	K ₂ O	
T ₁	0	0	0	520 h
T ₂	23	34	25	1390 a
T ₃	0	34	25	1030 f
T ₄	12	34	25	1180 d
T ₅	36	34	25	1405 a
T ₆	23	0	25	960 g
T ₇	23	23	25	1245 c
T ₈	23	46	25	1415 a
T ₉	23	34	0	1220 e
T ₁₀	23	34	12	1360 b
T ₁₁	23	34	36	1435 a
	LSD			65

The data related to grain yield was collected from each treatment and tabulated on basis of average of three replications. The results revealed that mung strain showed significant yield variation among different treatments. The minimum yield was observed in control (520 kg/ha) that indicated the sever deficiency of essential nutrients in soil. The maximum yield 1435 kg/ha was obtained from T₁₁ (23-34-36) in which maximum K was applied but it was at par with T₂ (23-34-25) that is recommended dose for mung crop in this region. Similarly response of maximum rate of P₂O₅ and N were also at par with recommended doses for these nutrients. So T₂, T₅, T₈ & T₁₁ are statistically at par with each other and hence T₂ (23-34 -25) is the best economical dose for this mung cultivar.

Means of Mung 334



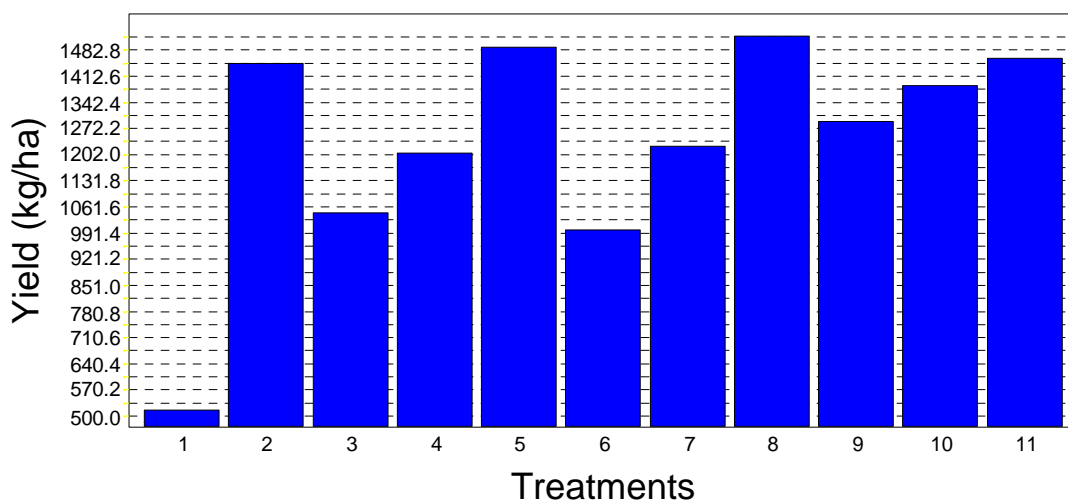
9. IMPACT OF FERTILIZER DOSES ON PROMISING MUNG STRAIN BRM-311 UNDER BAHAWALPUR CONDITIONS

In this trial new mung strain BRM-311 was sown to find out the impact of fertilizer doses under Bahawalpur conditions. Experiment has three replications in RCBD layout and eleven different nutrient combinations. All N, P & K was applied at sowing according to treatments, Cultural practices and plant protection measures were adopted as per recommendation for all the plots. Yield data was recorded and tabulated as Table # 13.

Table# 13:-Impact of different nutrient combinations on yield.

Treatment	Nutrients (Kg/ha)			Yield (Kg/ha)
	N	P ₂ O ₅	K ₂ O	
T ₁	0	0	0	550
T ₂	23	34	25	1460
T ₃	0	34	25	1020
T ₄	12	34	25	1185
T ₅	36	34	25	1490
T ₆	23	0	25	950
T ₇	23	23	25	1210
T ₈	23	46	25	1520
T ₉	23	34	0	1290
T ₁₀	23	34	12	1415
T ₁₁	23	34	36	1470
	LSD			68

Means of Mung 311



The grain yield was collected from each treatment from three replication and was tabulated as average of three replications. The results revealed that mung strain showed significant yield variation among different treatments. The minimum yield was observed in control (550 kg/ha) due to the severe deficiency of essential nutrients in soil. The maximum yield 1520 kg/ha was obtained from T₈ (23-46-25) in which maximum P₂O₅ was applied but it was at par with T₂ (23-34-25) that is recommended dose for mung crop

in this region. Similarly maximum rate of N and K were also at par with recommended doses for these nutrients. So T₂, T₅, T₈ & T₁₁ are statistically at par with each other and so T₂ (23-34 -25) is the best economical dose for this mung cultivar.

10. FERTILIZER REQUIREMENT OF NEW MILLET STRAIN RARI COMPOSIT-7 UNDER BAHAWALPUR CONDITIONS

This experiment was conducted to find out the most suitable dose of NPK for promising strains of millet (RARI-COMPOSITE-7) developed at RARI, Bahawalpur. In this study eleven NPK combinations were used following RCBD lay out with four replications. All P & K was applied at the time of sowing. While 1/3 N was applied at sowing, 1/3 N at first irrigation and 1/3 N at second irrigation. Yield data was recorded from each plot. Results of this experiment are tabulated as under (table 14) .

Table # 14 :Fertilizer effect on yield of millet strain (RARI Composit-7)

Treatments	Nutrients and Yield (kg/ha)				
	N	P ₂ O ₅	K ₂ O	2013	2014
T1	0	0	0	680	640
T2	150	90	60	1477	1580
T3	0	90	60	1003	1104
T4	100	90	60	921	1360
T5	200	90	60	1483	1600
T6	150	0	60	1040	1090
T7	150	60	60	1173	1370
T8	150	120	60	1467	1595
T9	150	90	0	1040	1250
T10	150	90	30	1127	1385
T11	150	90	90	1473	1590
LSD				59	66

The results of experiment showed that this strain highly responded to nutrients and have significance variation in different treatments. The maximum yield (1483 and 1600 kg ha⁻¹) was found in T₅ during 2013 and 2014 which is statistically at par with T₂, T₈ & T₁₁. Results indicated that application of higher doses of NPK as compared to recommended dose increased yield but non significantly and therefore recommended dose T₂ (150-90-60) is the best economical dose.

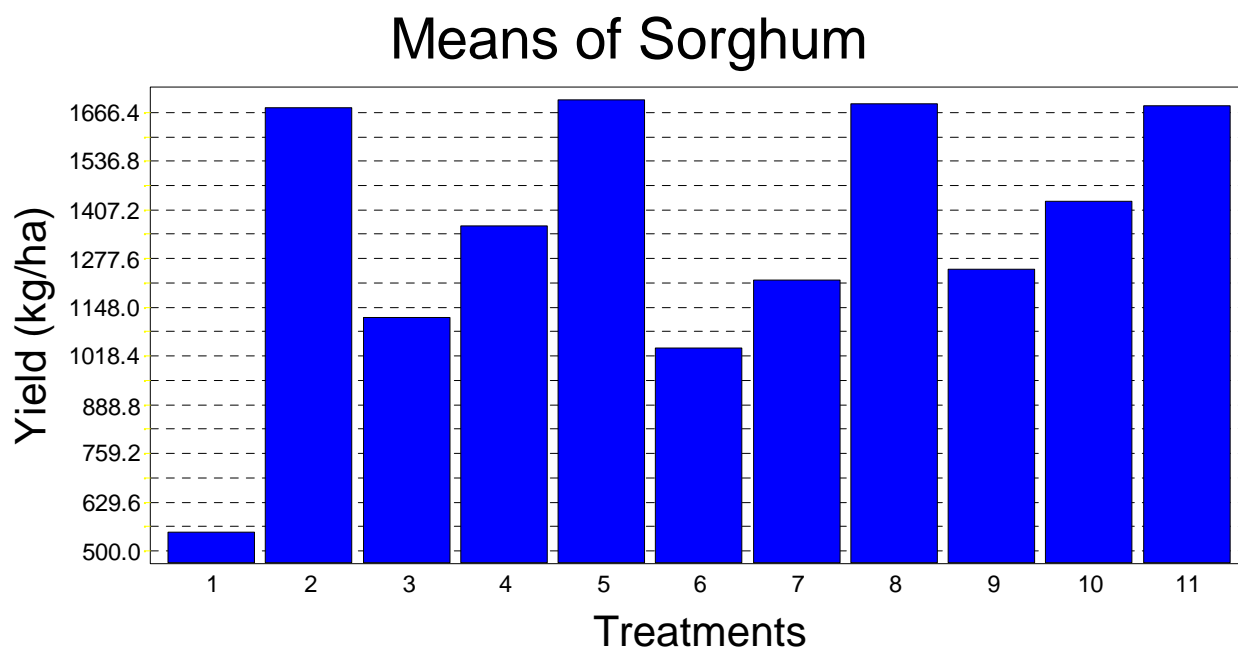
11. RESPONSE CURVE STUDIES FOR NEW SORGHUM RARI-S 5 UNDER BAHAWALPUR CONDITIONS

The objective of this experiment was to study the response of new sorghum strain RARI-S5 to different NPK combinations. In this study four levels of N & P and three

levels of K were used in eleven treatments. RCBD lay out was followed with four replication. All P & K was applied at the time of sowing. While 1/3 N was applied at sowing, 1/3 N at first irrigation and 1/3 N at second irrigation. Yield and yield components was recorded for each plot. Results of this experiment are tabulated as under in table # 15.

Table # 15 :Fertilizer effect on yield of sorghum strain RARI-S5

Treatments	Nutrients (Kg/ha)			Yield (Kg/ha)	
	N	P ₂ O ₅	K ₂ O	2013	2014
T1	0	0	0	580	550
T2	150	90	60	1593	1680
T3	0	90	60	1090	1120
T4	100	90	60	942	1363
T5	200	90	60	1603	1700
T6	150	0	60	1065	1040
T7	150	60	60	1140	1220
T8	150	120	60	1602	1690
T9	150	90	0	947	1250
T10	150	90	30	1263	1430
T11	150	90	90	1600	1685
LSD				58	65



The results of this study showed that maximum yield (1603 and 1700 kg ha⁻¹) was found in T₅ during 2013 and 2014 which is statistically at par with T₂ T₈, & T₁₁. All treatments had significant increased in yield as compared to control that had minimum yield (580 and 550 kg ha⁻¹). The results revealed that strain yield was increased as the availability of essential nutrients increased in different treatments. The best economical dose for this cultivar is T2 (150-90=60 kg/ha)

6. PLANT PATHOLOGY SECTION

1. SCREENING OF WHEAT VARIETIES/LINES AGAINST LEAF RUST

Two hundred and five (205) wheat varieties/lines received from Economic Botany section, Regional Agricultural Research Institute Bahawalpur and previous years selected lines were sown in two row of 2m length with 30cm row to row spacing. As a spreader Morocco was sown along the border and one row of Sahar-06 was sown after each test entries to facilitate the inoculum. The experiment was sown on 22-10-2014. Test entries were inoculated by spraying fresh spore suspension of rust on leaves, injecting spore suspension into the tillers and planting between border rows the already rust infected plants collected from October sown seedling nursery of morocco and Sahar-06. Disease data were recorded by following the modified Cobb's scale on the appearance of disease.



Thirteen (13) varieties/lines were remained immune against leaf rust while thirty nine (39) were resistant; twenty three (23) were MR and remaining exhibited MS and S reaction.

S.#	Reaction	No. of Entries	Promising Lines
1	0	13	Pirsabak-4,WL-711,14B1040,14B1013,13B2809,13B3158,13B3149,13B3133,13B3101,13B3093,13B3091,13B3088,13B3087
2	R	39	076422,12B2503,12B2553,13B3034,13B3035,13B3036,13B3037,13B3038,13B3039,14B1005,14B1038
3	MR	23	Iqbal-00,Uqab-00,Manthar-03,088200,099110,12B2525,12B2601,12B2603,13B3050,13B3062,13B3064, 099172
4	MS	62	Pasban-90,Punjab-96,BWP-97,Bhakkar-02,Fareed-06,Punjab-11,AARI-11,NARC-11,076309,076346,12B2509,13B3055,13B3085,14B1008, 12B2559
5	S	68	Bluesilver,Inqlab-91,Derawar-97,Punjnad-1,Sahar-06,FSD-08,099114,11B2095,12B2519,12B2522,12B2541 13B3023,13B3026,14B1007,14B1014,14B1026,14B1041
Total		205	

2. SCREENING OF WHEAT VARIETIES/LINES AGAINST YELLOW RUST UNDER INOCULATED CONDITION

Two hundred and five (205) wheat varieties /lines received from Economic Botany section, Regional Agricultural Research Institute Bahawalpur and previous years selected varieties /lines were sown in single row of 2m length with 30cm row to row spacing. One row of morocco was sown after every two entries keeping one line vacant in between the spreader rows to facilitate the inoculation. The sowing was done on 03.12.2014.

Test entries were inoculated by spraying fresh spore suspension of yellow rust on leaves and injecting into tillers at the tillering stage of plant growth. The diseased plants were also transplanted between border rows to obtain rapid and continuous infection in the field. Disease data was recorded following Cobb's Scale on the appearance of disease.



BWP-97, BWP-00, Manthar-03, Fareed-06, Sahar-06, FSD-08, Punjab-11, AARI-11, Pirsabak-04 and Pirsabak-05 exhibited immune response against Yellow rust. Iqbal-00 showed resistant (R) reaction. Rohtas-90, Ufaq-02, AAS-09, NARC-11, Galaxy-13 and WL-711 responded moderately resistant (MR). Bluesilver, Pasban-90, Derawar-97, Uqab-00, Maraj-02, moderately susceptible (MS) response. While Chakwal-50, Bhakar-02, TD-01, Shafaq-06, Lasani-08, Millat-11 represented susceptible reaction.

S.#	Reaction	No. of Entries	Promising Lines
1	0	153	BWP-97,BWP-00,Manthar-03,Fareed-06,Sahar-06,FSD-08,Punjab-11,AARI-11,Pirsabak-04,Pirsabak-05,14B1007,14B1038,14B1040,076309,099172,099346,099383,12B2509,12B2549,13B3023,13B3024,
2	R	4	Iqbal-00,12B2519,13B3041
3	MR	13	Rohtas-90,Ufaq-02,AAS-09,NARC-11,Galaxy-13,WL-711,12B2530,12B2555,12B2603,12B3083
4	MS	23	Bluesilver,Pasban-90,Derawar-97,Uqab-00,Maraj-02,13B3085
5	S	12	Chakwal-50,Bhakar-02,TD-01,Shafaq-06,Lasani-08,Millat-11,088200,099114,
Total		205	

3. **SCREENING OF WHEAT VARIETIES/LINES AGAINST STEM RUST UNDER NATURAL CONDITION**

Two hundred and five (205) wheat varieties /lines received from Economic Botany section, Regional Agricultural Research Institute Bahawalpur and previous years selected lines were sown in single row of 2m length with 30cm row to row spacing. One row of susceptible check to stem rust (Fsd-08) was sown after every two entries keeping one line vacant in between the spreader rows to facilitate the inoculation. The sowing was done on 25.11.2014.



No stem rust infection appears on any test entries during the year reported.

4. **MONITORING OF LEAF BLOTCH (*DRECHSLERA SOROKINIANA*) DISEASE ON WHEAT GERMPLASM UNDER NATURAL FIELD CONDITIONS**

Two hundred and five (205) different wheat varieties/lines received from Economic Botany section, Regional Agricultural Research Institute Bahawalpur and previous years selected lines were sown in single row of 2m length with 30cm row to row spacing Bhakar-02 was sown after every two entries as check for spot blotch disease .The experiment was sown On 24.11.2014.Disease data were



recorded at the time of disease appearance. Spot blotch disease infected (26) varieties and (83) advanced lines.

Out of two hundred and five (205), ninety six (96) entries were disease free, Fifty five (55) showed 1-5% disease reaction, Twenty four (24) presented 6-10% disease reaction, Thirteen (13) exhibited 11-20% disease , Fourteen (14) showed 21-40% disease reaction and three (03) have disease reaction more than 40 % of spot blotch. Spot blotch on check, Bhakar-02 was < 40% noted.

5. DETERMINATION OF KARNAL BUNT IN WHEAT SEED LOTS COLLECTED FROM FARMER FIELDS OF SOUTHERN PUNJAB

Thirty eight (38) wheat seed samples were received during 2014-15 harvest season from different seed lots at farmer's field of various districts of Punjab. The minimum weight of each collected seed sample was 500g.

The following results were achieved after assessing the samples.

Location	Samples received	Infected samples	Range (infection)
Ahmad pur East	16	12	0.0-0.47
Yazman	13	12	0.0-0.32
Bahawalpur	9	7	0.0-0.53
Total	38	31	



6. SCREENING OF WHEAT VARIETIES/LINES AGAINST KARNAL BUNT (*Tilletia indica*) UNDER INOCULATED CONDITON.

Sixty nine (69) different wheat varieties/lines received from Economic Botany Section were sown in single row of 2m length with 30cm row to row and after every 2 test entries one row was kept fallow to facilitate the inoculation procedure. The experiment was sown at 07-12-2014.

Entries were inoculated by injection method with the spore suspension of *Tilletia indica* in the boots at boot leaf stage.

Observations of the disease incidence were recorded at the time of maturity on healthy and bunted grains basis as under:

S#	Variety/lines	No. of Infected grains	Total no. of grains	% Disease incidence
1.	Blue silver	6	196	3.55
2.	Kohi noor-83	1	230	0.43
3.	Faisal-85	12	282	4.25
4.	Pasban-90	4	165	2.42
5.	Rohtas-90	1	604	0.16
6.	Inqilab-91	0	114	0.00
7.	Punjab-96	4	261	1.53
8.	MH-97	1	154	0.64
9.	BWP-97	0	65	0.00
10.	Derawer-97	6	220	2.72
11.	Punjnad-1	6	193	3.10
12.	Chakwal-50	2	369	0.54
13.	BWP-2000	1	82	1.21
14.	Iqbal-2000	6	533	1.12
15.	Uqab-2000	3	390	0.76
16.	Ufaq-2002	1	195	0.51
17.	Bhakkar-2002	4	242	1.65
18.	As-2002	5	200	2.50
19.	Manthar-2003	3	261	1.14
20.	Fareed-2006	0	255	0.00
21.	Shafaq-2006	1	77	1.29
22.	Sahar-2006	6	535	1.12
23.	FSD-2008	1	259	0.38
24.	Maeraj-2008	2	33	6.06
25.	Lasani-2008	2	368	0.54
26.	AAS-2011	4	475	0.84
27.	Punjab-2011	16	63	25.39
28.	Millat-2011	1	164	0.60
29.	AARi-2011	1	220	0.45
30.	NARC-2011	2	253	0.79
31.	076309	11	382	2.87
32.	076317	13	275	4.72
33.	076346	0	189	0.00
34.	076422	0	342	0.00
35.	088132	21	281	7.47
36.	088200	8	690	1.15
37.	099110	4	322	1.24
38.	099114	12	201	5.97
39.	099172	0	236	0.00

40.	11B2097	2	336	0.59
41.	11B2100	5	594	0.84
42.	12B2601	0	209	0.00
43.	12B2602	0	272	0.00
44.	12B2603	0	267	0.00
45.	12B2606	0	298	0.00
46.	TD1	10	347	2.88
47.	Galaxy13	5	253	1.97
48.	Pirsabak04	1	395	0.25
49.	Pirsabak05	0	280	0.00
50.	WL711	12	404	2.97
51.	13B-3073	0	210	0.00
52.	13B-3074	0	245	0.00
53.	13B3075	1	98	1.02
54.	13B3130	0	457	0.00
55.	13B3134	0	150	0.00
56.	13B3135	0	409	0.00
57.	13B3214	0	385	0.00
58.	13B3220	0	452	0.00
59.	13B3221	4	435	0.91
60.	13B3142	7	262	2.67
61.	14B1005	1	385	0.25
62.	14B1007	1	354	0.28
63.	14B1008	0	206	0.00
64.	14B1013	4	601	0.66
65.	14B1014	0	531	0.00
66.	14B1026	2	172	1.16
67.	14B1038	0	428	0.00
68.	14B1040	4	300	1.33
69.	14B1041	2	201	0.99

7. SCREENING OF WHEAT VARIETIES/LINES AGAINST LOOSE SMUT OF WHEAT

One hundred and eighty one (181) wheat varieties/lines inoculated last year were sown (26-11-2014) in one (1) meter long single rows with 60 cm R X R spacing in single replication. The test entries were inoculated with fresh spore suspension of loose smut at the time of earing. The data of disease incidence was recorded at the time of maturity, on diseased and healthy tiller basis.



Category	Rating	No.of var./lines	Promising varieties/lines
Immune (0)	0	22	Punjab-96,Bwp-97,Ufaq-02,BKR-02,Fareed-06,Shafaq-06,F.S.D-08,Mairaj-08,076309,13B3026.
Resistant (1% or less)	1	5	MH-97,Punjab-11,12B2549,13B3086,13B3079
Moderately Resistant (1-10%)	3	99	Inqlab-91,BWP-00,Iqbql-00,Ufaq-02,Sahar-06,Lasani-08,AAS-09,AARI-11,NARC-11,076346,076422,099110,099114,099346,11B2095,12B2557,099172
Moderately Susceptible (11-20%)	5	45	Bluesilver,Millat11,099384,12B2501,12B2506,12B2507,12B2519,12B2526,12B2557,12B2559,13B3027,13B3050
Susceptible (20-50%)	7	10	12B2506,12B255,12B2602,13B3049,13B3050
Highly Susceptible (50% & above)	9	0	
Total		181	

8. **YIELD LOSS ASSESSMENT OF WHEAT DUE TO LEAF RUST (*pucciniatriticina*) USING FUNGICIDES.**

Three (3) test varieties (Morocco, Sahar-06,ASS-11) i.e Highly Susceptible, Susceptible and Resistant respectively against leaf rust were sown for the evaluation of rusticides/fungicides against that disease. Sowing was done on 03.12.2014 in split plot design with two replications. Total number of plots were sixty six (66) and plot size was $5 \times 1.8 = 9\text{m}^2$. There were total eleven (11) treatments i.e one control two seed treatments and eight foliar sprays.

Six rusticides/ fungicides namely Tilt, Amistar, Folicur, Nativo, Hombre and Raxilultra were arranged for their efficacy against leaf rust on wheat crop. Four rusticides/fungicides i.e Tilt, Amistar, Folicur and Nativo were used as foliar fungicides and two i.e. Hombre and Raxilultra were used as seed treatment. The results are as under;

Sr. No	Treatments	Total weight (Biomass) (Kg)/Plot	Total weight (Biomass) (Kg)/hac	Total weight (seed) (kg)/Plot	Total weight (seed) (kg)/hec	1000 Grain weight (grms)	Moisture contents (%)
1	Control Morocco	9.75	9285.7	1.452	1382.8	31.7	8.6
2	Sahar-06	12.87	12142.8	2.154	2051.4	32.2	8.6
3	ASS-11	13.50	12857.1	2.813	2679.0	35.1	8.7
4	Hombre Morocco	9.25	8809.5	1.365	1299.9	32.6	9.1
5	Sahar-06	12.00	11428.5	3.024	2879.9	41.0	8.8
6	ASS-11	12.75	12142.8	3.343	3183.8	42.6	9.7
7	Raxilultra	9.50	9047.6	1.431	1362.8	33.3	9.1

	Morocco						
8	Sahar-06	11.87	11304.7	2.850	2714.3	42.2	8.9
9	ASS-11	12.25	11666.6	3.365	3204.8	41.6	9.5
10	Tilt (Single) Morocco	10.25	9761.9	1.283	1221.9	36.6	8.7
11	Sahar-06	13.25	12619.0	3.114	2965.7	39.3	9.1
12	ASS-11	13.12	12495.2	2.768	2636.2	38.2	9.1
13	Tilt (two) Morocco	10.37	9876.1	1.557	1482.9	38.4	9.0
14	Sahar-06	14.00	13333.3	3.325	3166.7	42.5	9.3
15	ASS-11	14.37	13685.7	4.140	3942.9	38.4	9.2
16	Amistar (single) Morocco	10.37	9876.1	1.591	1515.2	36.4	8.5
17	Sahar-06	12.50	11904.7	3.384	3222.9	39.7	9.1
18	ASS-11	13.12	12495.2	3.225	3071.4	36.4	9.1
19	Amistar (two) Morocco	10.37	9876.1	1.852	1763.8	39.8	9.3
20	Sahar-06	13.25	12619.0	3.631	3458.0	42.0	9.2
21	ASS-11	14.00	13333.3	4.116	3919.9	43.4	9.5
22	Folicur (single) Morocco	10.62	10114.2	1.387	1320.9	34.0	9.1
23	Sahar-06	13.25	12619.0	3.312	3154.2	41.3	9.0
24	ASS-11	13.75	13095.2	3.032	2887.6	35.8	9.7
25	Folicur (two) Morocco	10.62	10114.2	1.384	1318.0	33.9	8.9
26	Sahar-06	12.50	11904.7	3.037	2892.4	42.5	9.5
27	ASS-11	13.75	13095.2	3.030	2885.7	42.0	9.3
28	Nativo (single) Morocco	10.75	10238.0	1.475	1404.8	33.9	8.7
29	Sahar-06	13.12	12495.2	2.744	2613.3	40.4	9.4
30	ASS-11	14.12	13447.6	3.033	2888.6	38.6	9.3
31	Nativo (two) Morocco	10.75	10238.0	1.633	1555.2	34.5	8.8
32	Sahar-06	12.87	12257.1	2.899	2760.9	42.9	9.2
33	ASS-11	14.12	13447.6	2.982	2839.9	38.1	9.4

Sr.No	Treatments	Morocco		Sahar-06		Ass-11	
		(Biomass) (Kg)/ha	(seed) (kg)/ha	(Biomass) (Kg)/ha	(seed) (kg)/ha	(Biomass) (Kg)/ha	(seed) (kg)/ha
1	Control	9285.7	1382.8	12142.8	2051.4	12857.1	2679.0
2	Hombre	8809.5	1299.9	11428.5	2879.9	12142.8	3183.8
3	Raxilultra	9047.6	1362.8	11304.7	2714.3	11666.6	3204.8
4	Tilt (Single)	9761.9	1221.9	12619.0	2965.7	12495.2	2636.2
5	Tilt (two)	9876.1	1482.9	13333.3	3166.7	13685.7	3942.9
6	Amistar (single)	9876.1	1515.2	11904.7	3222.9	12495.2	3071.4
7	Amistar (two)	9876.1	1763.8	12619.0	3458.0	13333.3	3919.9
8	Folicur	10114.2	1320.9	12619.0	3154.2	13095.2	2887.6

	(single)						
9	Folicur (Two)	10114.2	1318.0	11904.7	2892.4	13095.2	2885.7
10	Nativo (single)	10238.0	1404.8	12495.2	2613.3	13447.6	2888.6
11	Nativo (Two)	10238.0	1555.2	12257.1	2760.9	13447.6	2839.9

While reviewing above results it shows that Amistar and Natevo were most effective against leaf rust of wheat.

9. **SCREENING OF MUNGBEAN VARIETIES/LINES AGAINST MUNG BEAN YELLOW MOSAIC VIRUS (MYMV)**

Fifteen (15) mungbean varieties/lines received from Pulses Section were planted to find out the sources of resistance against mungbean yellow mosaic virus (MYMV) under natural conditions. The experiment was sown in RCBD with 3 repeats by keeping plot size of 5X1.8m. One row of highly susceptible check (Mash bean) was planted after every two entries. Presence of the insect vector white fly was also recorded before and on the onset of the disease. Disease data of the Mung bean yellow mosaic virus was recorded as under.



Disease severity	%age of infection	Infection category	Reaction	No. of entries	Names of Varieties/lines
0	0%	Immanue	I	0	Non
1	1-10%	Highly resistant	HR	0	Non
2	11-20%	Resistant	R	0	Non
3	21-30%	Moderately resistant	MR	3	NM-2011,BRM-312,BRM-382.
4	31-50%	Moderately susceptible	MS	8	BRM-321, BRM-343, BRM-315, BRM-349, BRM-366, BRM-365, BRM-364,MUNG-06
5	More than 50%	Susceptible	S	4	BRM-350, BRM-356, Mash bean, Pigeon pea

10: **SCREENING OF SORGHUM VARIETIES/LINES AGAINST GRAIN SMUT (*Sphacelothecatorghii*)**

Nineteen (19) varieties/lines were sown (15-07-15) in two rows keeping the plot size

of 6m x 1.8m in each set. Test entries were infested by dipping in fresh spore suspension of the pathogen for 5 minutes and then incubated for 24 hours at 30⁰C in order to establish the pathogen intensity. Jowar-319 was used as susceptible check.

Data on the disease incidence was recorded on the basis of diseased and healthy heads at the time of maturity and is tabulated as under:



Reaction		Catagory	No of Line/ variety	Name of Line/ variety
I	Immune	0	10	YSS-98,YJS-3,YJS-4,YJS-5,YJS-10,YJS-15,YJS-16,YJS-19,YJS-62,YJS-67
HR	Highly Resistant	1	-	
R	Resistant	3	6	PARC-SS1,PARC-SS11,RARI-S4, RARI-S10, RARI-S16,JOEAR-86
MR	Moderately resistant	5	2	RARI-S3, RARI-S5,
S	Susceptible	7	1	JOWAR-319
HS	Highly susceptible	9	-	

Ten (10) entries i-eYSS-98,YJS-3,YJS-4,YJS-5,YJS-10,YJS-15,YJS-16,YJS-19,YJS-62 and YJS-67 present immune (Disease free) reaction, while six (6) entries i-e PARC-SS1,PARC-SS11,RARI-S4, RARI-S10, RARI-S16 and JOEAR-86showed Resistant reaction and two (2) entries i-e RARI-S3 and RARI-S5 exhibited Moderately resistant reaction.

11. SCREENING OF GUAR VARIETIES/LINES AGAINST LEAF SPOT (Alternariacucumerina).

Five (05) varieties/lines were sown (01-07-15) in six rows keeping the plot size of 7m x 1.8m in each set. The experiment was sown in RCBD with 3 repeats. The data of disease incidence was recorded at the time of disease appearance as under.



Reaction		Catagory	No of Line/ variety	Name of line/variety
I	Immune	0		-
HR	Highly Resistant	1		-
R	Resistant	3		-
MR	Moderately resistant	5	3	A,B,C
S	Moderately susceptible	7	2	D,E
HS	Susceptible	9		

12. EVALUATION OF BRASSICA CULTIVARS/LINES AGAINST ALTERNARIA BLIGHT, WHITE RUST, POWDERY MILDEW AND DOWNY MILDEW DISEASES

Twenty eight (28) varieties/lines of *Brassica juncea*(Mustard) obtained from Assistant Botanist (Oilseeds), RARI Bahawalpur were sown on 23.10.2014 following RCBD with 3 replications and keeping a plot size of 4m x 1.8m in order to find out the sources of resistance against Alternaria blight (*Alternariabrassicae*), white rust (*Albugo candida*), powdery mildew (*Erysiphecruciferarum*) and downy mildew (*PerenosporaParasitica*) under natural conditions. Disease data were recorded on the appearance of diseases is given as under:



Diseases Reaction	POWDERY MILDEW		ALTERNARIA BLIGHT	
	No.	Promising Varieties/lines	No.	Promising Varieties/lines
I	1	BRJ-1307	0	-
HR	2	BRJ-1103, BRJ-1451		-
R	0		0	-
MR	18	BRJ-9070, BRJ-9072, BRJ-1003, BRJ-1004, BRJ-1005, BRJ-1101, BRJ-1102, BRJ-1104, BRJ-1105, BRJ-1301, BRJ-1302, BRJ-1304, BRJ-1305, BRJ-1306, BRJ-1452, BRJ-1453, BRJ-1454, BRJ-1458	8	BRJ-1004, BRJ-1005, BRJ-1455, BRJ-1456, BRJ-1457, BRJ-1458, Bahawalpur raya, Khanpuraya
MS	6	BRJ-1201, BRJ-1455, BRJ-1456, BRJ-1457, Bahawalpur raya, Khanpuraya	16	BRJ-9072, BRJ-1003, BRJ-1102, BRJ-1103, BRJ-1104, BRJ-1201, BRJ-1205, BRJ-1301, BRJ-1302, BRJ-1304, BRJ-1305, BRJ-1306, BRJ-1307, BRJ-1451, BRJ-1453, BRJ-1454
S	1	BRJ-1205	4	BRJ-9070, BRJ-1101, BRJ-1105, BRJ-1452

- (I) There was no White rust on any variety/ line
- (II) There was no Downy mildew on any variety/ line

6.2 ENTOMOLOGY SECTION

1. SCREENING OF Bt-COTTON VARIETIES/STRAINS AGAINST SUCKING INSECT PEST UNDER NON-SPRAYED CONDITIONS AT BAHAWALPUR

The experiment was conducted to search out the Bt-cotton varieties/strains against sucking insect pest under non-sprayed conditions. The experiment consists of 17 strains, 3 replications with plot size of 3m×8 m and trial was laid out in RCBD. The data of sucking pest was recorded fortnightly. The experimental crop was not sprayed throughout the cropping season. The recorded data is given as under;

Strains/varieties	POPULATION PER LEAF		
	Jassid	White fly	Thrips
SS-32	2.4def	3.37e	9.72hi
VH-303	3.13abc	5.88b	12.46d
VH-305	3.03bcd	5.36b	14.56b
SLH-1	2.8bcde	5.74b	10.62g
SLH-4	3.76a	6.03b	11.98e
SLH-7	2.2ef	4.70d	8.22j
SLH-9	2.2ef	5.28b	14.0c
SLH-10	3.23ab	6.36a	15.11a
SLH-317 Non-bt	2.36def	5.78bc	12.21de
RH-627	3.37ab	4.96c	12.42de
BH-182	3.03bcd	5.64b	11.42f
BH-184	2.33ef	5.74b	11.00f
BH-180	2.33ef	4.00d	9.36i
BH-178	2.46cdef	5.53bc	12.60de
FH-142	2.0f	6.51a	8.12j
MNH-886	2.26ef	5.71bc	8.72j
SG-1	1.99f	5.56b	10.32gh
LSD(5%)	0.69	0.46	0.51

At the end of season all leaves were dropped. All the strains were susceptible to insect pest complex. The maximum population of Jassid 3.76/leave on strain SLH-4, white fly 6.51/leaf on strains FH_142 and Thrips 15.11 Per leaf on strain SLH-10 were recorded and minimum population of Jassid was recorded on SG-1 i.e 1.99, White fly on SS-32 i.e 3.37, and Thrips on FH-142 i. e 8.12.

2. SCREENING OF DIFFERENT BT-COTTON VARIETIES/STRAINS AGAINST BOLLWORM UNDER NON SPRAYED CONDITIONS AT BAHAWALPUR

The experiment was conducted to screen out the 17 Bt and non-Bt cotton strains against bollworms under non sprayed condition. The experiment was layout under RCBD with 3 replications and plot size of 3m×8m. Data of bollworm was recorded fortnightly and crop was kept unsprayed throughout the cropping season. Data of pinkbollworm was recorded on experimental crop, while other bollworms did not appear

STRAINS/VARIETIES	AV%DAMAGE BY PINK BOLLWORM
SS-32	20.66
VH-303	16.66
VH-305	28.33
SLH-1	15.0
SLH-4	30.0
SLH-7	16.66
SLH-9	15.00
SLH-10	16.66
SLH-317 Non-Bt	26.66
RH-627	16.00
BH-182	20.0
BH-184	16.66
BH-180	23.33
BH-178	20.0
FH-142	21.66
MNH-886	22.33
SG-1	13.00

All the entries were susceptible to pink bollworm. The highest/maximum %age damage by pink bollworms was observed on strain SLH-4 i.e 30.0 and minimum/lowest %age damage of pink bollworm was recorded on strain SLH-1,SLH-9 i.e.15.00.

3. **EFFICACY OF DIFFERENT INSETICIDES AGAINST DUSKY COTTON BUG. (*Phenacoccus solenopsis*)**

The main objective of this experiment was to to check the efficacy of various insecticides against dusky cotton bug. Variety/ Strain MNH-886 was sown under RCB, Design along with 03 repeats having plot size of 3 mx10m. Data was recorded before and after the application of insecticides which is given as under.

TREATMENTS	%Age Mortality
Confidor200SL	83.4

Acetameprid 20SL	71.33
Nitenpyram 10AS	50.10
Profenofos 50EC	44.60
Deltamethrin 2.5EC	53.70
Control	5.0

All the insecticide used as treatment shows better results however Confidor200SL gave 83.4 % mortality followed by Acetameprid 20SL which gave 71% mortality.

EVALUATION OF VARIOUS STRAINS/VARIETIES OF MUNG AGAINST WHITEFLY *BEMISIA TABBACI* GENN) UNDER NON SPRAYED CONDITIONS

The experiment was done to evaluate the mung varieties/strains against whitefly under the field conditions. There were 10 entries, three replications and plot size was 4m×1.8m of this experiment. The trial was conducted according to RCBD. The results are given as under:

Varieties/strains	Av. Whitefly/leaf
BRM-312	3.50
BRM-321	3.95
BRM-348	4.12
BRM-356	4.10
BRM-364	4.38
BRM-331	6.63
Chakwal M-06	4.0
Niab.mung	5.1



The maximum attack was recorded on BRM-331 i.e 6.63 white fly/ leaf and minimum population of white fly was recorded on BRM-312 i.e 3.50 .

EFFICACY OF DIFFERENT INSECTICIDE AGAINST BORER (*CHILLO PARTELLUS* (SWINHAE) ON SORGHUM CROP

The experiment was conducted to find out the most effective insecticides to control the borer. There were 07 treatments, with three replications and the trial was laid out in RCBD Jowar-86 was sown for this purpose. Attacked plants were counted and calculated

the attack %age. The insecticides were applied on crop at recommended doses. The results are given in the table below:

Treatments	%age Mortality of Borer
Carbofuran 3G(Ist Irrigation)	75.40
Tracer240sc	83.17
Coragen20SC	77.53
Emamectin benzoate1.9EC	88.50
Belt48SC	81.59
Control	4.66

The foliar application of insecticide gave better result as compare to granular application. All the treatments showed better results. The maximum control was recorded by Emamectinbenzoate 1.9EC i.e. 88.50.

SCREENING OF DIFFERENT PROMISING VARIETIES/LINES OF WHEAT AGAINST APHID AND HELICOVERPA SPP IN NORMAL AND LATE SOWN UNDER NATURAL CONDITION

The objective of this research was to screen the wheat varieties/strains against aphid under natural field condition in normal and late sown condition. There were 10 entries, with plot size of 5m×1.8m. The data of aphid/tillers and Helicoverpa/tiller was recorded. The results are given as under:



Normal Sown

Sr. No.	Verities/Strains	Av. Aphid/tiller	Av. <i>Helicoverpa</i> / tiller
1	6B6309	17.5ba	3.0
2	076346	20.0ab	3.2
3	076422	17.3b	3.6
4	10b9346	16.80b	4.0
5	10B9384	16.5b	5.2
6	Aas-11	17.0b	5.0
7	Fareed-06	24.0a	5.4
8	FSD-08	19.4ab	3.6

Lsd for aphid= 5.0

The highest populations of aphid was recorded on strain Fareed-06 i.e. 24.0 and *heliiothis* per tiller on strain 5.4 respectively .Minimum population of aphid/tiller i.e.16.80 was noted on strain 10B9384 under normal sown conditions.

RESULTS OF LATE SOWN TRIAL

Sr. No.	Varities/Strains	Av. Aphid/tiller	Av. <i>Helicoverpa</i> /tiller
1	6B6309	32.0ab	3.64
2	076346	35.0ab	4.60
3	076422	36.0ab	4.66
4	10b9346	32.0ab	4.30
5	10B9384	27.00b	6.33
6	Aas-11	28.0b	7.33
7	Fareed-06	40.38a	7.0
8	FSD-08	30.77ab	7.33

LSD (5%) for aphid=9.85

The highest populations of aphid were recorded on variety Fareed-06@40.38per tiller while minimum population @27 was noted on strain 10B9384. Maximum *Heliothis* per tiller was recorded on Aas-11,Fsd-08 i.e. 7.33 and minimum population was noted on strain 6B6309 i.e. 3.64.

ESTIMATION OF QUANTITATIVE LOSSES OF WHEAT APHIDS ON WHEAT CROP.

This experiment was conducted to estimate losses caused by aphids under field condition .There were four entries, having plot size of 5m×1.8m in this trial. The experiment was laid out in RCBD with 3 replications. Two sets of four wheat varieties were sown separately. One set was kept free from aphid attack by applying confidor@ 200 ml/acre at the time of appearance of pests till maturity of the crop. In Other set, aphid population was allowed to develop in the field. The data regarding aphid population /tiller was recorded from ten randomly selected plants per plot at ten days intervals. The yield of the treated and non-treated Plots was also be recorded for comparison. The results are given as under:



S. No.	Varieties/ strains	Average yield (Kg/plot)		Yield Losses(%)
		Sprayed	N.Sprayed	
1	074346	3.8	3.2	15

2	10b9346	4.15	3.25	21
3	Fsd-08	5.0	3.85	23
4	Aas-11	5.60	4.8	14

The maximum yield losses was recorded on strain FSD-08 i.e. 23percent.

SCREENING OF DIFFERENT BRASSICA VARIETIES/STRAINS AGAINST APHID UNDER NORMAL AND LATE SOWING CONDITIONS

This experiment was conducted to screen the Raya varieties /strains against aphid under field condition .There were ten entries having 3 replications and plot size of 5m×1.8m. The experiment was laid out in RCBD and data was recorded on aphid populations from 5cm length of inflorescence. The recorded data is given in following table:

Varieties/strains	Av.aphid pop/5cm length (normal sown)	Av.aphid pop/5cm length (Late sown)
BRJ-9070	14ef	33cde
BRJ-9072	18ef	32def
BRJ-1003	20cde	39abcd
BRJ-1004	12f	32def
BRJ- 1005	17ef	34cde
BRJ- 1102	28ab	45a
BRJ- 1103	17def	25f
BRJ- 1104	29cde	27ef
BRJ- 1105	25ab	43ab
BRJ- 1201	23bcd	36bcd
BWP-RAYA	30a	38bcd
KP-RAYA	28ab	40abc
LSD (5%)	6.0	7.19

The highest population of aphid per 5cm length was observed on BRJ-1103 (30.00) and lowest number of aphid was observed on BRJ-1004 (12.00) in normal sown while in late sown, the maximum population of aphid was recorded on strain BRJ-1102(45.0) and minimum population i.e. 25.0 on BRJ-1103.

ESTIMATION OF QUANTITATIVE LOSSES OF RAYA CAUSED BY APHIDS

This experiment was conducted to estimate losses caused by aphids under field condition. There were five entries, having plot size of 5m×1.8m. The experiment was laid out in RCBD, with 3 replications. Two sets of five raya varieties were sown separately. One set was kept free from aphid attack by applying carbosulfan@ 400 ml/acre at the time of appearance of pests till maturity of the crop. In Other set, aphid population was allowed to develop in the field. The data regarding aphid population /inflorescence was recorded from ten randomly selected plants per plot at ten days intervals. The yield of the treated and non-treated Plots was also be recorded for comparison.



The recorded data is given in table

S. No.	Varieties/ strains	Average yield (Kg/plot)		Yield Losses(%)
		Sprayed	N. Sprayed	
1	BRJ-9070	2.48	1.93	22
2	BRJ-9072	2.2	1.71	23
3	BRJ-1004	2.58	1.81	23
4	BWP.RAYA	2.23	1.7	26
5	K.P.RAYA	1.95	1.4	28

All the tested strains possess losses ranging from 22 to 28%. The maximum% loss by aphid was recorded on strain K.P.Raya @28.00%.

RESPONSE OF DIFFERENT PROMISING LINES OF CHICKPEA TO CHICKPEA POD BORER (*HELICOVERPA ARMIGERA*) (HB) UNDER FIELD CONDITIONS

This experiment was conducted to evaluate the chick pea varieties strains against pod borer *Helicoverpa armigera* under field conditions. There were 10 entries, with three replications and plot size of 4m×1.8m. The trial was conducted according to RCBD. The %age damage of pod borer and yield data were recorded. The results are given in table as under;

S. No.	Varieties/Strains	Av. Pod damage %age
1	BRC-427	13.33
2	BRC-388	13.0
3	BRC-402	14.0
4	BRC-390	12.66
5	BRC-61	11.66
6	BRC-405	13.0
7	BRC-404	11.66

8	BRC-403	11.0
9	PB-2008	15.0
10	Bhakkar-11	14.66

The maximum damage %age was recorded on PB-2008.@15.0% and minimum % age was recorded on BRC-403 @11.0%.

EVALUATION OF QUANTITATIVE LOSSES OF CHICK PEA CAUSED BY *Helicoverpa armigera* Hb.

The experiment was conducted to find out the quantitative losses of chick pea caused by borer. The trial was laid out in RCBD along with 03 repeats and the plot size of 4m×1.8m. Two sets of four varieties was sown separately. One set was kept free from *Helicoverpa* attack by applying Emamectin @ 200 ml/acre at the appearance of pests till maturity of the crop. In other set, crop was kept unsprayed for the development of *Helicoverpa*. The data regarding pest population was recorded from 15 randomly selected plants per plot. The yield of the treated and un-treated plots was also recorded for comparison. The results are given in the following table.

S. No.	Varieties/ strains	Average yield (Kg/plot)		Yield Losses(%)
		Sprayed	N.Sprayed	
1	BRC-388	1.73	1.45	14
2	BRC-427	1.47	1.27	13
3	PB-2008	1.89	1.50	20
4	Bhakkar-11	1.40	1.10	22

All the test entries show yield losses up to 22%. The maximum yield losses were recorded on Bhakkar-11 @22%. The minimum losses were recorded on BRC-427 which was 13 %.

METROLOGICAL DATA DURING WHEAT GROWING SEASON (RABI 2014-15)

FACTORS	NOVEMBER-2013		NOVEMBER-2014	
	Average	Range	Average	Range
Temp. (Max. °C)	22	18-33	27	24-30
(Min. °C)	14	11-21	13	10-19
Humidity (%)	75	60-84	74	65-82
Rainfall (mm)	Nil		Nil	
Cloudy Days	Nil		Nil	
FACTORS	DECEMBER-2013		DECEMBER-2014	
	Average	Range	Average	Range
Temp. (Max. °C)	21.48	19-25	16	11-28
(Min. °C)	5.15	3-9	09	04-14
Humidity (%)	75.66	69-85	72	61-85
Rainfall (mm)	-		Nil	
Cloudy Days	04		Nil	
FACTORS	JANUARY-2014		JANUARY-2015	
	Average	Range	Average	Range
Temp. (Max. °C)	15	11-19	14	13-21
(Min. °C)	07	3-12	06	03-13
Humidity (%)	77	73-85	70	60-80
Rainfall (mm)	Nil		Light showers	
Cloudy Days	05		04	
FACTORS	FEBRUARY-2014		FEBRUARY-2015	
	Average	Range	Average	Range
Temp. (Max. °C)	20	15-23	21	20-25
(Min. °C)	09	09-13	10	07-15
Humidity (%)	76	70-81	68	68-81
Rainfall (mm)	11mm		06mm	
Cloudy Days	06		04	
FACTORS	MARCH-2014		MARCH-2015	
	Average	Range	Average	Range
Temp. (Max. °C)	21.57	17-27	25	16-32
(Min. °C)	13.14	11-17	17	10-23
Humidity (%)	72.83	74-81	75	67-81
Rainfall (mm)	4		22	
Cloudy Days	10		03	
FACTORS	APRIL-2014		APRIL-2015	
	Average	Range	Average	Range
Temp. (Max. °C)	33.34	29-42	34	31-41
(Min. °C)	21.23	17-27	23	19-29
Humidity (%)	69.26	65-78	70	62-80
Rainfall (mm)	04		10	
Cloudy Days	05		7	
FACTORS	MAY-2014		MAY-2015	
	Average	Range	Average	Range
Temp. (Max. °C)	40	35-43	41	34-46
(Min. °C)	24	19-27	26	23-29
Humidity (%)	76	66-86	69	60-78
Rainfall (mm)	14		16	
Cloudy Days	08		03	

Maqsood/