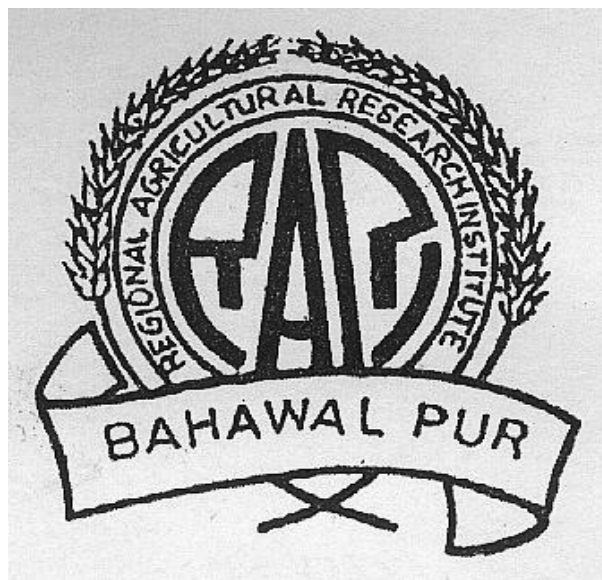


**ANNUAL DETAILED TECHNICAL
REPORT FOR THE YEAR
2019-20**



**REGIONAL AGRICULTURAL RESEARCH INSTITUTE,
BAHAWALPUR**

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1. INTRODUCTION

Regional Agricultural Research Institute, Bahawalpur was upgraded in 1987, however, it was established as Agriculture Research Station in 1950 at Khanpur, District Rahim Yar Khan and shifted to Bahawalpur during 1969. At this Institute, crop breeding efforts are underway to develop high yielding varieties of wheat, pulses, millet, sorghum and oilseed, suitable for irrigated as well as low rain or arid-climatic zone of Southern Punjab. Wheat is the main food crop of Pakistan, being cultivated on about nine million hectares in all over the country. Punjab is the main wheat producing province of the country (6.55 mh) that shares 91% of area under irrigated conditions and 9% under rainfed conditions. A number of high yielding, drought tolerant, disease and insect pest resistant wheat and other crop varieties along with their production and protection technologies have been released for general cultivation in the region. The Institute has released fourteen wheat, two mungbean, one sorghum, two pearl millet and one raya (Mustard) varieties up till now. The wheat variety Jauhar-16 is the third most cultivated variety in Punjab. This variety is high yielder as well as tolerant to drought and heat. An advance line of wheat (12B2511) is in final stage of approval. Dozens of advance lines of various crops including wheat (172190, 172185 and BF1705), oilseed (BRJ-1519, BRJ-1304, BRJ-1501, BRJ-1458 and BRJ-1405) and pulses (BR-446, BRC-408 and BRC-474) are in pipeline. The institute is also focusing on evolution of crop varieties resilient to drought and heat stresses under climate change scenario.

2. ORGANIZATION

Head of institute : Dr. Lal Hussain Akhtar, Director Agriculture (Research).

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3. BUDGET (2019-20)

Budget PC21018- Agriculture	Allocation			Expenditure		
	salary	Non-salary	Total	salary	Non-salary	Total
	74446640	1415630	88562270	7441182	14115462	88526644

4. INCOME

Target (Rs.)	Achievement (Rs.)
8038200	6215469

5. RESEARCH ACTIVITIES

5.1 ECONOMIC BOTANY SECTION

Activities regarding wheat breeding program (2019-20) included hybridization, study of filial generations (F₁-F₇), evaluation of wheat genotypes in various categories of wheat trials i.e. Preliminary, Regular, Regional, Provincial and National uniform wheat yield trials. Exotic

material (CIMMYT and ICARDA) received from National Coordinator Wheat was also evaluated under local conditions. Detail about these activities are given as under:

5.1.1. HYBRIDIZATION OF WHEAT FOR GENETIC IMPROVEMENT

Two sets of wheat crossing blocks were planted in November 2019 and crossing among the desirable parents was attempted in February-March. During this season, crossing of 1122 heads was attempted out of which only 540 were successful. Detail is given as under:

Purpose of Hybridization	No. of Crossed Heads	
	Attempted	Successful
High yield	442	260
Resistance to disease	330	120
Heat and drought tolerance	250	105
Quality	100	55
Total	1122	540

5.1.2. STUDY OF FILIAL GENERATIONS (F₁-F₇)

The successful crossed material is raised in various generations. Out of these generations, desirable plants/lines with new gene combinations are selected and promoted to next generations/trials during the subsequent years. The bulked 60 entries were included in yield trials for evaluation. Detail is given as under:

Generation	No. of entries studied	No. of entries selected	No. of entries Bulk
F ₁	450	-	-
F ₂	492	380	-
F ₃	700	492	-
F ₄	330	280	12
F ₅	448	108	40
F ₆	90	44	04
F ₇	28	-	04
Total	2538	1304	60

5.1.3. WHEAT YIELD TRIALS

Selected entries are included in different yield trials according to their status from preliminary to National wheat yield trials.

i) PRELIMINARY WHEAT YIELD A-TRIALS

One hundred and eighty (180) entries (excluding checks) were tested in 10+10 Normal as well as Late "A" trials. These trials were laid out according to RCBD with three

replications and plot size 6m². Fertilizer 150-120-60 kg NPK was applied. In addition to Rauni, 4 irrigations were applied throughout the growth period. These trials were sown on 11.11.2019 and harvested on 03.05.2020. The data on various morphological traits were recorded and yield data are given as under:

Trials	Genotypes	Grain yield (Kg ha⁻¹) Normal	Grain yield (Kg ha⁻¹) Late	Average Grain yield (Kg ha⁻¹) (Normal+Late)
A-1	193811	5444	4537	4991
	193813	5389	4391	4890
	193818	5333	4304	4819
	193809	5167	4295	4731
	193810	5091	4200	4646
	193817	4981	4158	4570
	Johar-16 (Check)	4833	4028	4431
A-2	193819	4500	4195	4348
	193827	4444	4031	4238
	193832	4444	3704	4074
	Johar-16 (Check)	4111	3426	3769
A-3	193843	4889	4734	4812
	193854	4750	4150	4450
	Johar-16 (Check)	4722	3935	4329
A-4	193856	3167	2987	3077
	193869	3056	2889	2973
	193863	3000	2600	2800
	193865	2778	2315	2547
	193857	2722	2215	2469
	193859	2556	2190	2373
	Johar-16 (Check)	2444	2037	2241
A-5	193890	4833	4028	4431
	193883	3944	3287	3616
	193880	3889	3195	3542
	Johar16(Check)	3778	3148	3463
A-6	193906	5056	4613	4835
	193901	4611	4343	4477
	193895	4556	4096	4326
	193907	4500	3706	4103
	Johar-16 (Check)	4102	3648	3875
A-7	193910	4111	3426	3769
	193913	4056	3380	3718
	193915	4000	3297	3649
	193916	3944	3200	3572

	193926 Johar-16 (Check)	3889 3722	3169 3102	3529 3412
A-8	193931 193932 193941 193933 193943 193937 Johar-16 (Check)	4889 4500 4333 4222 4056 4000 3778	4074 3750 3611 3501 3380 3233 3148	4482 4125 3972 3862 3718 3617 3463
A-9	193945 193954 193956 Johar-16 (Check)	5222 4944 4611 3315	4352 4120 3843 3111	4787 4532 4227 3213
A-10	193978 193976 Johar-16 (Check)	4512 4330 4074	4026 3979 3684	4269 4155 3879

ii) REGULAR WHEAT YIELD B-TRIALS

Total entries tested were 60 (excluding checks) in five (05) trials under two environments i.e. Normal and Late. Out of which, 20 genotypes were selected on the basis of desirable traits. These trials were laid out according to RCBD with three replications and plot size 9m². Fertilizer 150-120-60 kg NPK was applied. In addition to Rauni, 4 irrigations were applied throughout the growth period. These trials were sown on 12.11.2019 and harvested on 05.05.2020. The data on various morphological traits were recorded and are given as under:

Trials	Genotypes	Grain yield (Kg ha ⁻¹)		Grain yield (Kg ha ⁻¹) (Normal & Late)
		Normal	Late	
B 1	180007	4630	3667	4149
	180003	4259	3407	3833
	180011	4111	3296	3704
	195714	3926	3111	3519
	195718	3852	3074	3463
	Ghazi-19 (Check)	3778	3000	3389
B 2	195710	5667	4519	5093
	180025	5593	4481	5037
	180020	5556	4444	5000
	Ghazi-19 (Check)	4926	3963	4445
B 3	180041	5556	4407	4982
	195716	5222	4148	4685
	195711	5111	4074	4593

	180050	5037	4000	4519
	180054	5000	3963	4482
	Ghazi-19 (Check)	4333	3444	3889
B 4	195708	5963	4667	5315
	180101	5667	4444	5056
	180104	5370	4185	4778
	195712	5370	4185	4778
	180077	5333	4222	4778
	Ghazi-19 (Check)	4852	3778	4315
B 5	180125	4926	3815	4371
	Ghazi-19 (Check)	4518	3518	4018

iii) REGIONAL WHEAT YIELD TRIALS 2019-20

These trials were planted on six (06) locations in Southern Punjab i.e Multan, Rahim Yar Khan, Jahanian, Bahawalpur (Normal and Late), Khanpur and Alipur. Total number of entries was 14 including checks. The trial was laid out under RCBD with three replications. Plot size was 6 m² while NPK fertilizer were applied @ 150-120-60 kg ha⁻¹. Four irrigations were applied at critical crop growth stages. This trial was sown on 09-11-2019 and harvested on 01-05-2020 under normal environment. The grain yield data in kg ha⁻¹ are presented as under:

Genotypes	RARI BWP (N)	RARI BWP (L)	JAHANIAN	KHANPUR	MULTAN	RY khan	Ali Pur	Average Grain yield of 06- locations
17568	3944	3278	6417	6133	4222	5000	6222	5031
17534	4222	2167	6028	6267	4500	4722	5667	4796
17554	4361	2722	5778	6756	4167	5056	4333	4739
17588	4333	2278	5750	6067	3278	5889	5444	4720
17623	4061	2111	6083	6978	3444	5111	5056	4692
18611	3944	2717	4500	6000	3944	6111	5611	4690
Ghazi-19 (check)	4056	2333	5667	6089	3917	5944	5278	4755

iv) **PUNJAB UNIFORM WHEAT YIELD TRIALS 2019-20**

This trial was composed by the Director wheat, Wheat Research Institute, Faisalabad and consisted of 50 strains. This trial was planted in Southern Punjab i.e Multan, Rahim Yar Khan, Jahanian, Bahawalpur, Khanpur and Alipur. Seven (07) sets were received and planted on 06 locations while 2 sets (normal and late) were planted at Bahawalpur. The trial was laid out under alpha lattice design with two replications. Plot size was 6 m² while NPK fertilizer were applied @ 150-120-60 kg ha⁻¹. Four irrigations were applied at critical crop growth stages. Two genotypes BF-1807 and 181601 developed by this institute ranked 5th and 9th with an average yield of 4538 and 4429 kg ha⁻¹ respectively on 29 locations in all over Punjab. Average grain yield in kg ha⁻¹ of top 10 genotypes over 06 locations in Southern Punjab is given as under:

Genotypes	RARI BWP (N)	RARI BWP (L)	Jahanian	Multan	RY Khan	Khanpur	Ali pur	Average Grain yield of 06-locations	Average Grain yield of 29-locations
HYT 70-16	6167	4250	6725	3617	6969	6843	5662	5748	4929
HYT 70-4	6000	4083	6692	4150	6192	6061	6894	5725	4662
BF-1807	5583	3917	6158	4800	6782	5629	7003	5696	4538
NW-9	5582	4083	6492	4183	6782	6220	6121	5638	4424
16FJ17	5750	4833	6533	3917	6965	5199	5662	5551	4484
181601	5163	4017	6450	4458	6994	6276	5356	5531	4429
NR 549	6000	3667	6700	3579	4878	6486	7045	5479	4590
V-17055	5350	3667	6492	4458	6680	6606	5050	5472	4475
NR 550	5276	4000	6617	3583	5256	6493	6274	5357	4449
V-17086	5167	3417	6283	3750	4033	6867	6274	5113	4576
FSD-08 (check)	5750	3250	5658	4750	6635	6825	4591	5351	3894

v) **NATIONAL UNIFORM WHEAT YIELD TRIALS 2019-20**

This trial was composed by National Coordinator (Wheat), PARC, Islamabad. It consisted of 60 new strains developed by wheat breeders from all over the country. This Institute planted this trial at six (06) locations in Southern Punjab i.e Multan, Rahim Yar Khan, Jahanian, Bahawalpur (Normal and Late), Khanpur and Alipur. The trial was laid out under alpha lattice design with three replications at RARI with plot size of 9 m² and two replications with plot size

of 6 m² at rest of the locations. NPK fertilizer were applied @ 150-120-60 kg ha⁻¹. Four irrigations were applied at critical crop growth stages. Performance of top five entries in kg ha⁻¹ in Southern Punjab is given as under:

Genotypes	RARI BWP (N)	RARI BWP (L)	MULT AN	RYKH AN	KHANPUR	JAHAN IAN	ALIP UR	Average of 06-locations (kg ha ⁻¹)
18	5667	4444	4222	6111	7744	6889	7322	6057
3	5667	4333	5444	6556	7200	6278	6244	5960
2	4778	4556	3778	7211	7756	6500	7011	5941
6	6000	4000	5444	5389	7767	5889	5722	5744
7	5000	4756	3778	4222	7722	7167	7311	5708

vi) **WHEAT BIO-FORTIFICATION (PARB PROJECT-904)**

There is worldwide issue of malnutrition. The wheat varieties of Pakistan contain 13-14% protein and **34-66ppm Fe & 28-46ppm Zn** in its grain, which is far less than the daily human requirement i.e. **8 -18 mg Fe & 12-16 mg Zn**. Keeping in view the issue, PARB has funded a project no. 904 aiming enhancing the contents of Fe & Zn in new perspective/ wheat varieties so that the nation could be feed with a high quality wheat. For this purpose a regular study comprising of hybridization, filial generation study and evaluation of homozygous genotypes in on station and out station yield trials were carried out during 2019-20. Targeted and random crosses of about 300 heads were attempted, out of which 140 heads were selected which will be sown in next season. Each A and B trial comprising of 20 genotypes with three different treatments (a) controlled (b) soil fertilizer application (c) foliar fertilizer application; with three replications including two checks (Zincol & Ghazi-19). The fertilizers (ZnSO₄ & FeSO₄) were applied at the rate of 10kg/ha ZnSO₄ & FeSO₄ in soil application at the time of sowing and 0.3% solution of both fertilizers at the stage of booting. The results showed that the yield and quality traits were enhanced under foliar application condition.

Yield comparison of **A-trial** (20) entries under three different treatments during year 2019-20 is given below:

Entry	T₁	T₂	T₃	Mean
BF-1901	4833	5222	4611	4889
BF-1902	4611	5056	4333	4667
BF-1903	5306	4778	4556	4880
BF-1904	5333	5222	4222	4926
BF-1905	4333	3583	4611	4176
BF-1906	4917	4361	4111	4463
BF-1907	3361	3222	3333	3306
BF-1908	4083	3792	3250	3708
BF-1909	2778	2333	3333	2815
Zincol-16	3292	4167	4833	4097
BF-1910	3750	5500	5500	4917
BF-1911	4000	3667	3833	3833
BF-1912	2278	2833	2667	2593
BF-1913	3417	3500	3000	3306
BF-1914	4472	3750	3889	4037
BF-1915	2722	3111	3333	3056
BF-1916	3250	2111	4500	3287
BF-1917	3361	3750	2667	3259
BF-1918	2889	4667	3556	3704
Ghazi-19	4750	4222	4944	4639
	3887	3942	3954	3928

These high yielder genotypes from A-trial of bio-fortification project will be sent in PUWYT 2020-21 in next year. The purpose of B trial is only for the confirmation of previous year results. The best lines from B trial (previous year A-trial) were already sent to PUWYT named BF-1807 & BF-1808. The outcome of this project is given as under:

- One genotype BF-1705 from wheat bio-fortification trial under PARB project-904 performed better in PUWYT 2018-19 were sent to NUWYT 2019-20. NUWYT results are still awaited.
- Another entry BF-1807 ranked 5th in PUWYT 2019-20 out of 50 entries. Average yield of BF-1807 in PUWYT 2019-20 was 4538 kg ha⁻¹ on 29 locations.

5.1.4. STUDY OF EXOTIC MATERIAL

Seven exotic nurseries received from National Coordinator (Wheat), NARC, Islamabad were planted at RARI, Bahawalpur. Relevant data were collected and sent back to the concerned quarter. The better performing strains were selected for further studies. Detail is given as under:

Trial Name	Total entries	Selected entries
40-ESWYT	50	10
10-HPYT	50	15
52th IBWSN	294	33
18-HTWYT	50	12
27-SAWYT	50	11
37th SAWSN	284	17
HYT-100	100	20
Total	878	118

5.1.5. WHEAT YIELD TRIALS UNDER MOISTURE STRESS

Three Regular yield trials each consisting of 14 genotypes were studied under moisture stress conditions. Plantation was done after application of soaking dose. After that no irrigation was applied while 42mm rainfall was recorded. The trials were laid out under RCBD fashion with three replications and plot size 9 m². Relevant data were recorded. Grain yield data of outstanding strains are given as under:

TRIALS	Genotypes	Grain yield (Kg ha⁻¹)
B-1	180041	2370
	180003	2148
	180053	2111
	180141	2000
	195705	2000
	Johar-16	1963
B-2	180043	2815
	180130	2815
	180004	2778
	Johar-16	2481
B-3	180005	2815
	195703	2667
	180038	2593
	180138	2593
	180055	2555
	Johar-16	2185

5.1.6. HEAT TOLERANCE STUDY IN WHEAT

The best performing wheat strains out of A and B trials, sown during 2018-19 under late conditions (mid of December 2019). The trials were laid out under RCBD fashion with three replications. Plot size of A and B trials was 6m² and 9m². Purpose of late planting was to expose maximum growth stages of wheat to high temperature. At grain filling stage, maximum temperature was touching 30° C. The results of better performing genotypes are given as under:

Trials	Genotypes	Grain yield (Kg ha⁻¹)
A 1	193811	4537
	193813	4391
	193818	4304
	Johar-16	4028
A 2	193819	4195
	193827	4031
	193832	3704
	Johar-16	3426
A 3	193843	4734
	193854	4150
	Johar-16	3935
A 4	193856	2987
	193869	2889
	193863	2600
	Johar-16	2037
A 5	193890	4028
	193883	3287
	193880	3195
	Johar-16	3148
A 6	193906	4613
	193901	4343
	Johar-16	3648
A 7	193910	3426
	193913	3380
	193915	3297
	Johar-16	3102
A 8	193931	4074
	193932	3750
	193941	3611
	Johar-16	

		3148
A 9	193945 193954 193956 Johar-16	4352 4120 3843 3111
A 10	193978 193976 Johar-16	4026 3979 3684
B 1	180007 180003 180011 Ghazi-19	3667 3407 3296 3000
B 2	195710 180025 180020 Ghazi-19	4519 4481 4444 3963
B 3	180041 195716 195711 Ghazi-19	4407 4148 4074 3444
B 4	195708 180101 180104 Ghazi-19	4667 4444 4185 3778
B 5	180125 Ghazi-19	3815 3518

5.1.7. SHUTTLE BREEDING

Normally, it takes 12 years to develop a new variety. To cut short the evolution period, off season planting is done at Kaghan. Harvested material is again planted at this institute, in normal season. Material sown during 2019-20 at Kaghan is given as under:

Generations	Entries	Entries selected
F ₂	100	62
F ₃	64	41
F ₄	50	36
Total	214	139

5.1.8. PRE-BASIC SEED PRODUCTION

18000 kg Wheat seed of different categories was produced during season. Detail is given as under:

Varieties	Seed Quantity (kg)	
	BNS	Pre-Basic
Aas-11	300	4500
Johar-16	300	4500
Gold-16	100	-
Ghazi-19	300	9000
12B-2511	4500	-
Total	5500	18000

5.2 OILSEED SECTION

5.2.1. COLLECTION AND MAINTENANCE OF GERMPLASM OF MUSTARD

180 entries of mustard were tested and maintained data regarding desirable traits that days to flowering, plant height, days to maturity and other yield components were recorded and data is as under:

Traits	Ranges
Days to flowering	47-60
Plant Height (cm)	55-120
Days to maturity	130-160

5.2.2. HYBRIDIZATION OF *Brassica juncea*

Seed of three successful crosses will be sown to grow F1 generation for further studies.

Detail of crosses is given below:

S. No.	Crosses
1	BRJ-1405×SPS-235
2	BRJ-1304× SPS-235
3	Bahawalpur Raya× SPS-235

5.2.3. STUDY OF FILIAL GENERATIONS OF *BRASSICA JUNCEA*

Following progenies with desirable characteristics were selected for further evaluation.

Generations	No. of Progenies studied	No. of Progenies studies
F1	03 Crosses	-

F2	03 Crosses	-
F3	03 Crosses	26
F4	03 Crosses	15
F5	02Crosses	10
F6	02Crosses	08

5.2.4. PRELIMINARY MUSTARD YIELD TRIAL

10 entries/varieties were tested under RCBD layout having three replications . Yield results are given below:

Varieties/strains	Seed Yield (kg ha ⁻¹)	±% over checks	
		Super Raya	Bwp Raya
BRJ-1990	1641	-8	-14
BRJ-1991	1690	-5	-11
BRJ-1992	1818	2	-3
BRJ-1993	1818	2	-3
BRJ-1994	2136	20	14
BRJ-1995	2211	24	17
BRJ-1996	1395	-27	-34
BRJ-1997	2273	28	21
Super Raya (check)	1771	-	-
Bwp Raya (check)	1876	-	-

LSD (0.05) =259.79

Strain BRJ-1997 gave maximum yield of 2273 kg ha⁻¹ followed by strain BRJ-1995 which gave yield of 2211 kg ha⁻¹.

5.2.5. REGULAR MUSTARD YIELD TRIAL

Ten entries/varieties were tested under RCBD layout having three replications. Yield results are given below:

Varieties/Strains	Seed Yield (kg ha ⁻¹)	±% over checks	
		Super Raya	Bwp Raya
BRJ-1102	2240	12	10
BRJ-1669	2011	2	0
BRJ-1775	1986	-1	-2
BRJ-1776	1916	-3	-6
BRJ-1801	1790	-9	-11
BRJ-1182	2273	14	11
BRJ-1885	2000	0.58	-1.57
BRJ-1886	1996	0.45	-1.71
Super Raya (check)	1988	-	-
Bwp Raya (check)	2031	-	-

LSD (0.05) = 272.39

5.2.6. ADVANCE MUSTARD YIELD TRIAL

Eight entries/varieties were tested under RCBD layout having three replications. Yield results are given below:

Varieties/Strains	Seed Yield (kg ha ⁻¹)	±% over checks	
		Super Raya	Super Raya
BRJ-1003	1247	-10	-15
BRJ-1665	1212	-16	-22
BRJ-1773	1427	6	1.5
BRJ-1774	1400	4	0.32
BRJ-1775	1748	49	43
BRJ-1778	1536	28	23
Super Raya (check)	1561	-	-
Bwp Raya (check)	1405	-	-

LSD (0.05) =466.76

5.2.7. MICRO YIELD TRIAL OF MUSTARD (*B. juncea*)

Twelve varieties / strains received from ORI, Faisalabad were sown under RCBD layout having three replications.

Coding	De-coding	FSD	Khanpur	Karor	Piplan	BWP	F.Jhang	Chakwal	Av.	± increase over check
1	17CBJ 007	2668	1467	1963	1481	2289	815	1556	1748	1.5
2	KJ-282	2782	1889	2148	2528	1996	588	1441	1911	11
3	RBJ-16007	1860	1578	2185	1481	1980	616	1400	1586	-8
4	RBJ-17015	1259	1437	1408	1593	1881	801	1370	1393	-23
5	17CBJ001	1069	1241	1621	1926	1974	838	1361	1433	-20
6	Super Raya (Check)	1386	1963	2395	1722	2130	1093	1361	1721	
7	BRJ-15019	2207	1678	2222	1972	1956	981	1311	1761	2
8	RBJ-17005	1909	1393	1807	1594	2039	671	1289	1529	-12
9	KJ-274	2177	1870	2037	1898	2283	1060	1222	1793	4
10	RBJ-17013	2198	1170	2049	1965	2080	704	1194	1637	-5
11	BRJ-1501	1716	1956	2646	1935	2320	796	1161	1790	4
12	17CBJ 002	2027	1226	1630	1611	2061	727	1067	1478	-16

5.2.8. MICRO YIELD TRIAL OF RAPESEED (*B. napus*)

Eleven varieties / strains received from ORI, Faisalabad were sown under RCBD layout having three replications.

Coding	De-coding	FSD	Khanpur	Karor	Piplan	BWP	F.Jhang	Chakwal	Av.	± increase over check	
										Super Raya	Chakwal Sarson
A	RBN-14017	1910	2870	2352	1546	2157	1037	1574	1979	21	18
B	RBN-1601	2398	2593	2837	2141	1969	1014	1148	2160	32	29
C	RBN-17014	1841	2148	2519	1269	2111	995	1611	1814	11	8
D	RBN-1807	2364	2352	2804	1861	1515	903	1058	1966	20	17
E	RBN-18021	2583	2407	3081	2046	2257	893	1074	2212	35	32

F	17CBN 004	1336	1481	2430	1352	1443	851	1100	1488	-10	-12
G	17CBN 007	1563	2126	2333	1426	1706	833	1100	1665	2	0
H	KN-331	1724	2022	2289	1517	1283	815	1185	1608	-1.5	-4
I	KN-338	1594	2059	2337	1704	1937	718	1500	1725	5	3
J	Super Canola (Check)	1771	2137	2685	1394	1144	671	1426	1434		
K	Chakwal Sarson (Check)	1221	2593	2567	1843	1170	634	1296	1671		

5.2.9. NATIONAL UNIFORM YIELD TRIAL OF MUSTARD

Seed of thirty five entries supplied by the National Coordinator (Oilseed), NARC, Islamabad was sown under RCBD layout having three replications. Data were recorded according to the instructions of National Coordinator (Oilseed). Performance of new line of mustard BRJ-1458 and BRJ-1405 in NUYT 2019-20 are given below:

De-coding	ARI DIK	AZRC DIK	BARI, Chakwal	NIFA, Peshawar	ORI, FSD	ORI Tandojam	RARI, BWP	Pioneer, Sahiwal	NARC, Islamabad	Mean	± increase over check	
											Super Raya	Coral-432
BRJ-1458	2169	1349	1494	2389	2473	3376	3103	2722	1089	2240	2	8
BRJ-1405	1864	1616	1872	2693	2432	3687	2520	3007	1008	2300	4	5
Super Raya (Check)	2284	1342	1258	2121	2479	3093	2872	3385	939	2197	-	-
CORAL-432 (Check)	2156	1409	1520	2417	2567	3438	2772	1671	1108	2117	-	-

5.2.10. NATIONAL UNIFORM YIELD TRIAL OF RAPESEED

21 Strain/varieties of Rapeseed received from National coordinator (oilseed), NARC, Islamabad sown under RCBD layout having three replications. Data regarding seed yield are given as under:

Entry			ARI DIK	AZRC DIK	BARI Chakwal	NIFA Peshawar	ORI FSD	ORI T.Jam	RARI BWP	NARC Islamabad	Mean
No	Coded	Decoded									
1	Can-190081	AA-131	1870	1144	2610	4333	1943	5276	1578	2247	2625
2	Can-1900892	ZCA-13	2489	2009	2356	3911	2862	5132	2006	2391	2894
3	Rap-190091	BR-8-2	1926	2329	2446	4060	2697	5237	1778	1736	2776
4	Rap-190092	RM-193-1	1822	2107	2194	3642	2227	4633	1700	1727	2507
5	Rap-190093	RR-8-1	2422	2350	2517	4178	2274	5221	2372	2162	2937
6	Rap-190094	CHS-9	2263	2137	2133	3541	2097	4482	1675	2242	2571
7	Can-1900183	HC-021C	2267	2238	2078	3947	2083	4911	2061	2401	2748
8	Can-190084	HC-022B	2852	2359	2745	3703	1302	4390	1972	2370	2712
9	Rap-190095	CHS-2	2304	2139	2378	4251	2201	5290	2036	1624	2776
10	Rap-190096	RBN-31016	2033	2031	2231	3634	1680	4442	2214	1306	2446
11	Rap-190097	RBN13017	2233	1994	2561	3330	2585	4419	1903	1405	2554
12	Rap-190098	14CBN00	2322	1789	2189	3509	1734	4327	1536	2299	2331

		9									
13	Rap-190099	16CBN007	2256	2364	2006	4233	2319	5295	1550	1510	2692
14	Rap-190100	16CBN002	2263	2536	2114	3449	1656	4237	1508	1392	2394
15	Rap-190101	HOPE-09	2174	2762	2550	4557	1988	5530	1686	2032	2910
16	Super Canola (Check)		2337	3047	2189	4255	1655	5097	1692	1032	2663
17	Hyola-401 (Check)		2326	923	2210	4334	1494	5128	2086	1459	2495
18	Can-1900185	C-1	3133	2415	2563	3388	2646	4301	1558	2714	2865
19	Can-1900186	CHYB3393T	2159	2067	2611	4095	2022	5049	2136	1973	2764
20	Can-1900187	KN-309	2500	1837	2041	3669	2155	4637	1681	1743	2533
21	Can-1900188	KN-339	2333	2320	2467	3634	1574	4406	1622	2235	2574
Mean			2299	2138	2342	3888	2057	4839	1826	1857	

5.2.11. NATIONAL UNIFORM YIELD TRIAL OF TARAMIRA

Seed of Eight strains/varieties supplied by the National Coordinator (Oilseed), NARC, Islamabad was sown under RCB layout having three replications. Data regarding seed yield are given as under:

Entry			ARI DIK	AZRC DIK	BARI Chakwal	ORI FSD	ORI T.Jam	RARI BWP	NARC Islamabad	Mean
No	Coded	Decoded								
1	Ta-19001	16CES003	949	1517	494	530	894	842	527	822
2	Ta-19002	15 CES006	921	1367	564	754	782	845	408	806
3	Ta-19003	15 CES001	907	1075	644	637	1031	767	352	773
4	Ta-19004	15 CES003	1093	975	489	1089	891	814	471	832
5	Ta-19005	15 CES002	792	1126	656	1319	1073	931	558	922
Mean			932	1212	569	866	934	840	463	

5.2.12. PRODUCTION OF PREBASIC AND “BNS” SEED OF BAHAWALPUR RAYA

For production of BNS 10 to 12 single plants of BWP-Raya true to type were selected, single row of each selected plant was sown. 24 kg BNS Seed was collected at the time of harvesting. For production of pre-basic seed of BWP-Raya, BNS seed of previous year was sown. The following quantity of category seed of BWP-Raya was produced:

Category of seed	Seed Quantity (Kg)
BNS	24
Pre-basic	80
Total	104

5.3 PULSES SECTION

5.3.1. MUNGBEAN [*Vigna radiata* L. (Wilzeck)]

i) COLLECTION AND MAINTENANCE OF GERMPLASM

Mung germplasm consisted of 39 entries which were sown following augmented design on 20.07.2019 keeping plot size of 2.4 m². The entries were harvested on 29.10.2019. 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	47	56
Days to 90% maturity	78	87
100 seed weight (g)	25	28
No. of seed per pod	10	13
Yield (Kg ha ⁻¹)	321	524

ii) HYBRIDIZATION

Two crosses were attempted during Kharif-2019 for further studies. Detail of crosses is given as under:

1. 98CM016 X NM-2006 (04 pods)
2. 3CMG507 X BRM-303 (03 pods)

iii) PRELIMINARY YIELD TRIAL

A trial of mungbean consisting of 17 entries including two checks was conducted with 03 replications with a plot size of 4.8 m². The trial was sown on 20.07.2019 and the recommended agronomic practices were followed throughout the growing season. The trial was harvested on 29.10.2019. It is evident from the results that 06 strains out yielded both the checks and 05 strains showed less yields than both the checks. The performance of strains is given as under:

Strains	Yield (Kg ha ⁻¹)	% ± Over checks	
		AZRI-M-06	NM-2011
BRM-401	678	4.3	31.1
BRM-402	667	2.6	29.0
BRM-403	648	-0.3	25.3
BRM-404	625	-3.8	20.9
BRM-405	601	-7.5	16.2
BRM-406	771	18.6	49.1
BRM-407	729	12.2	41.0
BRM-408	401	-38.3	-22.4
BRM-409	383	-41.1	-25.9

BRM-410	354	-45.5	-31.5
BRM-411	697	7.2	34.8
BRM-412	683	5.1	32.1
BRM-413	458	-29.5	-11.4
BRM-414	617	-5.1	19.3
BRM-415	321	-50.6	-37.9
AZRI-M-06 (check)	650		
NM-2011 (check)	517		

iv) **ADVANCE YIELD TRIAL**

A trial of mungbean consisting of 09 entries including 02 checks was conducted in RCBD fashion with 3 replications and a plot size of 4.8 m². The trial was sown on 20.07.2019. The recommended agronomic practices were followed throughout the growing season. The trial was harvested on 27.10.2019. Yield data showed that five strains gave higher yield than both the checks while 01 strain was low yielder than the checks. The performance of strains is given as under:

Strains	Yield (Kg ha ⁻¹)	% ± over checks	
		Azri-M-06	NM-2011
BRM-385	781	20.0	28.7
BRM-386	771	18.4	27.0
BRM-387	729	12.0	20.1
BRM-388	709	8.9	16.8
BRM-390	695	6.8	14.5
BRM-391	617	-5.2	1.6
BRM-392	521	-20.0	-14.2
AZRI-M-06 (check)	651		
NM-2011 (check)	607		

v) **ADAPTATION YIELD TRIAL**

A trial of mungbean consisting of 04 entries along with 2 checks was conducted in RCBD design with 03 replications with a plot size of 4.8m². The recommended agronomic practices were followed throughout the growing season. The trial was sown on 20-07-2019 and harvested on 29-10-2019. Three strains gave higher yield than both checks while one strain was less yielder than checks. The performance of strains is given as under:

V. Code	Yield (Kg ha ⁻¹)	% ± over checks	
		NM-2011	AZRI-06
BRM-369	585	4.5	-2.2

BRM-371	690	23.2	15.4
BRM-372	710	26.8	18.7
BRM-374	750	33.9	25.4
NM-11(Check)	560		
AZRI-M-06 (Check)	598		

vii) **NATIONAL UNIFORM YIELD TRIAL**

A trial consisting of 20 mungbean entries received from National Coordinator (Pulses), NARC, Islamabad was sown on 21.07.2019. It was laid out in RCBD with 3 replications and a plot size of 4.8 m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 20.10.2019. The yield data of trial was recorded and sent to coordinator (Pulses) and are presented as under:

Entry Name	Source	Yield (Kg ha ⁻¹)
AZRC-E2-18	AZRC-D.I.Khan	706
MH-16053	NIAB,FSD	768
13006	PRI,RARI,FSD	805
14005	PRI,RARI,FSD	803
14009	PRI,RARI,FSD	798
TM-1426	AZRI-BHAKAR	835
NCM-11-Z	PRP,CSI,NARC,ISLAMAB AD	688
TM-1627	AZRI-BHAKAR	931 (2nd)
MH-13091	NIAB,FSD	949 (1st)
MSPS-119	PRP,CSI,NARC,ISLAMAB AD	869(3rd)
TM-1418	AZRI-BHAKAR	715
AZRI-MUNG-2018	CHECK	734
NCM-13	PRP,CSI,NARC,ISLAMAB AD	775
NM-11	CHECK	811
NIFA-MUNG-6	NIFA,TARNAB,PESHAW AR	681
GV-1	ARI,MINGORA,SWAT	825

MH-16058	NIAB-FSD	692
AZRI MUNG-06	CHECK	700
NM-2011	CHECK	634
NM-06	CHECK	649

5.3.2. QUALITY SEED PRODUCTION

150 kg pre-basic seed of BWP-MUNG-17 was produced during the year 2019.

5.3.3. CHICKPEA (*Cicer arietinum* L.)

i) COLLECTION AND MAINTENANCE OF GERMPLASM

Chickpea germplasm consisted of 125 entries which were sown on 22.10.2019 according to augmented design keeping plot size of 2.4 m². The entries were kept under constant observation and similar agronomic practices were applied to all the entries. The entries were harvested on 24.04.2020. Observation regarding days taken to 50% flowering, 90% pod maturity and yield were recorded and are presented as under:



Traits	Minimum	Maximum
Plant Height (cm)	60	85
Days to 50% flowering	75	129
Days to 90% maturity	128	140
100 seed weight (g)	20	35
Pods plant ⁻¹	55	70
Seed pod ⁻¹	01	02

ii) HYBRIDIZATION

The following crosses were attempted during Rabi 2019-20. Only 3 crosses (cross No.1, 4 & 5) were successfully harvested for raising F₁ during next year.

S. No.	Name of Crosses			Successful crosses
1.	CH-51/99	x	Bhakkar-11	successful (01 pod)
2.	BRC-452	x	Bittal-16	unsuccessful
3.	BRC-390	x	Noor-09	unsuccessful
4.	BRC-395	x	Bittal-16	successful (03 pod)

5. BRC-390 x Bittal-16 successful (03 pod)
 6. Bittal-16 x BRC-474 unsuccessful

iii) **PRELIMINARY YIELD TRIAL**

17 entries selected from local germplasm including two local checks were evaluated. These entries were sown in a plot size of 4.8m² on 22.10.2019 in RCBD fashion. 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 14.04.2020. Seven promising entries were selected for future studies. The performance is given as under:

Strains	Grain Yield (Kg ha ⁻¹)	%± over check	
		BITTAL-16	BHK-2011
BRC-2013	3783	53.6	21.1
BRC-2004	3712	50.7	18.9
BRC-2003	3679	49.4	17.8
BRC-2012	3679	49.4	17.8
BRC-2006	3436	39.5	10.0
BRC-2002	3367	36.7	7.8
BRC-2001	3159	28.3	1.2
Bakkhar-11	3123		
BRC-2011	2984	21.2	-4.5
BRC-2008	2742	11.3	-12.2
BRC-2010	2665	8.2	-14.7
BRC-2005	2463	0.0	-21.1
BRC-2007	2463	0.0	-21.1
BRC-2014	2463	0.0	-21.1
Bittal-16	2463		
BRC-2009	2338	-5.1	-25.1
BRC-2015	2317	-5.9	-25.8

iv) **REGULAR YIELD TRIAL (Desi)**

A trial consisting of 08 entries including 02 checks was sown on 23.10.2019. 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 15.04.2020 and yield data of the entries were recorded. Analysis of variance of the yield data revealed significant differences among mean values of various strains and given in the following table:

Strains	Grain Yield (Kg ha ⁻¹)	%± over check	
		BITTAL-2016	BHK-2011
BRC-D-2016	2881	12.1	41.6
BRC-D-2017	2923	13.8	43.7
BRC-D-2018	2895	12.7	42.3
BRC-D-2019	2499	-2.7	22.9

BRC-D-2020	2013	-21.6	-1.0
BRC-D-2021	2235	-13.0	9.9
Bittal-16	2569		
Bakkhar-11	2034		

v) **REGULAR YIELD TRIAL (Kabuli)**

A trial consisting of 09 strains including 02 checks was sown on 23.10.2019. It was laid out in RCBD with 3 replications and a plot size of 4.8 m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 15.04.2020 and yield data of the entries was recorded. Analysis of variance of the yield data revealed significant differences among mean values of various strains. All the strains gave more yield over both the checks and are given in the following table:

Strains	Grain Yield (Kg ha ⁻¹)	%± over check	
		CM-2008	Noor-2013
BRC-K-2022	1860	-2.3	4.8
BRC-K-2023	2058	8.1	15.9
BRC-K-2024	2569	35.0	44.7
BRC-K-2025	2412	26.7	35.9
BRC-K-2026	2482	30.4	39.8
BRC-K-2027	2069	8.7	16.6
BRC-K-2028	2048	7.6	15.4
CM-2008	1903		
Noor-2013	1775		

vi) **ADVANCE YIELD TRIAL (Kabuli)**

A trial consisting of 14 entries including 02 checks was sown on 23.10.2019. 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 22.04.2020. Analysis of variance of the yield data revealed significant differences among mean values of various strains. The data are given in the following table:

Strains	Grain Yield (Kg ha ⁻¹)	%± over check	
		BITTAL-16	BHK-2011
BRC-512	2255	-5.0	-6.6
BRC-513	2430	2.4	0.6
BRC-514	2013	-15.2	-16.6
BRC-515	2463	3.7	2.0
BRC-517	2880	21.3	19.3
BRC-518	2463	3.7	2.0
BRC-519	2394	0.8	-0.9
BRC-520	2463	3.7	2.0
BRC-522	2255	-5.0	-6.6
BRC-523	2567	8.1	6.3
BRC-524	2326	-2.0	-3.7

BRC-526	2742	15.5	13.5
BITTAL-16	2374		
BHK-11	2415		

vii) ADAPTATION YIELD TRIAL (Kabuli)

A trial consisting of 09 entries including 02 checks was sown on 26.10.2019. 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. Yield data showed that 04 entries out yielded both the check varieties. Analysis of variance showed highly significant differences among the genotypes. The trial was harvested on 27.04.2020. The data are given in the following table:

Strains	Grain Yield (Kg ha ⁻¹)	%± over check	
		Bittal-16	BHK-11
BRC-501	2498	17.2	2.8
BRC-503	2498	17.2	2.8
BRC-505	2580	21.0	6.2
BRC-509	1805	-15.3	-25.7
BRC-510	2742	28.6	12.8
BRC-474	2290	7.4	-5.8
BRC-408	2117	-0.7	-12.9
Bittal-16	2132		
BHK-11	2430		

viii) COOPERATIVE YIELD TRIAL CHICKPEA (KABULI), PRI, FAISALABAD

A trial consisting of 20 entries received from Director PRI, Faisalabad was sown on 22.10.2019. 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 16.04.2020 and yield data were recorded. The compiled data were sent to Director, Pulses Research Institute, Faisalabad and results are as under:

Varieties/Lines	Code	Locations										Yield (Kg ha ⁻¹)
		PRI,FSD	PRI,FSD	PRI,FSD	NIAB	RARI	BARS	AZRI	GBRS, Kallurkot	GBRS, kallurkot	Rakhuttra	
		Normal	Zero Irri	One Irri	FSD	BWP	F. Jang	BKR	(Barani)	(Irri)		
PCK-16010	A	783	694	1054	1029	1528	671	1764	1368	1729	201	1082
PCK-16027	B	810	531	625	878	2083	681	1633	1507	2055	260	1106
CH73/13	C	806	639	861	985	2118	686	1635	1062	1795	260	1085
CH51/12	D	736	424	545	866	2194	699	1375	1389	2014	187	1043
CH69/09	E	758	441	719	887	1806	696	1550	1354	1951	271	1043
BRC408	F	552	524	757	867	2687	684	1611	1347	1819	326	1117
PCK17001	G	809	517	687	868	2187	693	1666	618	2035	458	1054
PCK17002	H	479	406	465	899	2500	663	1758	1680	1604	365	1082

TGK1508	I	600	893	802	879	2083	707	1610	1229	1274	333	1041
TGK1504	J	931	632	962	1003	2208	723	1794	1069	2083	198	1160
CH74/13	K	719	365	670	929	2243	710	1844	1472	1465	306	1072
CH72/13	L	854	611	715	912	1944	660	1554	875	1899	340	1036
PCK17018	M	649	319	469	852	2292	683	1436	1510	1743	187	1014
PCK17024	N	490	223	587	915	2326	703	1217	1406	1736	208	981
PCK17030	O	540	368	490	876	1465	676	1719	1660	2014	312	1012
CH56/12	P	549	515	715	898	1701	729	1681	868	1736	212	960
CH47/13	Q	753	413	809	910	1937	716	1646	972	1941	201	1030
TGK1503	R	861	479	757	909	2431	733	1618	896	1979	201	1086
NOOR2013	S	658	545	663	892	1826	681	1522	1417	1764	229	1020
NOOR2019	T	854	597	924	985	1910	719	1751	1042	1923	333	1104

ix) COOPERATIVE YIELD TRIAL CHICKPEA (DESI), Set-I, PRI, FAISALABAD

A trial consisting of 16 entries received from Director PRI, Faisalabad was sown on 22.10.2019. 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 16.04.2020 and yield data were recorded. The compiled data were sent to Director, Pulses Research Institute, Faisalabad and results are as under:

COOPERATIVE YIELD TRIAL Set- 1 OF CHICKPEA (DESI) RABI 2019-20															
Sr. #	Co de	Entry	PRI, Fsd	NIA B Fsd	K.K ot	AZ RI. Bkr	B.Pu r	K.Kot (Barani)	AZRI. Bkr (Barani)	K.Kot (Farmer Field)	K.Kot (Farmer Field)	Rakhut ra (Barani)	AZRI. Bkr (Farmer Field)	AZRI. Bkr (Farmer Field)	Ave. (Kg ha ⁻¹)
			1	2	3	4	5	6	7	8	9	10	11	12	
1	A	BRC-474	490	1206	1438	1819	3021	1521	560	375	382	236	664	1386	1091
2	B	TG-1427	867	1395	1826	1969	3785	1299	739	302	306	292	1142	1153	1256
3	C	Bittal-16	370	1002	2056	1821	2431	1535	744	392	431	347	760	1303	1099
4	D	TG-1430	412	1147	1670	1865	1701	1694	551	174	260	160	997	1374	1001
5	E	D-17003	774	1429	2250	1758	2951	1799	493	517	344	208	1168	1389	1257
6	F	D-17006	537	1793	2139	1976	3507	1375	682	250	299	243	1201	1299	1275
7	G	CH21/13	762	1767	2583	2069	3438	1514	580	229	319	188	751	1554	1313
8	H	CH28/13	463	1621	2069	2298	3229	1618	547	392	580	188	910	1235	1262
9	I	CH39/13	299	1250	2063	2174	2882	1576	567	524	486	181	1121	1361	1207
10	J	CH-2016	448	1012	1576	1851	3958	514	607	170	365	139	816	1301	1063

11	K	D-17015	160	1068	168 8	150 7	3229	1076	972	226	323	222	969	1357	1066
12	L	D-17019	767	1560	237 5	119 6	3576	1597	806	476	497	313	847	1167	1265
13	M	TG-1504	479	1558	170 5	171 2	2743	1306	838	292	278	271	1008	1179	1114
14	N	CH30/12	118	1248	252 8	218 2	2986	1500	721	413	413	271	1028	1278	1224
15	O	D-17028	457	1607	209 7	181 3	3576	1465	767	510	455	201	863	1516	1277
16	P	TG-1510	358	1309	186 1	207 2	2257	896	835	306	361	285	1145	1381	1089

x) **COOPERATIVE YIELD TRIAL CHICKPEA (DESI), Set-II, PRI, FAISALABAD**

A trial consisting of 16 entries received from Director PRI, Faisalabad was sown on 22.10.2019. 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 16.04.2020 and yield data were recorded. The compiled data were sent to Director, Pulses Research Institute, Faisalabad and results are as under:

COOPERATIVE YIELD TRIAL Set- 2 OF CHICKPEA (DESI) RABI 2019-20															
Sr.#	Co de	Entry	PRI, Fsd	NIA B Fsd	K. Kot	AZ RI Bkr	B.Pu r	K.Ko t (Barani)	AZRI. Bkr (Barani)	K.Kot (Farmer Field)	K.Kot (Farmer Field)	Rakhutra (Barani)	AZRI. Bkr (Farmer Field)	AZRI. Bkr (Farmer Field)	Ave. (Kg/h)
			1	2	3	4	5	6	7	8	9	10	11	12	
1	A	BRC-446	179	1406	140 3	179 1	2674	1479	840	392	444	264	1206	1035	1093
2	B	TG-1305	389	2490	167 4	229 9	2965	1403	1061	431	552	431	1653	1011	1363
3	C	Bittal-16	456	1871	180 9	205 8	2125	1222	868	354	486	326	1406	1177	1180
4	D	TG-1428	417	2229	207 6	235 8	3076	813	1060	378	396	378	1540	1135	1321
5	E	D-17002	289	2875	155 9	262 8	2674	1674	949	215	274	122	1128	1122	1292
6	F	D-17005	754	2219	147 6	213 5	2354	1958	1038	493	493	264	1476	1444	1342
7	G	CH15/13	431	1771	189 9	182 8	2500	1778	1085	396	399	385	1125	1145	1228
8	H	CH26/13	719	2073	191 0	225 3	3299	1882	1021	347	448	323	1640	1438	1446
9	I	CH30/13	753	2429	268 1	245 8	3403	1174	908	382	587	340	1567	1600	1523
10	J	CH-2016	347	1750	175 0	179 2	2833	792	1000	257	295	257	1417	1444	1161
11	K	D-17014	247	1844	159 7	209 4	2271	1104	1431	368	385	368	1034	1319	1172
12	L	D-17016	771	2017	241 0	197 6	2882	1990	1458	375	580	306	1136	1396	1441
13	M	TG-1501	166	2115	166 0	211 0	1653	1188	1388	260	295	240	1578	1410	1172
14	N	CH13/12	726	1573	156 9	180 5	2535	1396	1279	344	538	135	951	1313	1180
15	O	D-17027	424	1725	189 6	187 4	2847	1236	1431	403	410	403	1049	1528	1269
16	P	D17035	282	2371	122 2	245 8	2569	1646	1044	326	361	194	1645	1267	1282

xi) NATIONAL UNIFORM YIELD TRIAL (DESI)

A trial consisting of 14 entries received from National Coordinator (Pulses), NARC, Islamabad was sown on 02.11.2018. It was laid out in RCBD with 3 replications and a plot size of 4.8 m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 22.04.2020 and yield data of trial were recorded. This institute shared one strain name by BRC-446. The compiled data sent to National Coordinator (Pulses), NARC, Islamabad.

S.No	Code	Entries	Institute	Blight Rating	Locations ^a											Mean
					1	2	3	4	5	6	7	8	9	10	11	
1	CD19095	CH-11/12	NIAB, Faisalabad	7	629	1015	1194	2014	1425	626	1833	2117	1136	2427	2257	1516
2	CD19071	BRC-474	RARI, Bahawalpur	7	624	1886	1147	2778	794	543	1108	1549	1225	2313	2708	1516
3	CD19058	D-16029	PRI, Faisalabad	7	918	1082	1885	1632	471	673	2243	1546	979	2653	2222	1482
4	CD19080	D-15024	PRI, Faisalabad	5	656	957	1544	1806	978	600	2444	2281	1148	2139	1597	1468
5	CD19053	TG-1427	AZRI, Bhakkar	5	652	798	1545	1875	1239	628	1406	2352	1259	2465	1806	1457
6	CD19085	CH35/10	NIAB, Faisalabad	9	561	1599	1299	1910	1456	635	1215	1994	841	2681	1806	1454
7	CD19070	CH-12/12	NIAB, Faisalabad	7	705	1007	1931	1771	606	618	1958	2176	1061	2326	1806	1451
8	CD19084	D-16004	PRI, Faisalabad	7	1071	1052	1264	1944	1317	581	1396	1628	978	2250	2188	1424
9	CD19060	SL05-53	ARS, Karak	7	1126	1950	1226	2014	385	665	1715	1653	1017	2250	1597	1418
10	CD19051	CH-32/10	NIAB, Faisalabad	5	633	1213	928	1736	1417	627	1365	2304	1121	2201	2049	1418
11	CD19069	TG-1510	AZRI, Bhakkar	7	976	1132	875	1597	1354	644	1559	2469	1041	2431	1458	1412
12	CD19055	D-16003	PRI, Faisalabad	5	625	757	1170	1910	838	591	1667	2372	1043	2639	1806	1402
13	CD19088	TG1305	AZRI, Bhakkar	3	592	643	1217	1632	890	593	2403	2004	939	2472	1979	1397
14	CD19065	D-15033	PRI, Faisalabad	5	210	990	1323	1875	1274	653	1722	1956	963	2444	1632	1367
15	CD19090	CH24/11	NIAB, Faisalabad	5	304	1200	1136	1910	725	682	1868	2027	958	2347	1771	1357
16	CD19072	D-16020	PRI, Faisalabad	7	240	1048	1105	1979	1197	575	1597	2075	956	2354	1736	1351
17	CD19067	INDUS-19	CHECK	7	319	1077	1077	1875	914	535	1681	1966	1029	2181	1736	1308
18	CD19064	BRC-446	RARI, Bahawalpur	9	219	1111	1069	1694	697	663	1104	2335	897	2486	1632	1264
19	CD19076	TG-1430	AZRI, Bhakkar	7	340	913	1068	1597	803	649	1167	2141	967	2181	1764	1235
Location Mean					600	1128	1263	1871	988	620	1655	2050	1029	2381	1871	

xii) CHICKPEA NATIONAL UNIFORM YIELD TRIAL (KABULI) 2018-2019

A trial consisting of 16 entries received from National Coordinator (Pulses), NARC, Islamabad was sown on 02.11.2018. It was laid out in RCBD with 3 replications and a plot size of 4.8 m². Normal/recommended agronomic practices were applied as and when required. The trial was harvested on 22.04.2020 and yield data of trial were recorded. The compiled data sent to National Coordinator (Pulses), NARC, Islamabad.

S.No	Code	Entry Name	Institute	Blight Rating	Locations										Mean
					1	2	3	4	5	6	7	8	9	10	
1	CK19005	BRC-408	RARI Bahawalpur	9	976	1283	1090	250	760	1656	1989	852	2438	2049	1334
2	CK19022	15 KCC-112	BARI, Chakwal	7	969	1175	824	476	711	1563	2314	968	2604	1354	1296
3	CK19009	15FCK16	BARS Fatehjang	5	924	1007	1008	482	742	1424	2175	932	2479	1736	1291
4	CK19011	TGK1504	AZRI, Bhakkar	9	965	1659	1251	601	667	1146	1698	922	2389	1250	1255
5	CK19030	TGK1508	AZRI, Bhakkar	5	872	1779	740	488	742	1316	1918	906	2493	1285	1254
6	CK19001	NCK-1801	PRP,NARC, Islamabad	3	861	827	1038	499	660	1184	1731	1106	2479	2000	1238
7	CK19020	CH64/11	NIAB, Faisalabad	9	908	831	795	556	768	1611	1501	911	2479	2014	1237
8	CK19003	CH66/10	NIAB, Faisalabad	9	753	1265	831	576	779	1368	1933	863	2438	1563	1237
9	CK19007	PCK-15001	PRI, Faisalabad	9	667	1595	872	588	723	1000	1740	888	2410	1806	1229
10	CK19027	CH47/12	NIAB, Faisalabad	9	917	1701	769	507	730	1576	1054	999	2111	1736	1210
11	CK19013	Noor-2013	(CHECK)	9	674	1398	840	522	726	927	1874	931	2729	1458	1208
12	CK19025	14FCK02	BARS Fatehjang	7	764	792	847	431	784	1358	1978	1008	2306	1354	1162
13	CK19029	CH48/12	NIAB, Faisalabad	9	665	1278	949	388	698	1236	1546	885	2583	1007	1123
14	CK19015	TGK1503	AZRI, Bhakkar	9	1250	1423	738	239	679	785	1174	978	2646	1285	1120
15	CK19018	PCK-15019	PRI, Faisalabad	3	750	906	986	194	714	899	2097	1105	2326	1076	1105
16	CK19035	CH53/12	NIAB, Faisalabad	9	931	1061	918	455	731	1253	749	933	2160	1285	1048
Location Mean					865	1249	906	453	726	1269	1717	949	2442	1516	

5.3.4. QUALITY SEED PRODUCTION

300 kg basic seed of promising strain BRC-408 (kabuli), 40 kg of strain BRC-446 and 350 kg of BRC-474 was produced during the year 2019-20.

5.4 MILLET SECTION

5.4.1. Sorghum (*Sorghum bicolor L. Moench*)

i) COLLECTION AND MAINTENANCE OF GERMPLASM

31 entries of sorghum and 28 entries of pearl Millet (Bajra) were tested and maintained. Data regarding diseasable traits i.e. Plant height, days to heading, maturity and other yield components were recorded and data is as under:

Traits	Ranges
Days to heading	81-94
Plant Height (cm)	145-325
Days to maturity	125-140

ii) VARIETAL YIELD TRIAL OF SORGHUM

10 promising strain/varieties of sorghum alongwith two checks (jowar-86 and YSS-98) were tested for grain yield. The trial was sown under RCBD layout with three replications and plot size of 12m². Fertilizer @ 125-115-0 NPK kg ha⁻¹ was applied. Data regarding grain yield were recorded. The result show that the strain RARI-S-22 performed well and gave maximum yield of 2550 kg ha⁻¹ followed by RARI-S-14 which gave yield of 2378 kg ha⁻¹ are presented in the following table:

Strains	Grain yield (Kg ha ⁻¹)	± increase over check	
		Jawar-86	YSS-98
RARI-S-22	2550	38	42
RARI-S-14	2378	29	32
RARI-S-18	2233	21	24
RARI-S-17	2189	19	22
RARI-S-16	2133	15	19
RARI-S-5	1972	7	10
Jowar-86 (check)	1839	-	-
YSS-98 (check)	1789	-	-
BR-319	1768	-4	-2
RARI-S-3	1761	-4	-2

CV %age=16.35

LSD at 5% 578.15

5.4.2. Pearl Millet (*Pennisetum americanum*)

i) VARIETAL YIELD TRIAL

10 promising strains/varieties of pearl millet (Bajra) along with two checks (Barani Bajra & Cholistani Bajra) were tested for grain yield. The trial was sown under RCBD layout having three replicatios and plot size of 12m². Fertilizers @125-115-0 NPK kg ha⁻¹ was applied. Data regarding grain yield were recorded. Composit-7 gave maximum yield of 2761 kg ha⁻¹ followed by Barani Bajra which gave yield of 2461 kg ha⁻¹ are presented in the following table:

Trains	Grain yield (Kg ha ⁻¹)	± increase over check	
		Barani Bajra	Cholistani Bajra
RARI-Composit-7	2761	12	14
Barani Bajra (check)	2461	-	-
Cholistani Bajra (check)	2405	-	-
RARI-Composit-4	2378	-3	-2
MS-1	1972	-24	-22
RARI-Composit-1	1956	-26	-23
RARI-Composit-6	1917	-28	-25
RARI-Composit-5	1889	-30	-27
RARI-Composit-2	1817	-35	-32
RARI-Composit-3	1805	-36	-33

CV %age=15.51 LSD at 5% 568.35

ii) NATIONAL UNIFORM SORGHUM YIELD TRIAL

12 promising strains/hybrids of sorghum along with one check-YSS-42 received from National Coodinator (Fodder), NARC, Islamabad were tested for grain yield. The trial was sown under RCBD layout having three replications and plot size of 12m². Fertilizers @125-115-0 NPK kg ha⁻¹ was applied. Data regarding grain yield were recorded and sent to National Coordinator (Fodder), NARC,

Islamabad. The results showed that the strain GS-66 performed well and gave maximum grain yield 2938 kg ha⁻¹ followed by YSH-95 which gave yield of 2453 kg ha⁻¹ presented in the following table:

Strains	Grain yield (Kg ha ⁻¹)	± increase over check
RARI-S-22	1460	-80
MINTO	1256	-109
NADINA	1738	-51
LASSANI	1569	-67
EAGLE	2224	-18
YSH-95	2453	-7
YSH-134	1956	-34
YSH-151	1729	-52
YSH-132	2016	-30
YSS-42 (check)	2627	-
SG-87	1336	-96
GS-66	2938	12

CV %age=12.62

LSD at 5% 420.64

iii) NATIONAL UNIFORM MILLET HYBRID YIELD TRIAL

22 promising hybrids of pearl millet along with one check YBS-98 received from National Coordinator (Fodder), NARC, Islamabad were tested for grain yield. The trial was sown under RCBD layout having three replications and plot size of 12m². Fertilizers @125-115-0 NPK kg ha⁻¹ was applied. Data regarding grain yield was recorded and sent to National Coordinator (Fodder), NARC, Islamabad. The results showed that the strain HP-233 performed well and gave maximum yield of 4360 kg ha⁻¹ followed by 86M38 which gave yield of 4284 kg ha⁻¹ are presented in the following table:

Hybrid	Grain Yield (Kg ha ⁻¹)	± increase over check
Fareed-01	3678	28
Hercules	2587	-11
Shahansha	3258	13
86M20	3524	22
14RBS-01	2538	-13
HS 888	2936	2
86M38	4284	49
14RBS-05	3107	8
14RBS-02	2231	-28
KQS-HM-3	2471	-16
SM-01	2213	-29
SD-55S20	2009	-43
SD-55S90	2022	-42
SD-55S95	1707	-68
SHAHENSHA	3178	10
RARI-COMPOSIT-7	3324	15
YBS-278	3389	18
YBS-89	2840	-01
MP-24	2049	-34

AA-7868	2418	-18
YBS-98 (check)	2867	-
HP-233	4360	52

CV %age=7.96

LSD at 5% 370.61

5.5 VEGETABLE SECTION

5.5.1. COLLECTION AND EVALUATION OF ONION GERMPLASM UNDER CLIMATIC CONDITIONS OF SOUTHERN PUNJAB.

11 entries of onion were collected from VRI Faisalabad and sown under Bahawalpur conditions to check their adoptability. Randomised Complete Block Design was used with three replications and plot size was 4.88 x 1.52 sq m. Phulkara variety was used as a check.

The results indicated that variety Mirpur Khaas was top in yield with 19.4 t/hac. bulb yield followed by Robina with 17.7t/ha. among all tested entries. The same two varieties also exhibited highest Av. bulb weight of 77g and 71g respectively. These results clearly indicated that highest yield in these varieties was directly due to bulb size. Sets harvested of these entries have been stored and will be planted in next season for further testing/utilisation in breeding regime.

5.5.2. 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=180 kg), Turnip (var. Golden ball=34 Kg , var. purple top=132 Kg) , Redish (var. mino= 13 Kg and var. 40-days= 325 kg), Okra (var. Sabaz Pari= 85 kg) and onion (var. phulkara =65 kg) pure seed was produced.

5.6 AGRONOMY SECTION

5.6.1. EFFECT OF VARIOUS IRRIGATION LEVELS ON GROWTH AND YIELD OF COTTON CROP (*Gossypium hirsutum* L.)

This trial was conducted to evaluate the effect of various irrigation levels on the performance of two cotton varieties. The experiment was laid out in split plot arrangement with three replications and a plot size of 24m² .Fertilizer was applied at the rate of 175-90-0 NPK kg ha⁻¹. The following treatments were used in the experiment:

A. Irrigation Levels

T1=4 (1st irrigation 35 DAS and subsequent irrigations at 28 days interval)

T2=5 (1st irrigation 35 DAS and subsequent irrigations at 21 days interval)

T3=6 (1st irrigation 35 DAS and subsequent irrigations at 14 days interval)

B. Varieties

V1= IUB-13

V2= BS-18

Seed cotton yield (kg ha ⁻¹)				
Varieties	4 Irrigation (T1)	5 Irrigation (T2)	6 Irrigation (T3)	Means
IUB-13	2238	1757	1480	1825 A
BS-18	2035	1498	1036	1523 B
Means	2136 A	1628.0 B	1258 C	

LSD for irrigation @ 0.05=205

LSD for varieties @ 0.05 =168

LSD for interaction @ 0.05=290

The results revealed that 4 irrigations gave highest yield (2136 kg ha⁻¹). In case of varieties, the maximum yielding variety was IUB-13 (1825 kg ha⁻¹) while BS-18 produced 1523 kg seed cotton ha⁻¹.

5.6.2. VALIDATION OF CROP MODEL ON MUNG BEAN (*Vigna radiata*) CROP FOR MITIGATING CLIMATE CHANGE EFFECT UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to calibrate and evaluate climate model for mungbean crop under Bahawalpur conditions for further validation of data and yield forecast under changing climate scenario. The DSSAT crop growth model was used in this experiment which required various files for its simulation. The treatments included T1=No stress (Irrigation as & when required), T2=Moisture stress from blooming till complete maturity, T3=Moisture stress at seed filling stage and T4= Moisture stress from flowering to pod formation stage. It was laid out in RCBD with three replicates and a plot size of 10.8 m².

During 2019, weather file, soil profile, crop production practices (X file), time series growth rates (T file) was formed and subjected to model. The genetic coefficients are under the calibration process. However, the actual result (comparison between simulated yield and actual yield) will be analyzed during 2020.

5.6.3. EFFICACY OF WEEDICIDE FOR WEED CONTROL PRACTICES IN MUNG BEAN

An experiment was conducted to evaluate the most effective weed control method in mungbean crop. The main objective was to evaluate the efficacy of different weedicides frequently used by farmers. The experiment was laid out in RCBD with four replications and a plot size of 10.8 m². The variety tested was Bahawalpur Mung-17. The treatments were as under:

T1=control, T2=hand weeding (once), T3=pendimethyline @3 lit ha⁻¹ (pre-emergence), T4=acetachlore @2 lit ha⁻¹ (pre emergence), T5= pendimethyline @3 lit ha⁻¹ (Post- emergence), T6= acetachlore @2 lit ha⁻¹ (post-emergence), T7=lactophin @500ml ha⁻¹ (post emergence) and T8=Quizlofop p-ethyl @500 ml ha⁻¹ (post emergence)

Grain yield (kg ha⁻¹)	
Treatments	Mean
T1 Control	866.7 C
T2 Hand Weeding	1157.7 A
T3 Pendimethline Pre-Emergence	1125.9 A
T4 Aeastachlore Pre-Emergence	1049 AB
T5 Pendimethline Post-Emergence	1012.7 B
T6 Aeastachlore Post-Emergence	927.5 BC
T7 Lactophin Post-Emergence	1160.5 A
T8 Quizlofop P-ethyle Post-Emergence	1178.8 A

LSD @ 0.05= 69.5

The results revealed that effective weed control in mungbean can be obtained by using Pendimethyline (Pre emergence), Quizlofop-P-Ethyle and Lactophin (post emergence) weedicides as they are capable of controlling narrow and broad leaves of mungbean and can render higher grain yields. The maximum grain yield 1178 kg ha⁻¹ was recorded as 1178 kg

ha⁻¹ in T5 while minimum grain yield (867 kg ha⁻¹) was obtained in T6 (Control). The second most effective weedicide was Lactophin when applied after emergence of crop where the grain yield of 1160 kg ha⁻¹ was recorded.

5.6.4. GENOTYPE × ENVIRONMENT INTERACTION AND STABILITY OF SORGHUM BICOLOR LINES FOR SOME AGRONOMIC AND YIELD TRAITS IN SOUTHERN PUNJAB

The experiment was conducted to evaluate agronomic traits and stability of different sorghum genotypes. Three varieties i.e. RARI-S-14, RARI-S-22 and Jowar-86 were tested under different environmental conditions (soil and climate). The experiment was laid out in split plot arrangement with three replications and a plot size of 24m². The crop was sown at four different row spacing. The experiment was sown in normal and problematic soil at 10 days interval i.e. on 25 June and 5th, 15th and 25th July 2019. The trial was harvested on ----- The data on grain yield were recorded.

The results obtained are presented below:

Problematic Soil Grain Yield (kg ha ⁻¹)				Normal soil Grain yield (Kg ha ⁻¹)			
Sowing dates	RARI-S-14	RARI-S-22	Jowar-87	Sowing dates	RARI-S-14	RARI-S-22	Jowar-86
E1	1637	1014	968	E1	1660	1061	968
E2	1799	1476	1314	E2	2006	1799	1591
E3	1337	1222	1084	E3	1891	1637	1130
E4	1245	784	922	E4	1453	853	1107

Problematic soil

LSD for sowing date= 226

LSD for varieties= 234

Normal soil

LSD for sowing date=266

LSD for varieties =111

The results obtained depicted that sorghum grain yield was significantly affected by two soil conditions. Problematic soils gave minimum yield while normal soil was capable of producing

optimum yields. The variety RARI-S-14 was found to be the best and gave grain yields of 1245 to 1799 and 1753 under problematic and 1453 to 2006 kg ha⁻¹ under RARI-S-14 soil. The best sowing date was as 5th july.

5.6.5. EFFECT OF SPACING ON GRAIN YIELD OF NEWLY DEVELOPED MILLET STRAINS

Two locally developed pearl millet strains (Composite-1 and Composite-7) were tested under four different row spacing (30, 45, 60, 75 cm) to know their effect on the growth and final grain yield of millet crop. The experiment was laid out in split plot arrangement with three replications and a plot size of 24 m².

The results revealed that grain yield of millet strains was significantly affected by various row spacing. The maximum yield of 1286 and 1470 kg ha⁻¹ was obtained at 45 cm apart row spacing whereas the minimum yield of 773 and 831 kg ha⁻¹ was recorded under 75 cm apart rows. As far as the varieties are concerned, no significant difference was observed between the two. The detail data are given as under:

Spacing Grain yield kg ha⁻¹				
Varieties	30 cm S1	45cm S2	60cm S3	75cm S4
Comp-1	1194	1286	1064	831
Comp-7	1230	1470	1204	773

Lsd for spacing @ 0.05=69.8

Lsd for varieties @ 0.05 =168.5

5.6.6. SOWING DATE TRIAL ON RAYA STRAINS/VARIETIES

The experiment was conducted to find the most suitable planting time for the maximum production of locally developed Raya strains. The experiment followed split plot arrangement with three replications and a plot size of 10.8m². The experiment was sown on. At maturity yield data were recorded.

<u>Sowing dates/Seed yield kg ha⁻¹</u>				
Varieties	01/10	15/10	1/11	15/11
BRJ-1304	1821.0	2037.0	1358.0	802.5
BRJ-1405	1913.6	1944.4	1481.5	925.9
BRJ-1458	2067.9	2067.9	1728.4	1172.8
BRJ-1501	1821.0	1944.4	1913.6	1358.0

BRJ-1519	1759.3	1821.0	1543.2	987.7
Bwp raya (C)	2067.9	1913.6	1635.8	1080.2
V7 Super raya (C)	2098.8	2129.6	1574.1	1018.5

LSD for sowing= 219

LSD for Variety= 204.13

The grain yield data revealed that the most suitable sowing time for Raya strains was 15th October, which gave significantly higher grain yields, the crop sown on 1st October (1759 to 2099 kg ha⁻¹) was also statistically at par with 15th October as compared to the other sowing dates. 15 November was not suitable for achieving good yield. As far as the varieties/strains are concerned, both BRJ-1458 and BRJ-1501 produced highest yield. The minimum yield was obtained in case of BRJ-1304 and BRJ-1519.

5.6.7. ADOPTION OF NEWLY DEVELOPED WHEAT VARIETIES/STRAINS TO CLIMATIC CHANGES UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to evaluate the highly productive locally developed wheat strains and their adaptation to the changing climate conditions of Bahawalpur. The experiment was laid out in split plot arrangement with three replications and a plot size of 7.2m21.2x6m. Wheat grain yield and experimental treatments are presented below:

Wheat Grain yield kg ha ⁻¹							
Sowing dates	BF1705	172149	172185	172189	172190	Fsd-08 (C)	Ghazi-16 (C)
20 Oct	5787	4490	4166	4583	4351	3425	4768
1 st Nov	4861	2963	3379	4421	4398	2592	4305
11 th Nov	6203	4282	5046	5046	5000	4166	5601
21 Nov	4490	2129	2731	2500	2731	2129	4398
1 st Dec	4027	2407	2222	2453	2963	2083	2546
21 st Dec	3194	2314	1944	2407	2685	1875	2638
1 st Jan	3101	2222	1851	2268	2685	1527	2407
11 th Jan	2916	1851	1805	1759	2638	1574	2222

LSD for varieties/strains@ 0.05 =168

LSD for sowing dates@0.05 =240

Sowing time is one of the most important factors which influences wheat yield. The reason behind this relies on the fact that by the changing sowing date the climatic conditions like temperature, rainfall and humidity also fluctuates ultimately affecting the plant's physiological functions. The results revealed that third sowing date i.e. 11th Nov is suitable for producing maximum grain yield. The best sowing date for wheat for Bahawalpur condition can be recommended as 11th of Nov as it gave maximum grain yield. Practice of sowing wheat after December should be banned. As far as the varieties/strains are concerned, strain BF-1705 performed the best. However, FSD-08 gave minimum yield.

5.6.8. RESPONSE OF TALL WHEAT VARIETIES UNDER DIFFERENT MOISTURE REGIMES IN SOUTHERN PUNJAB

The experiment was conducted to evaluate the best possible moisture regime for various wheat varieties/strains under Bahawalpur conditions. The trial was laid out in RCBD split plot arrangement with three replications and a plot size of 12.6 m²

The experimental treatments and irrigation levels are depicted in the table below:

Irrigations	Wheat Varieties
I ₁ = 1 irrigation at 25 days after sowing (DAS)	BF1705

I ₂ = 3 irrigations at 25,80,115 days after sowing (DAS)	172185
I ₃ = 5 irrigations at 25,50,75,100 and 125 days after sowing (DAS)	172190
	Johar-16
	Fsd-08

The wheat grain yield obtained under various irrigation treatments is presented below:

Irrigations/Wheat Grain yield kg ha⁻¹

Varieties/strains	I ₁ (1 irrigations)	I ₂ (3 irrigations)	I ₃ (5 irrigations)
BF1705	5277	5555	5277
2185	4777	4833	4797
2190	4855	4888	4950
johar-16	5037	5203	5047
Fsd-08	4629	4777	4717

LSD for irrigation@0.05 =86.9
LSD for varieties@0.05 =120.4

The results clearly depicted that different irrigations significantly affected the grain yield of wheat. Maximum grain yield was obtained from all varieties when three irrigations were applied to wheat crop giving yield ranging from 4777 to 5555 kg ha⁻¹ followed by five irrigations I₃ (4717-5277). The strain BF-1705 gave best yield results of 5217-5555kg ha⁻¹ while minimum yield was obtained in case of FSD-08 (4629-4777) kg ha⁻¹).

5.6.9. EFFICACY OF VARIOUS WEEDICIDES AGAINST BROAD AND NARROW LEAF WEEDS IN WHEAT CROP

The experiment was laid out to evaluate the performance of different weedicides to control narrow leaf weeds in wheat crop under Bahawalpur conditions. The experiment was laid out in RCBD arrangement with three replications and plot size of 12.6m². The treatment details and results are given in the following table :

Grain yield (kg ha⁻¹)

Weedicides	Grain yield kg ha ⁻¹
Bromoxonil	3900A
Topic	3500B
Starin M	4000A
Trica super	3500B
Axil	4000A
Logran	3800AB
Control	2000C
Hand weeding	3500B

LSD @ 0.05=351

The results showed that different weedicides affect wheat grain yield by targeting various broad and narrow leaf weeds. Bromoxonil, Starin M and axil were best in controlling the weeds. Thus reduced competition between wheat and weeds resulted in highest wheat grain yield of 3900, 4000 and 4000 kg ha⁻¹, respectively . The least yield was obtained in case of control treatment where no weedicide or hand weeding were applied. The yield in control plot was 2000 kg ha⁻¹.

5.7 CHEMISTRY/SOIL SCIENCE

5.7.1. RESPONSE OF MUNG BEAN TO SOIL VS. FOLIAR APPLICATION OF FERROUS SULPHATE

The experiment was conducted to evaluate the response of Mung cultivar “Bahawalpur Mung-17” to soil vs. foliar application of ferrous sulphate. The RCBD arrangement was followed with six treatments and three replications with a plot size of 22.5 m². All soil application of fertilizers was applied at sowing on 09-07-2019. and foliar application was applied 40 DAS. All cultural practices and plant protection measures were adopted as per recommendations. Plant growth parameters and grain yield data were recorded upon harvesting on 25-09-2019. Soil samples were collected before sowing and after harvest from the depths of 0-15 and 15-30 cm for EC, pH, OM & NPK determination. The results showed that T₄ showed maximum yield of 1014 kg ha⁻¹ which was statistically at par with T₆, T₅, T₃ and T₁. The results revealed that T₁ was the best economical dose for this Mung cultivar (Fig. 1).

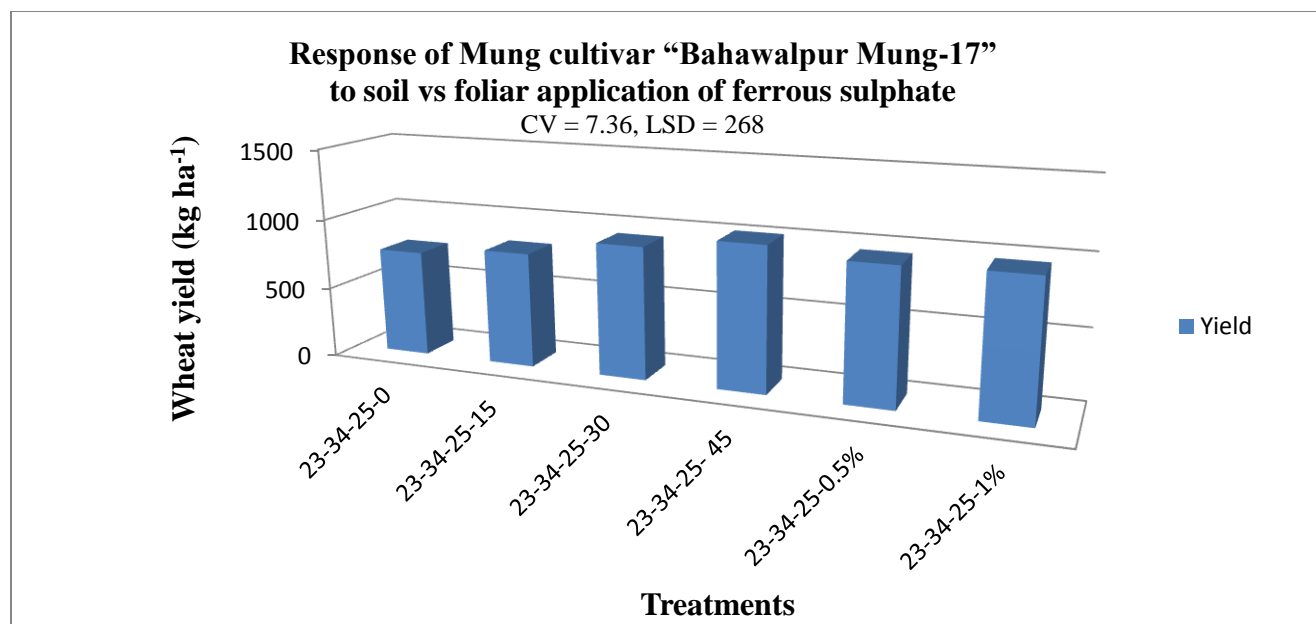


Fig. 1. Response of Mung cultivar "Bahawalpur Mung-17" to soil vs foliar application of ferrous sulphate.

5.7.2. RESPONSE OF MUNG BEAN TO SOIL VS FOLIAR APPLICATION OF ZINC SULPHATE

This trial was laid out in an RCBD arrangement with six treatments and three replications with a plot size of 22.5 m². The objective of this study was to find out the effect of zinc sulfate on the yield of Mung. All soil application fertilizers were applied at sowing on 09-07-2019 and foliar application was applied 40 DAS. All cultural practices and plant protection measures were adopted as per recommendations. Plant growth parameters were taken at different growth stages. The crop was harvested on 25-09-2019 and grain yield data were recorded. Soil samples were collected before sowing and after harvest from the depths of 0-15 and 15-30 cm for EC, pH, OM & NPK determination. The results revealed that T₄ (soil applied ZnSO₄ @ 25 kg ha⁻¹) gave maximum yield of 1001 kg ha⁻¹ which was statistically at par with all other treatments. So, the results showed that T₁ was found to be the best economical dose for this Mung cultivar as depicted in fig. 2.

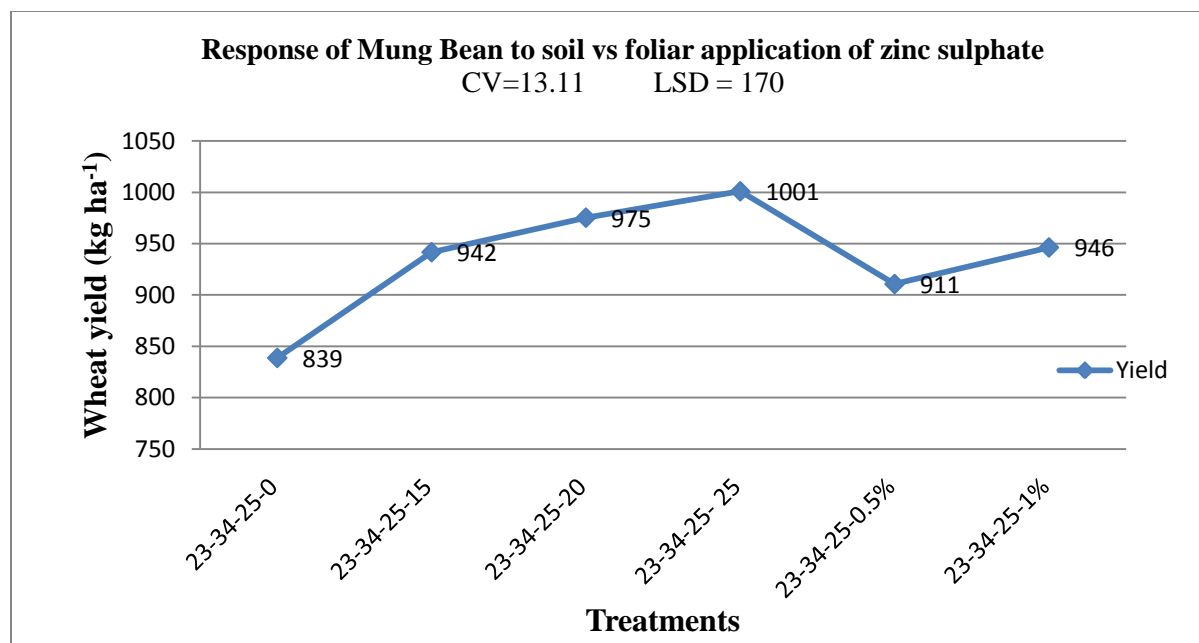


Fig. 2. Response of Mung Bean to soil vs foliar application of zinc sulphate

5.7.3. RESPONSE OF MUNG BEAN TO SULPHUR APPLICATION UNDER BAHAWALPUR CONDITIONS

This experiment was conducted with the objective to find out the effect of different doses of sulfur on Mung Bean yield. The trial was laid out in RCBD with seven treatments and three replications with a plot size of 22.5 m². The sowing was completed on 09-07-2019 and all the N, P, K, and S were applied at sowing. All cultural practices and plant protection measures were adopted as per recommendations. Yield parameters were noted at different growth stages and yield data were recorded upon harvesting on 25-09-2019. Soil samples were collected before sowing and after harvest. The data collected revealed that highest grain yield (999 kg ha⁻¹) was obtained in T₄ which was statistically at par with all other treatments. Hence, results showed that T₁ was found to be the best economical dose for this Mung cultivar (Fig. 3).

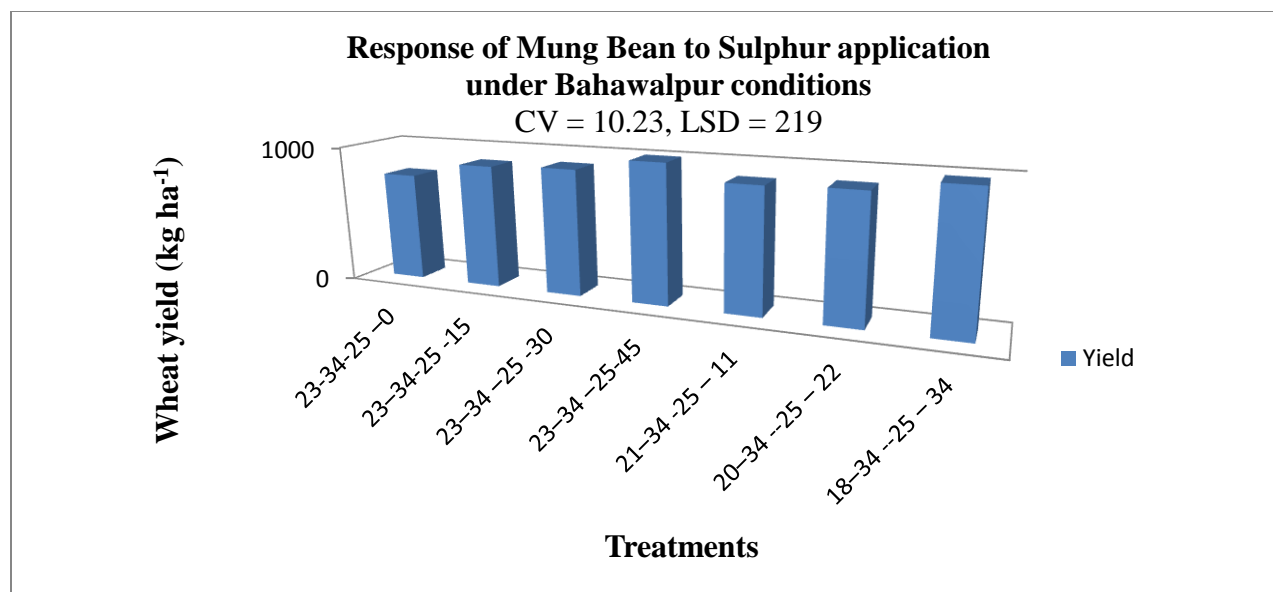


Fig. 3. Response of Mung Bean to Sulphur application under Bahawalpur conditions

5.7.4. IMPACT OF NPK FERTILIZER DOSES ON PROMISING MUNG STRAIN BRM-355 UNDER BAHAWALPUR CONDITIONS

The experiment was conducted with the objective to find out the impact of different NPK doses on Mung strain, BRM-355 under Bahawalpur conditions. The seeds were soiled on 25-07-2019 in an RCBD lay out with a plot size of 22.5 m² having three replications and eleven different nutrient combinations/treatments. All N,P and K was applied at sowing according to treatments. Cultural practices and plant protection measures were adopted as per recommendation. Pre-sowing and post-harvest soil samples were collected and analyzed. Yield data were recorded upon harvesting on 26-09-2019. The data showed that highest yield of 1008 kg ha⁻¹ was obtained in T₅ that was statistically non-significant with that of T₃, T₄, T₈ and T₁₀. Results given as under indicated that T₄ was found to be the best economical dose for this Mung bean cultivar (Fig. 4).

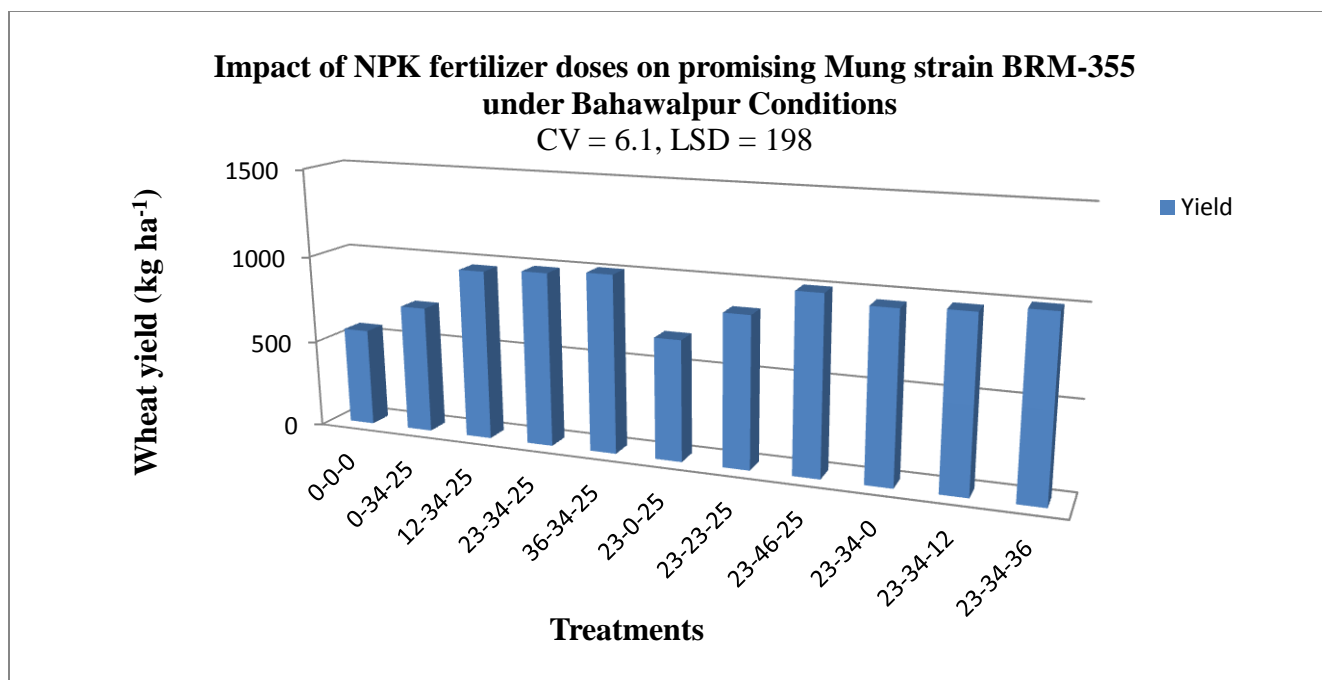


Fig. 4. Impact of NPK fertilizer doses on promising Mung strain BRM-355 under Bahawalpur conditions.

5.7.5. EVALUATION OF PROMISING MILLET STRAINS AT DIFFERENT LEVELS OF FERTILIZER UNDER BAHAWALPUR CONDITIONS

This study was conducted to evaluate the response of three Millet strains/varieties subjected to different levels of fertilizers under split plot design with a plot size of 80 m² having four treatments and three replications. All P, K and 1/3rd N was applied at sowing on 01-08-2019 according to the treatments while remaining N was applied at 1st irrigation. Pre-sowing and post-harvest soil samples were collected and analyzed. Cultural practices and plant protection measures were adopted as per recommendations. Yield data were recorded when harvesting was done on 25-11-2019. All the three strains/varieties responded positively to fertilizer doses. Maximum yields were recorded in T4 for all the strains/varieties and these were statistically at par with each other under all treatments and yields obtained in T3. Composit-7 gave higher yields (718 kg ha⁻¹) in control but in all other treatments Cholistani Bajra showed maximum yields i.e. 1166 kg ha⁻¹ in T2, 1585 kg ha⁻¹ in T3 and 1719 kg ha⁻¹ in T4 as compared to Composit-7 and Composit-4. The yields obtained in T3 and T4 are also statistically at par for all the varieties/strains. Hence, T3 was concluded as the best economical dose of fertilizer and

Cholistani Bajra as the best variety in this experiment under Bahawalpur climatic conditions (Fig. 5).

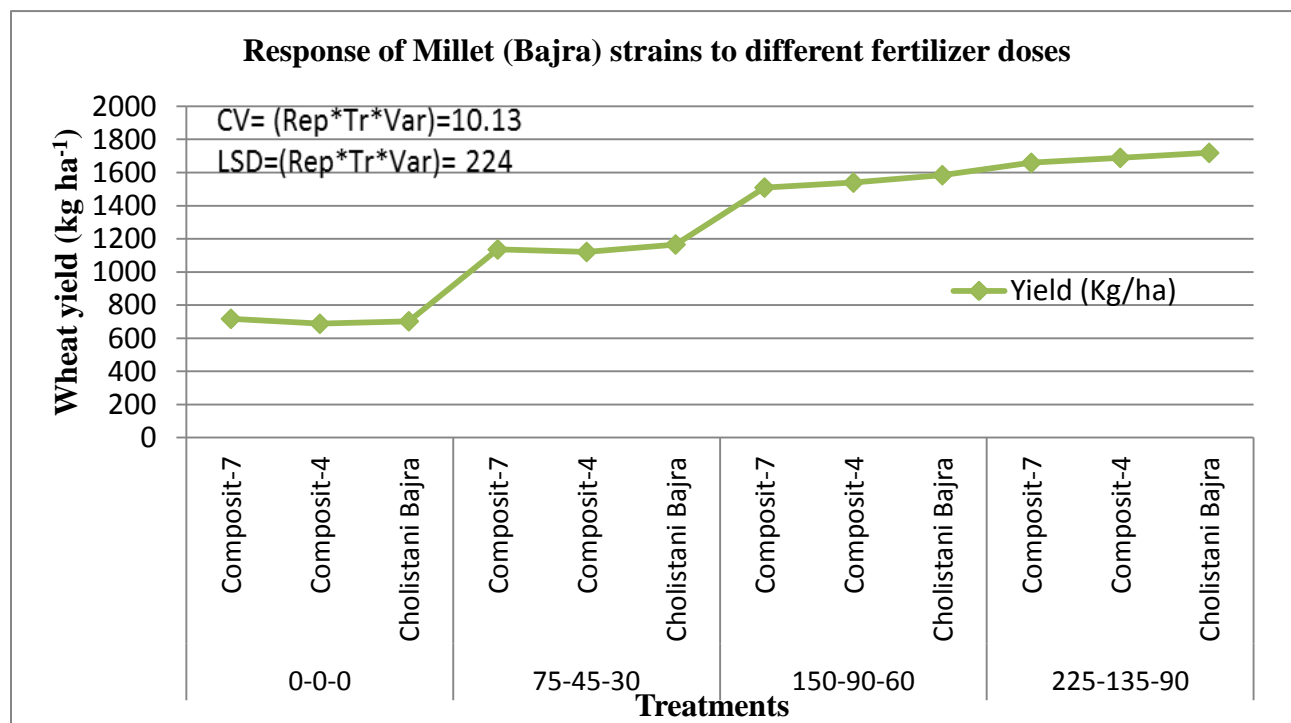


Fig.5. Response of Millet (Bajra) strains to different fertilizer doses.

5.7.6. EVALUATION OF PROMISING SORGHUM STRAINS AT DIFFERENT LEVELS OF FERTILIZER UNDER BAHAWALPUR CONDITIONS

This experiment was designed to evaluate the response of three Sorghum strains/varieties subjected to different levels of fertilizers. A split plot arrangement was followed with four treatments and three replications having a plot size of 80 m². All P, K and 1/3rd N was applied at sowing on 01-08-2019 according to the treatments and the remaining 2/3rd N was applied on 1st irrigation. Cultural practices and plant protection measures were adopted as per recommendation. Pre-sowing and post-harvest soil samples were collected and analyzed. Yield data were recorded upon harvesting on 18-12-2019. The data revealed that all the three strains/varieties responded positively to fertilizer doses. The following graph indicates that all the cultivars showed highest yields in T₄ and these were statistically at par with each other and with yields obtained in T₃. RARI-S-14 produced higher yields in all the treatments i.e. 1002 kg ha⁻¹ in control, 1555 kg ha⁻¹ in T₂, 2078 kg ha⁻¹ in T₃ and 2198 kg ha⁻¹ in T₄ as compared to others i.e. RARI-S-22 and

Jowar-86. Hence, T₃ was best fertilizer dose for all the strains/varieties under study and RARI-S-14 is the best cultivar in this comparative study under Bahawalpur conditions (Fig. 6).

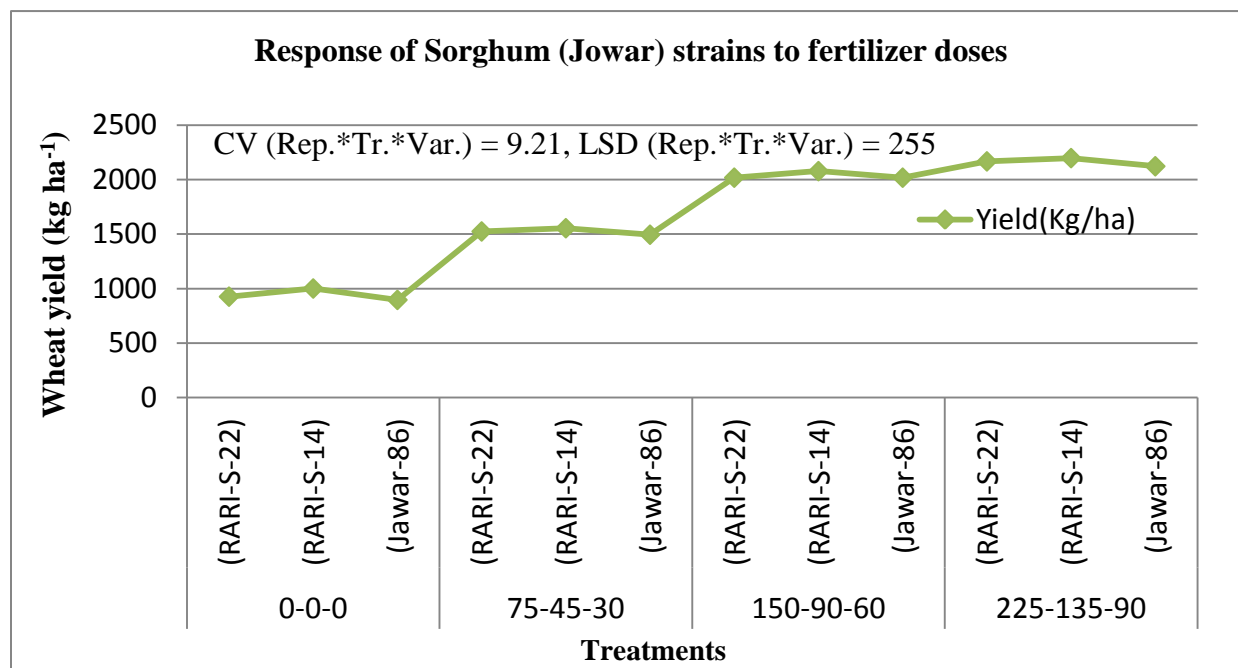


Fig. 6. Response of Sorghum (Jowar) strains to fertilizer doses

5.7.7. SCREENING OF WHEAT STRAINS AGAINST SALINITY (A HYDROPONIC STUDY, PHASE-I)

This hydroponic study was carried out in solution culture to select the resistant wheat strains against salinity. In this experiment, ten (10) wheat strains (180018, 180038, 180087, 180091, 180101, 180114, 180126, 180144, 195715 and 195719) were sown in four water tubs having different salinity levels (Fit, 5, 10 and 15 dSm⁻¹ EC water). Nursery of wheat was raised on 11-02-2020 in plastic pots having 5 kg silt per pot. Seedlings were transplanted on 03-03-2020 at two leaf stage into the tubs each of size 1m×1m×0.30m having half strength modified Hoagland's Nutrient solution (Hoagland and Arnon, 1938). Each tub contained sixty plants (2 plants per hole) having plant-to-plant and row-to-row distances of 15cm. The holes were made in thermopore sheet floating over the nutrient solution. There were three replicates of each strain in each tub. A completely randomized design was followed. Salinity levels were developed with NaCl and pH of solutions was maintained at 6 - 6.5 on daily basis. Plants were harvested on 13-04-2020 after 35 days of salinity stress. Data of growth parameters i.e. plant shoot & root length, plant shoot & root fresh and dry weights and no. of tillers were recorded. Results revealed that the strain 180126 performed the best followed

by 180018 and 195715 in respect of majority of growth parameters as compared to others at highest level of EC i.e. 15 dSm^{-1} (Fig. 7-15). These strains were selected for next phase i.e. pot experiment to be conducted in the next Rabi season.

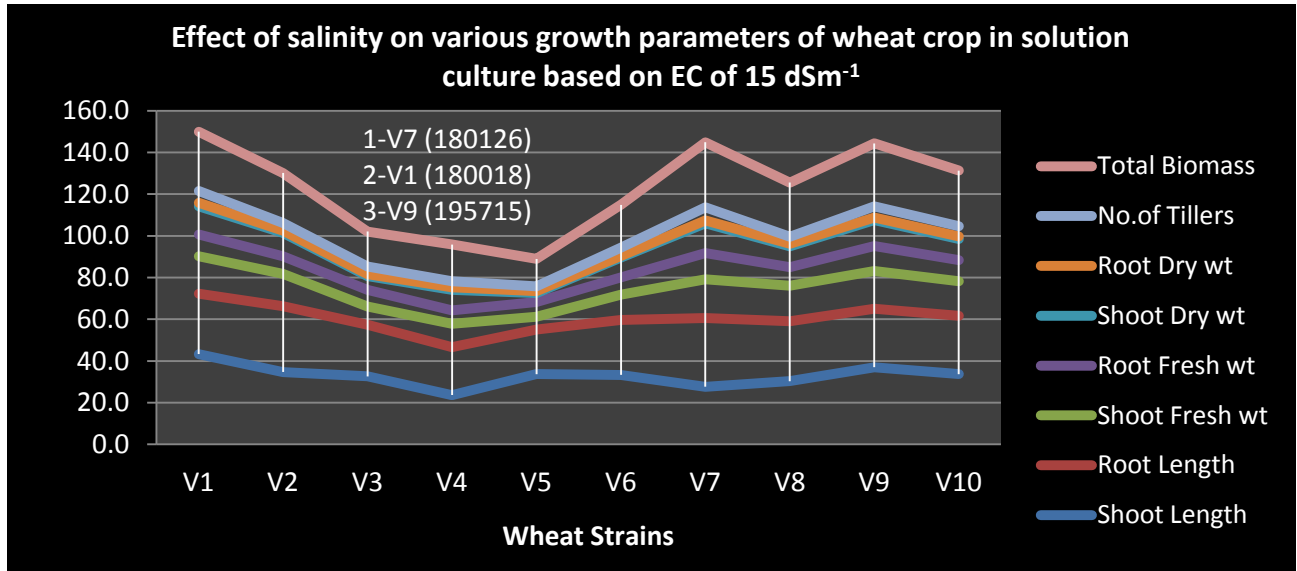


Fig. 7. Effect of salinity on various growth parameters of wheat crop in solution culture based on EC of 15 dSm^{-1}

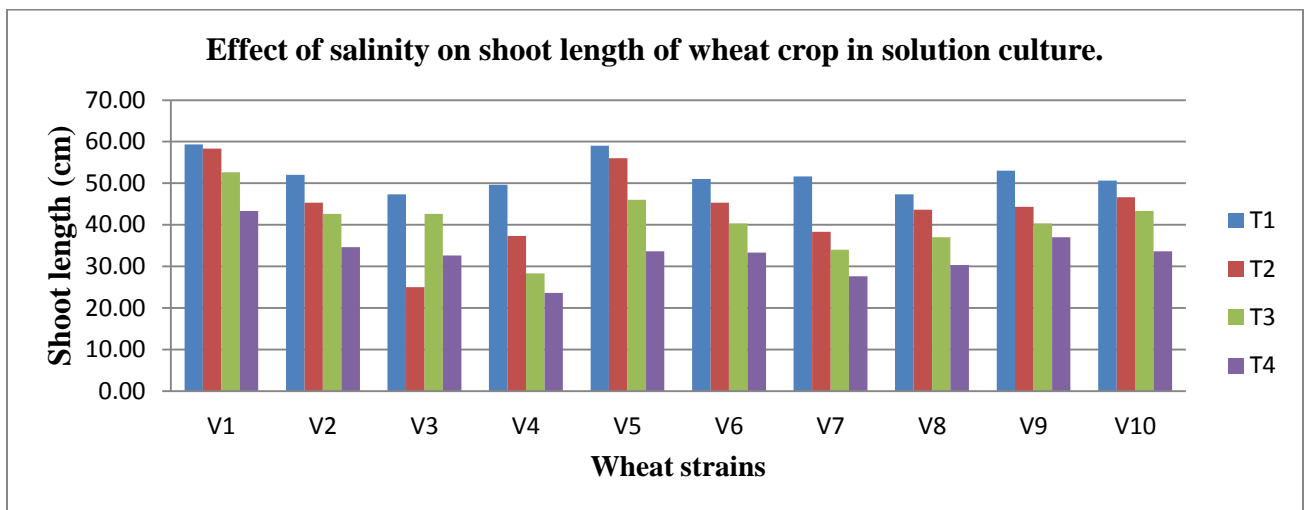


Fig. 8. Effect of salinity on shoot length of wheat crop in solution culture.

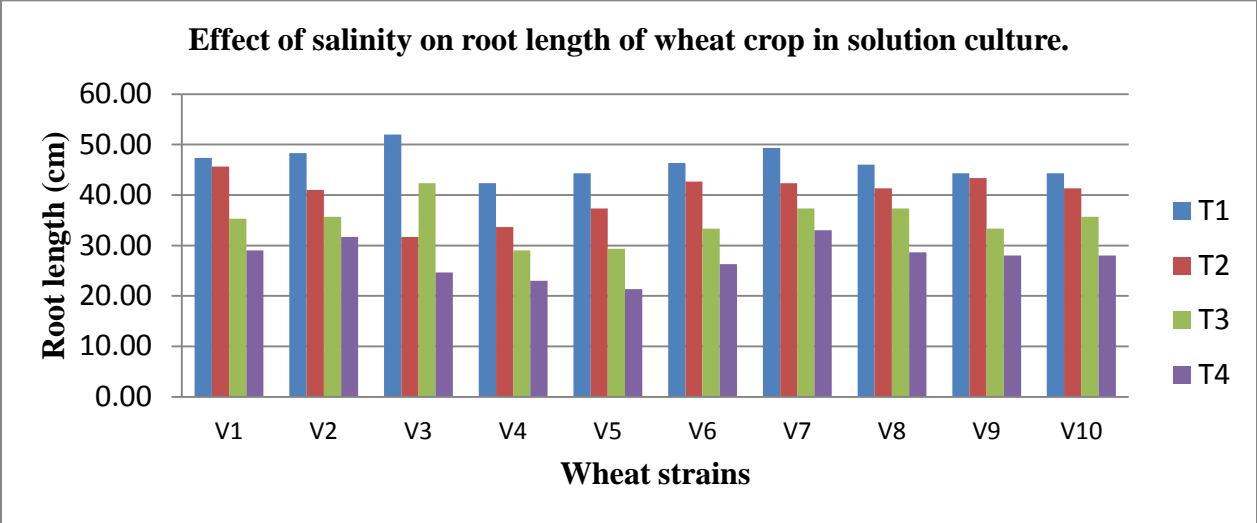


Fig. 9. Effect of salinity on root length of wheat crop in solution culture.

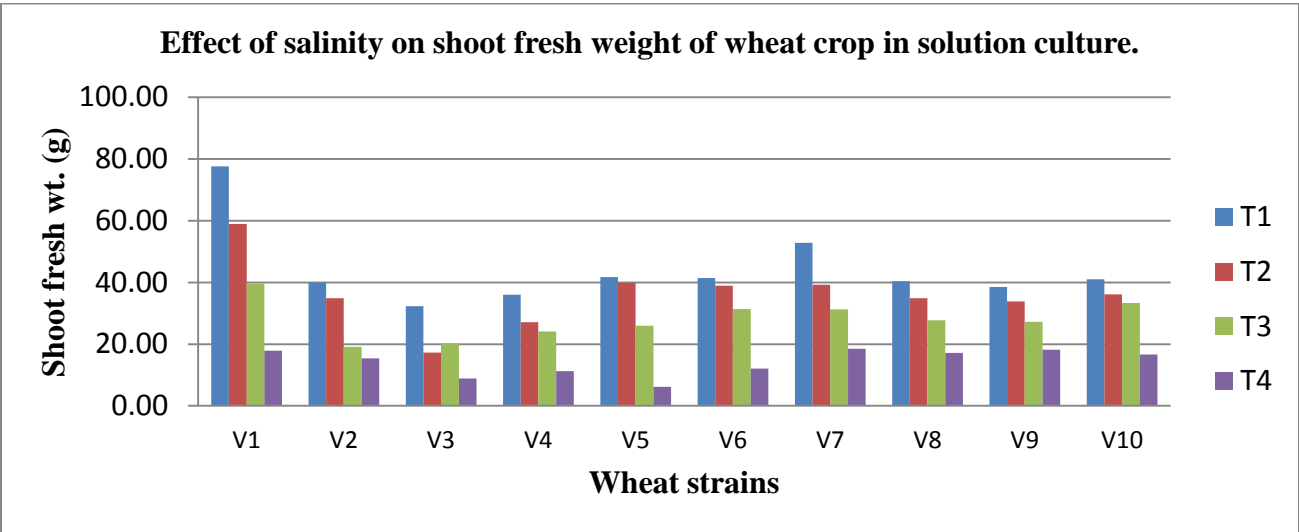


Fig. 10. Effect of salinity on shoot fresh weight of wheat crop in solution culture.

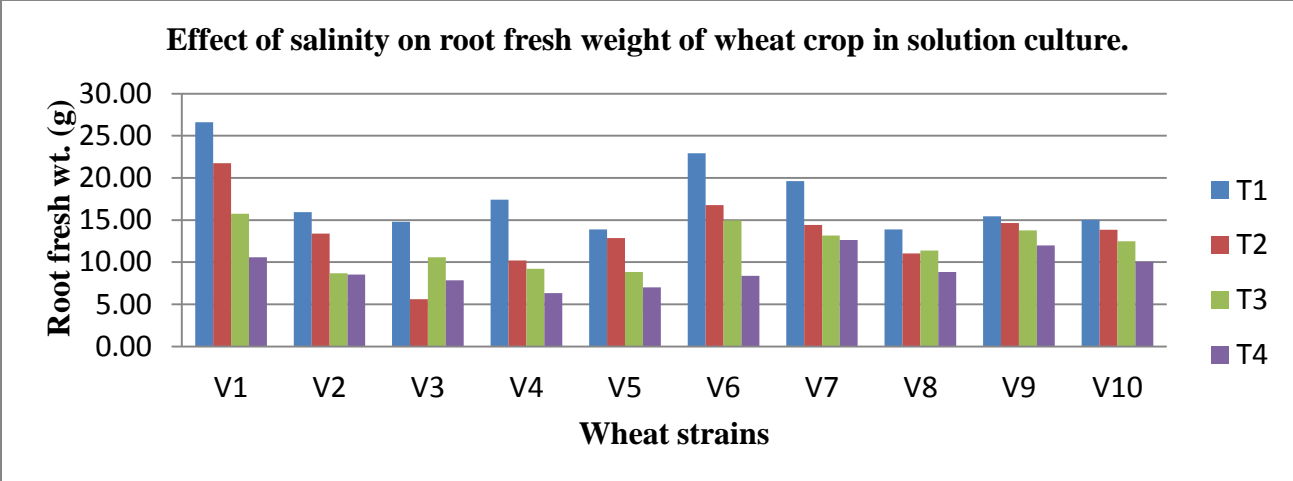


Fig. 11. Effect of salinity on root fresh weight of wheat crop in solution culture.

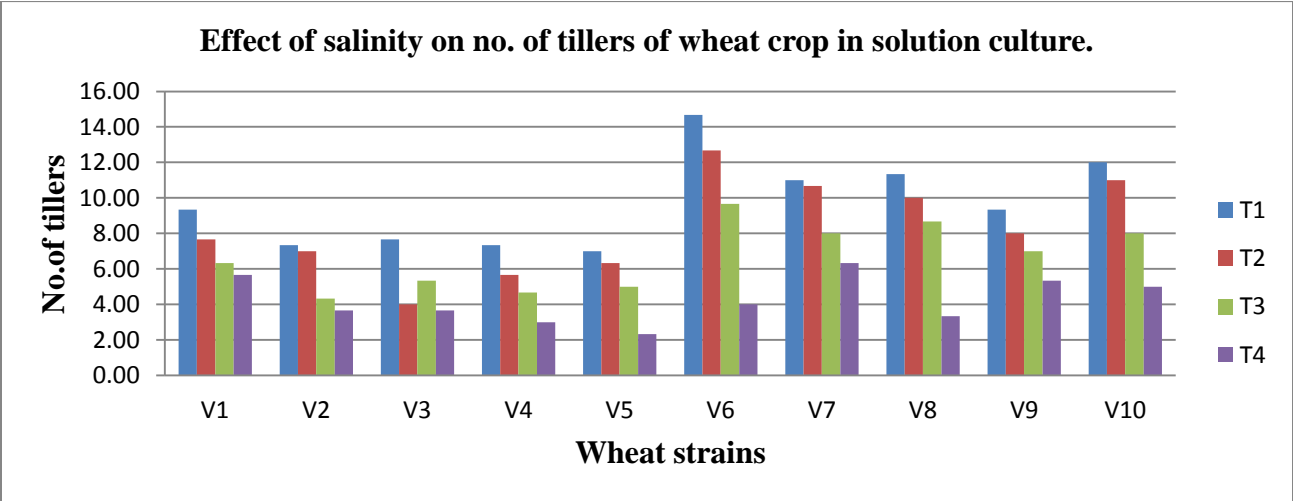


Fig. 12. Effect of salinity on no. of tillers of wheat crop in solution culture.

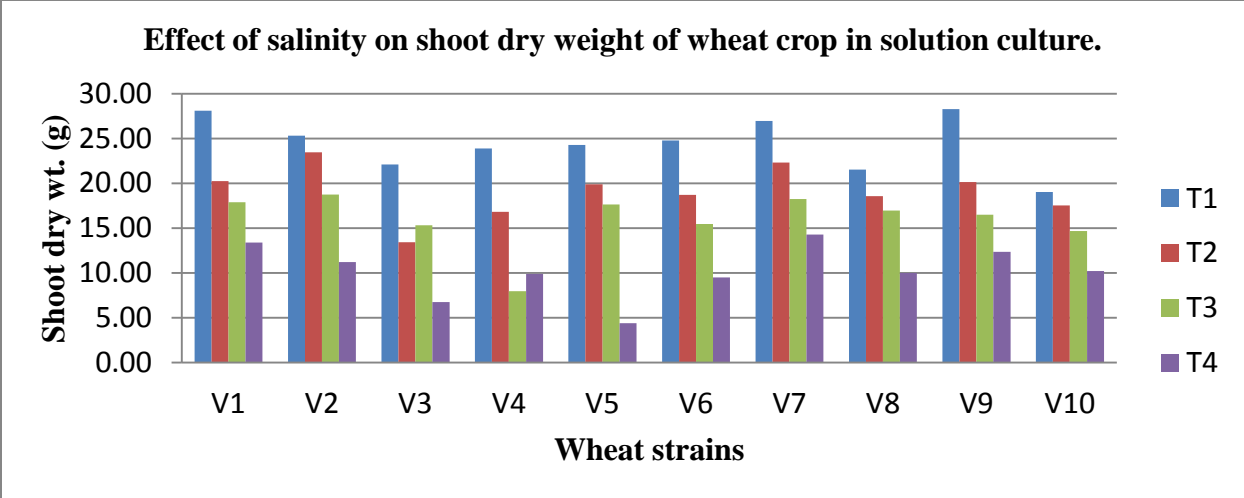


Fig. 13. Effect of salinity on shoot dry weight of wheat crop in solution culture.

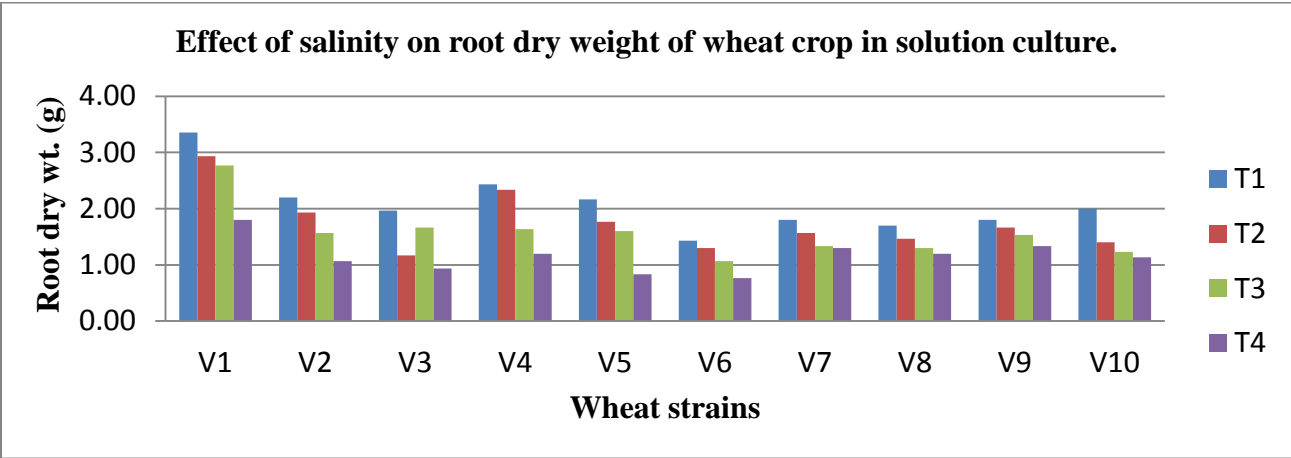


Fig. 14. Effect of salinity on root dry weight of wheat crop in solution culture.

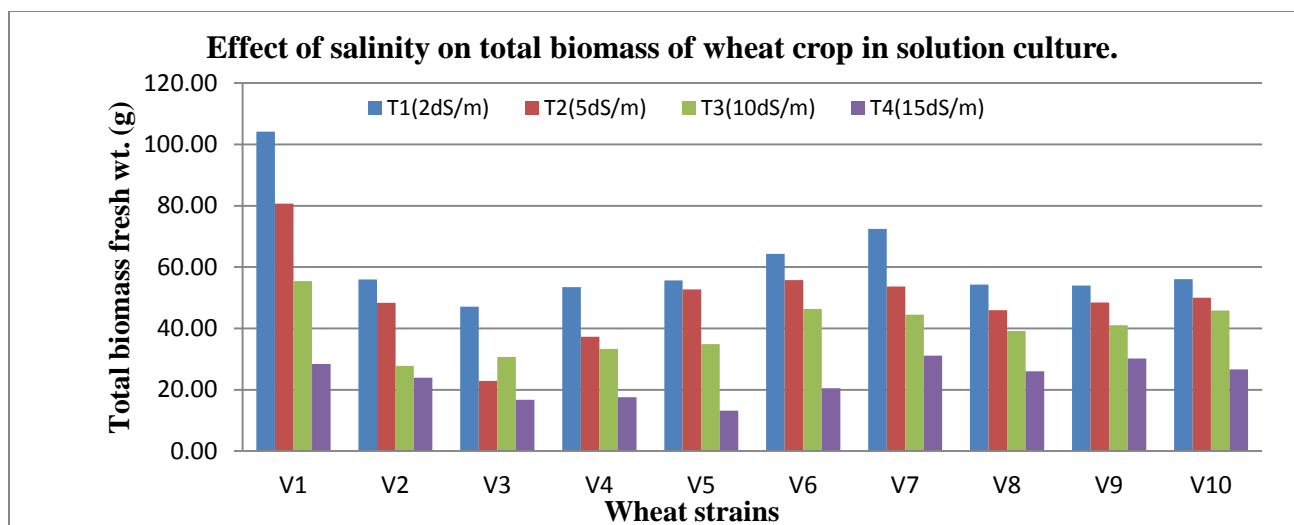


Fig. 15. Effect of salinity on total biomass of wheat crop in solution culture.

5.7.8. SCREENING OF WHEAT STRAINS AGAINST SALINITY (POT EXPERIMENT, PHASE-II)

This study was done in pots to select the resistant wheat strains against salinity which were selected as best performer i.e. BF-18-19 (1825), PUWYT-17-18 (1154) and RWYT-18-19 (V-4) in hydroponic experiment conducted during the previous rabi season i.e. 2018-19. Three wheat strains were sown on 26-11-2019 in pots following CRD arrangement with three replications and were subjected to four different salinity levels developed in 10 kg of soil in each pot i.e. 1.7, 5, 10 and 15 dSm^{-1} EC soil. The salinity was developed in pots using four salts NaCl, NaSO_4 , CaCl_2 and MgSO_4 in the ratio of 6:4:2:1. Basal dose of NP & K @ 150-120-60 kg ha^{-1} was added in each pot before sowing. The crop was harvested on 20-04-2020. The data recorded revealed that wheat strain RWYT-18-19 (V-4) showed best results regarding majority of parameters i.e. plant height, No. of tillers, spike length, total biomass, 1000-grain weight and grain yield followed by BF-18-19 (1825) and PUWYT-17-18 (1125) at highest salinity level i.e. 15 dSm^{-1} . So, strain RWYT-18-19 (V-4) showed better resistance to salinity as compared to other strains under study. (Fig. 16-22).

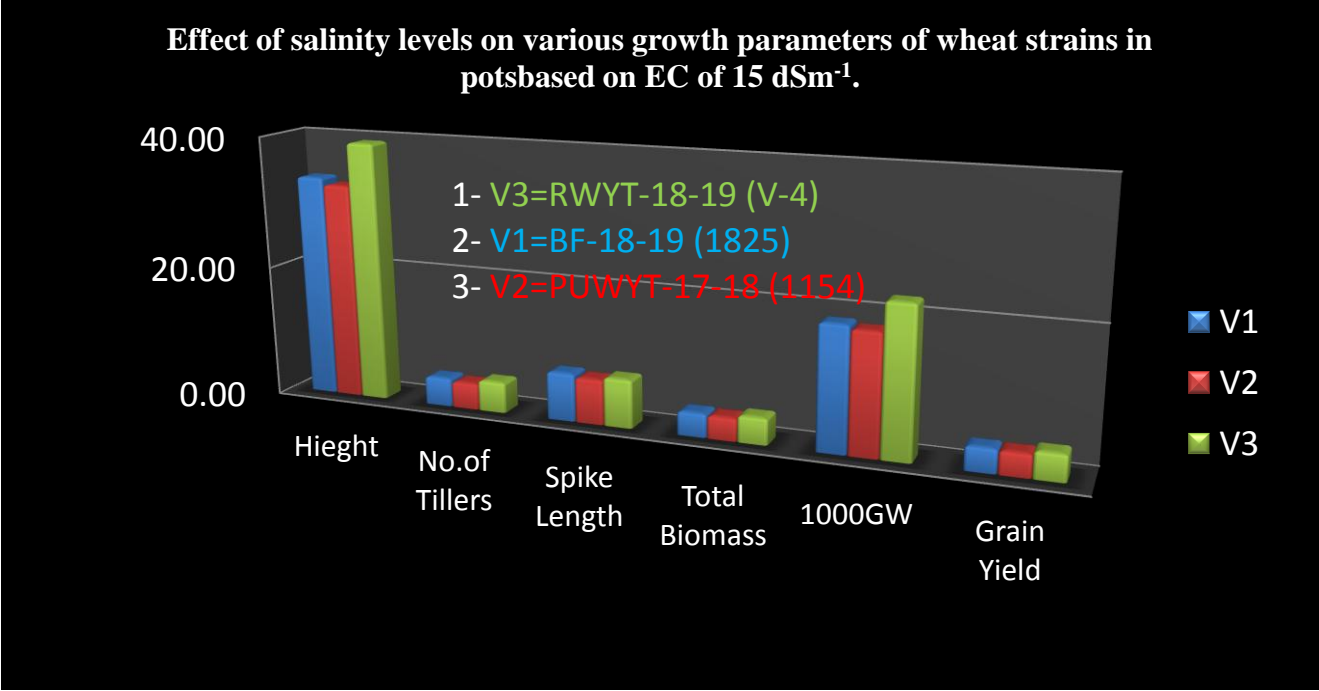


Fig. 16. Effect of salinity levels on various growth parameters of wheat strains in pots based on EC of 15 dSm⁻¹.

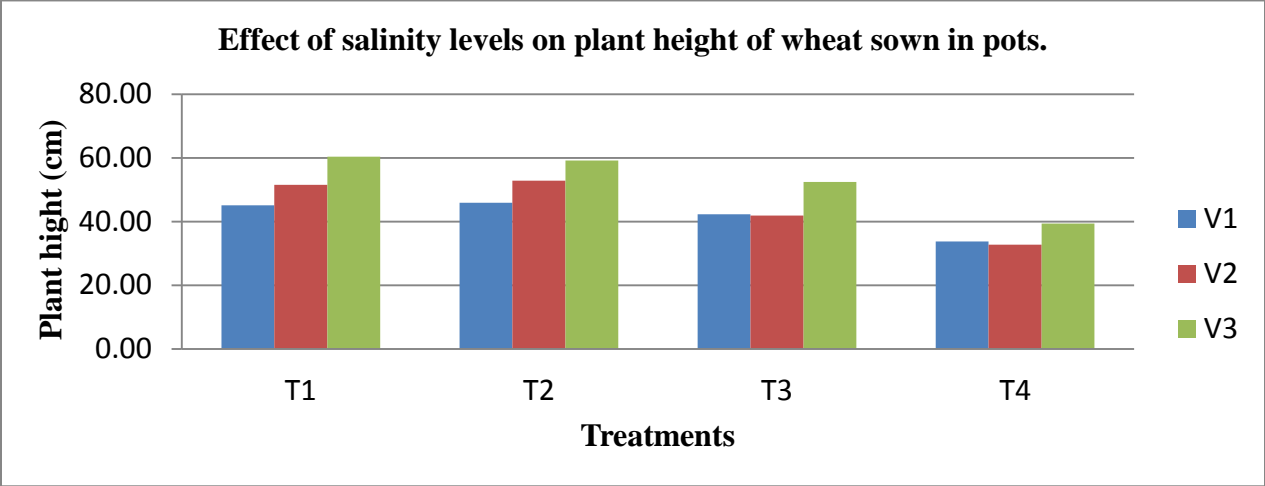


Fig. 17. Effect of salinity levels on plant height of wheat sown in pots.

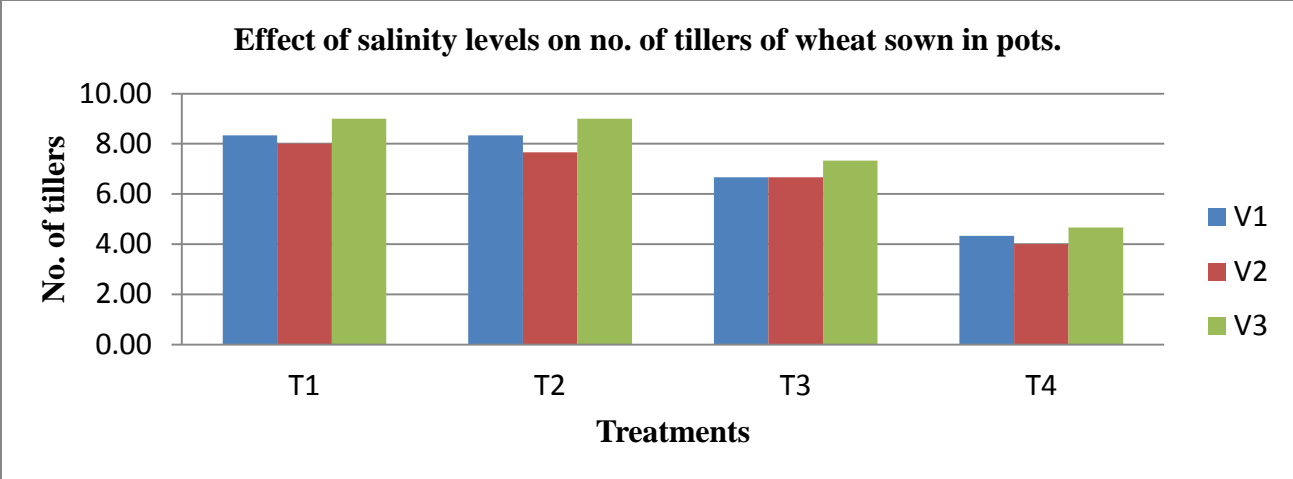


Fig. 18. Effect of salinity levels on No. of tillers of wheat sown in pots.

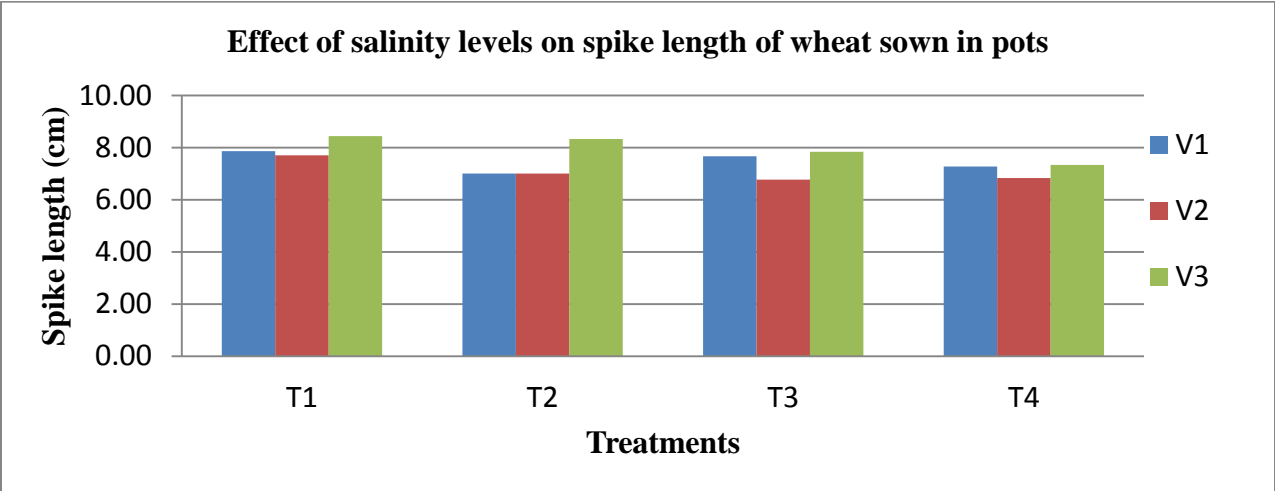


Fig. 19. Effect of salinity levels on spike length of wheat sown in pots.

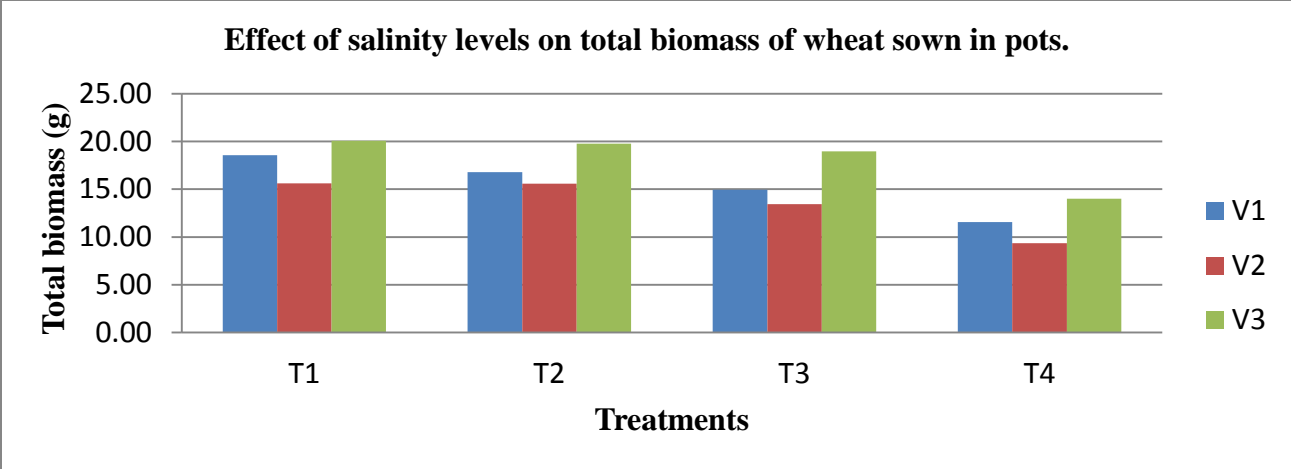


Fig. 20. Effect of salinity levels on total biomass of wheat sown in pots.

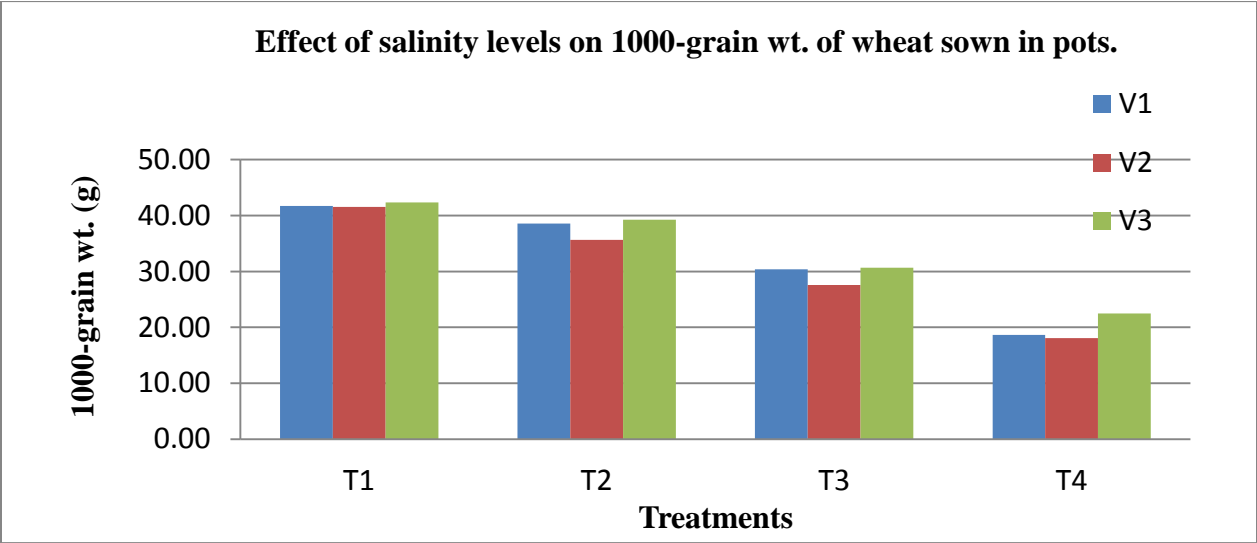


Fig.21. Effect of salinity levels on 1000-grain wt. of wheat sown in pots.

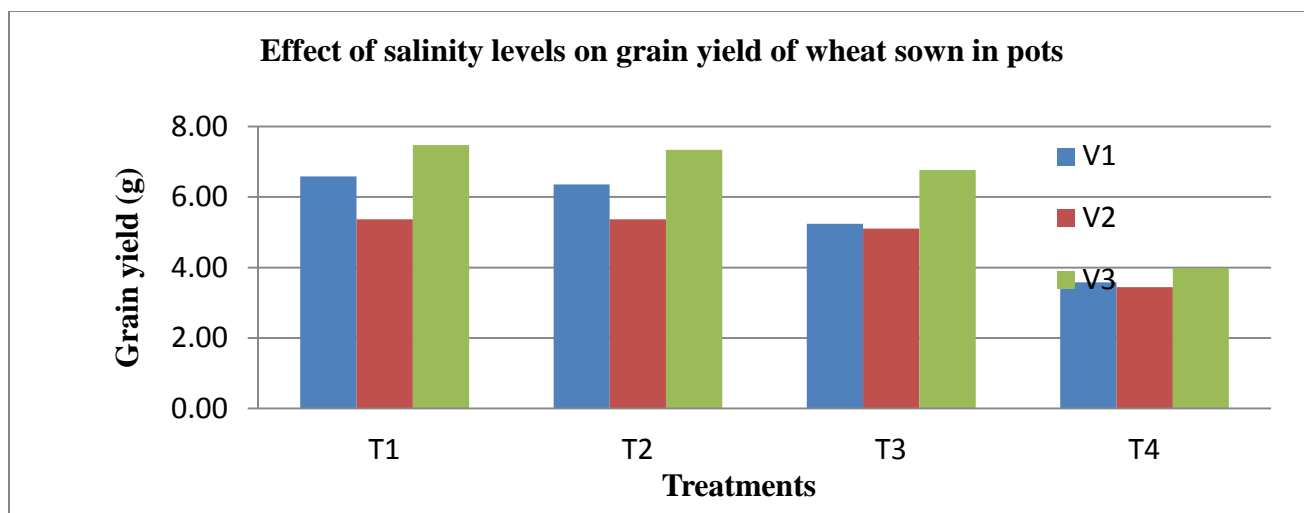


Fig. 22. Effect of salinity levels on grain yield of wheat sown in pots.

5.7.9. RESPONSE OF WHEAT TO DIFFERENT DOSES OF $ZnSO_4$ UNDER BAHAWALPUR ENVIRONMENT

This experiment was conducted to assess effect of Zinc Sulphate on the yield of Wheat crop (Johar-16). For this purpose, an experiment comprising five treatments was laid out with three replications following a RCBD layout with a plot size of 54 m^2 . All P, K, $ZnSO_4$ & half N, was applied at sowing 27-11-2019 whereas the remaining half N was applied at 1st irrigation. Data on yield parameters were recorded upon harvesting on 29-4-2020. Soil samples were analyzed before sowing and after harvesting. Maximum yield of 2870 kg ha^{-1} was obtained in T_5 which was at par with T_2 , T_3 , and T_4 treatments showing non-significant difference in yields. Minimum yield of 2511 Kg ha^{-1} was observed where no $ZnSO_4$ was applied i.e. Control. According to results obtained, T_2 was found to be the best economical dose for $ZnSO_4$ (Fig. 23).

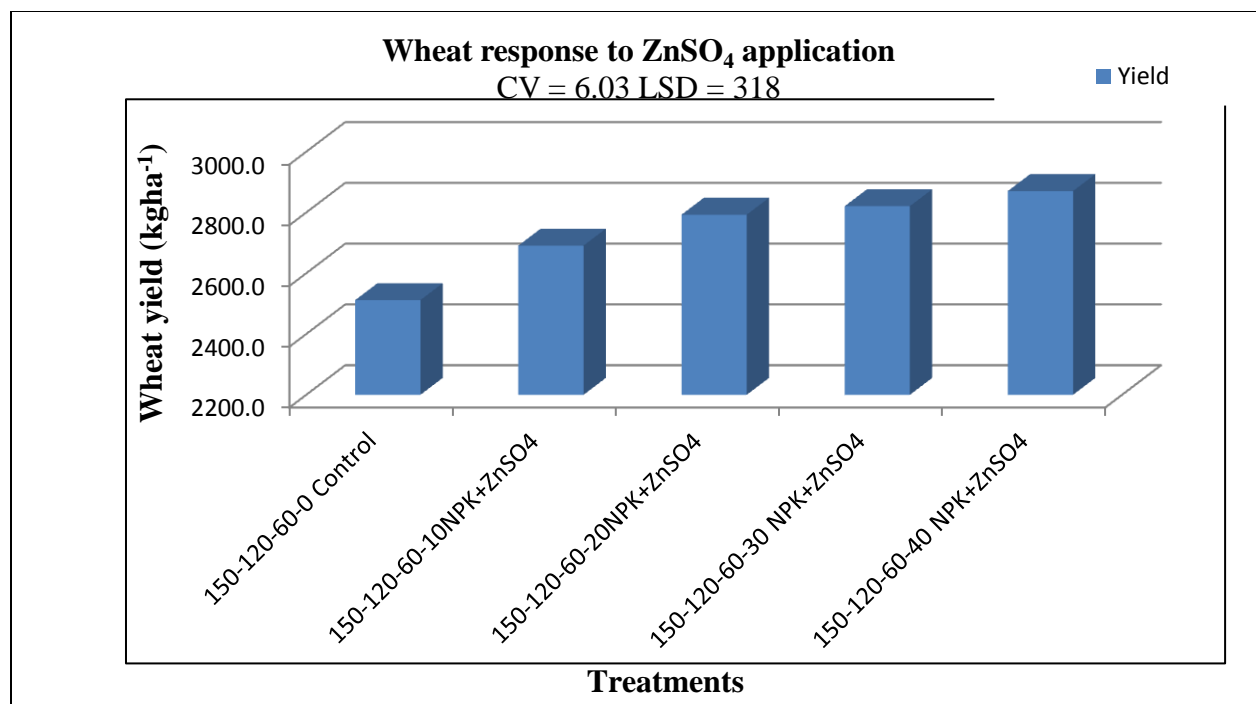


Fig. 23. Wheat response to ZnSO₄ application.

5.7.10. EFFECT OF SEED PRIMING WITH VARIOUS CONCENTRATIONS OF ZNSO₄ ON YIELD AND YIELD COMPONENTS OF WHEAT

This experiment was performed to study the effect of seed priming with various zinc concentration on yield and yield components of wheat under Bahawalpur conditions. For this purpose, six treatments with three replications were designed in a RCBD layout with a plot size of 45 m². All P, K, ZnSO₄ & half N was applied at sowing on 27-11-2019 whereas the remaining half N was applied at 1st irrigation. Data on yield parameters were recorded upon harvesting on 29-04-2020. Soil samples were analyzed before sowing and after harvesting. Results indicated that maximum yield of 3011 kg ha⁻¹ was obtained in T₆ and minimum yield was observed in control. However, the yield differences among treatments were statistically non-significant (Fig. 24).

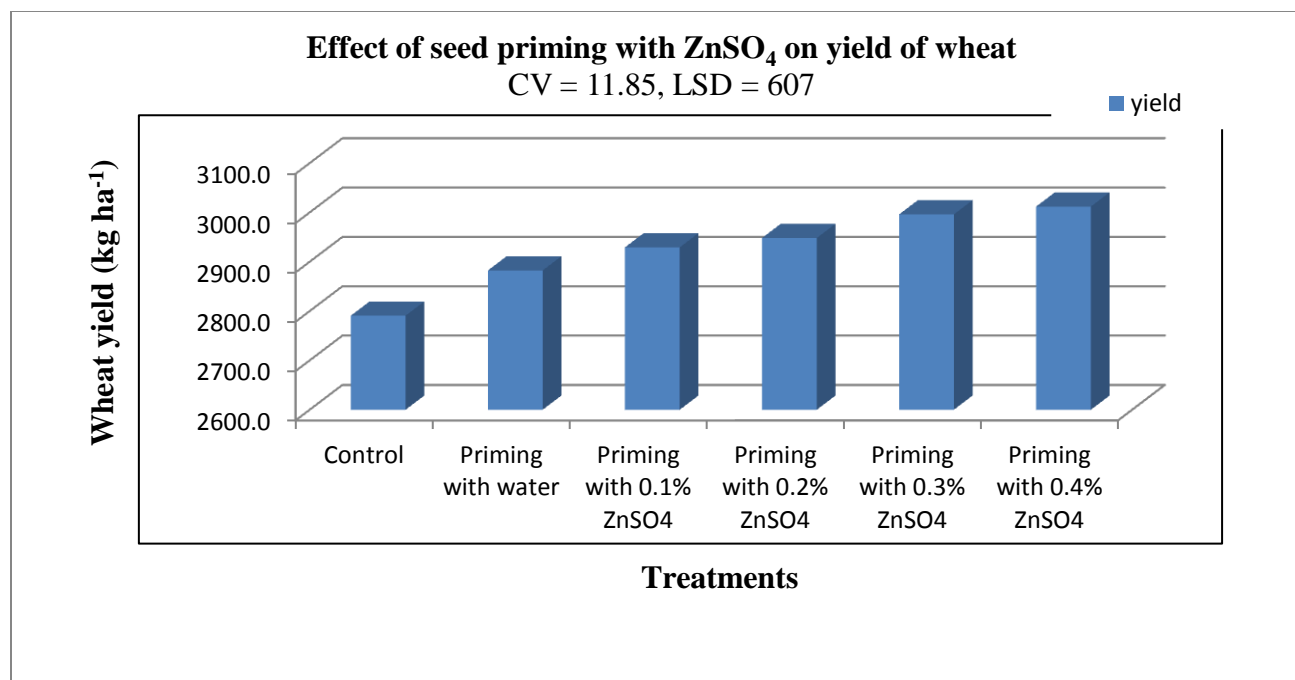


Fig. 24. Effect of seed priming with ZnSO₄ on yield of wheat.

5.7.11. EFFECT OF INTEGRATED USE OF FERTILIZER AND POULTRY MANURE ON WHEAT YIELD

The experiment was conducted to find out the low-cost substitute of N-fertilizer. Five treatments were randomized under RCBD layout having three replications with a plot size of 54 m². All P, K, Poultry manure (PM) and 1/3rd N was applied at sowing on 28-11-2019 while 1/3rd N at 1st irrigation and remaining 1/3rd N was applied at milking stage, according to the treatments. Pre-sowing and post-harvest soil samples were collected and analyzed. Cultural practices and plant protection measures were adopted as per recommendations. Data on yield parameters were recorded upon harvesting on 28-04-2020. Maximum yield of 2535 kg ha⁻¹ was obtained in T₂ where Poultry Manure @ 4 tons ha⁻¹ was applied as an alternate of N, whereas yield of 2272 kg ha⁻¹ was obtained in T₅. The yields were statistically at par with one another except control where it was 1393 kg ha⁻¹. It is obvious from this study that Poultry Manure @ 4 tons ha⁻¹ may be a complete substitute of N-fertilizer under Bahawalpur climatic conditions.

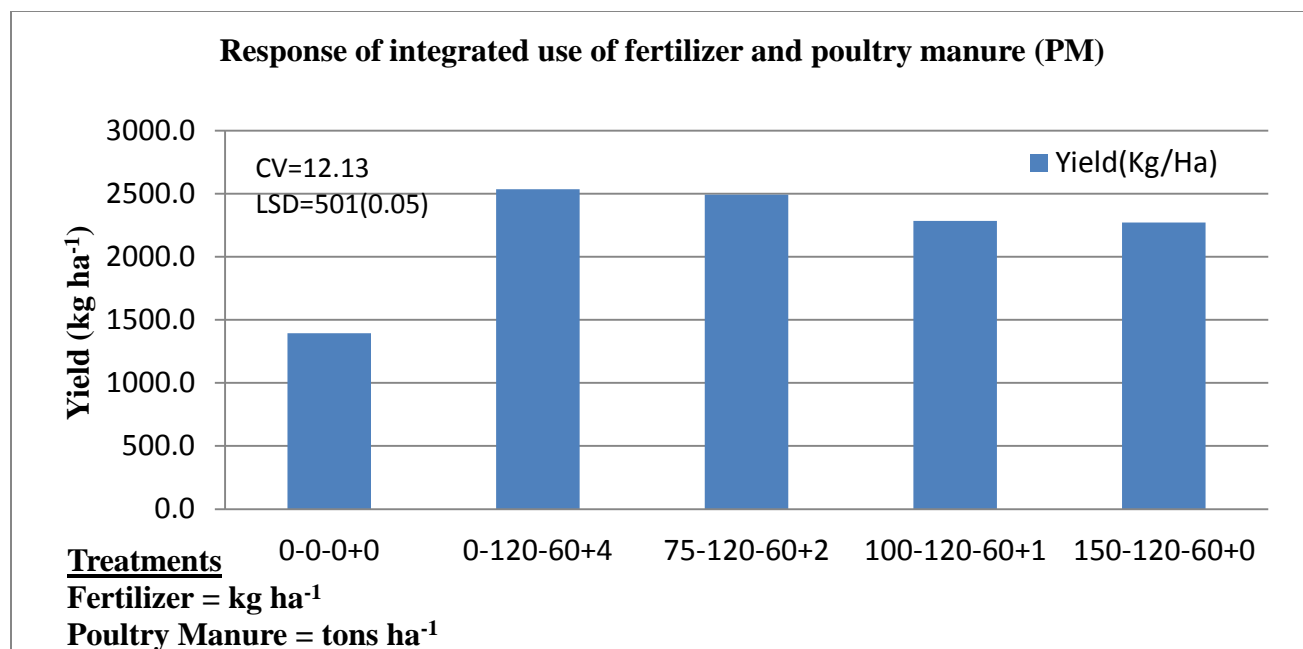


Fig. 25. Response of integrated use of fertilizer and poultry manure (PM).

5.7.12. FERTILIZER REQUIREMENTS OF PROMISING WHEAT STRAINS UNDER BAHAWALPUR CONDITIONS

The study was conducted to determine the most suitable dose of NPK for new wheat cultivars BF 1705 and BF-2190. Fertilizer was applied at deficient, adequate and excessive levels to check the response of two strains. The trial was laid out in a split plot design with a plot size of 22.5 m² with eleven treatments and three replications. All P, K & half N, was applied at sowing on 28-11-2019 whereas the remaining half N was applied at 1st irrigation. Data on yield parameters were recorded upon harvesting on 28-04-2020 . Soil samples were analyzed before sowing and after harvesting. According to results of experiment, fertilizer application increased grain yield of both strains. Maximum yield of 2765 and 2676 Kg ha⁻¹ was found in both strains in T₈ which is statistically at par with T₄, T₅ & T₁₁. So, T₄ proved to be the most economical dose with a yield of 2691 and 2616 kg ha⁻¹ for both wheat cultivars BF 1705 & BF-2190 respectively. However, BF-1705 gave the higher grain yield as compared to BF-2190 in all the treatments (Fig. 26).

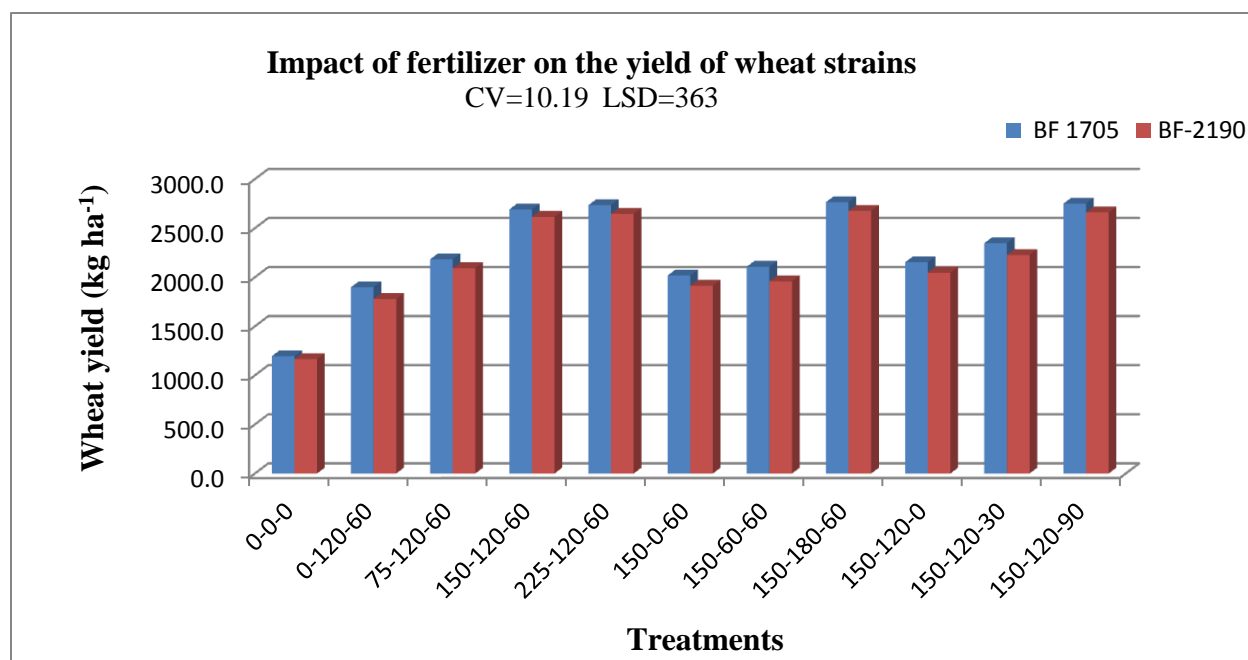


Fig.26. Impact of fertilizer on the yield of wheat strains.

5.7.13. RESPONSE CURVE STUDIES FOR NEW PROMISING RAYA STRAINS UNDER BAHAWALPUR CONDITIONS

This experiment was conducted to find a response curve of NPK for Raya crop. Newly evolved Raya strains BRJ-1304, BRJ-1405 and BRJ-1458 were tested with eleven combinations of NPK and three replications in a Split Plot Design with plot size of 49.5 m². All N, P & K was applied at sowing on 17-10-2019 according to the treatments. Cultural practices and plant protection measures were adopted as per recommendation. Pre-sowing and post-harvest soil samples were collected and analyzed. Data on yield parameters were recorded upon harvesting on 17-03-2020. The data revealed that all strains responded positively to fertilizer doses. Fig.27 shows that varieties differed non-significantly from one another in grain yield. Grain yield recorded in different varieties showed that the maximum yield was obtained from BRJ-1304 (1235 kg ha⁻¹) which was significantly higher as compared to other varieties BRJ-1405 and BRJ-1458. As far as fertilizer dose is concerned, T₈ gave maximum yield among the strains i.e. BRJ-1304, BRJ-1405 and BRJ-1458. Moreover, it was found that the results of T₈ are statistically at

par with T₄, T₅ and T₁₁. However, minimum yield was obtained in control. T₄ was concluded as the best economical dose of fertilizer for Raya crop under Bahawalpur conditions.

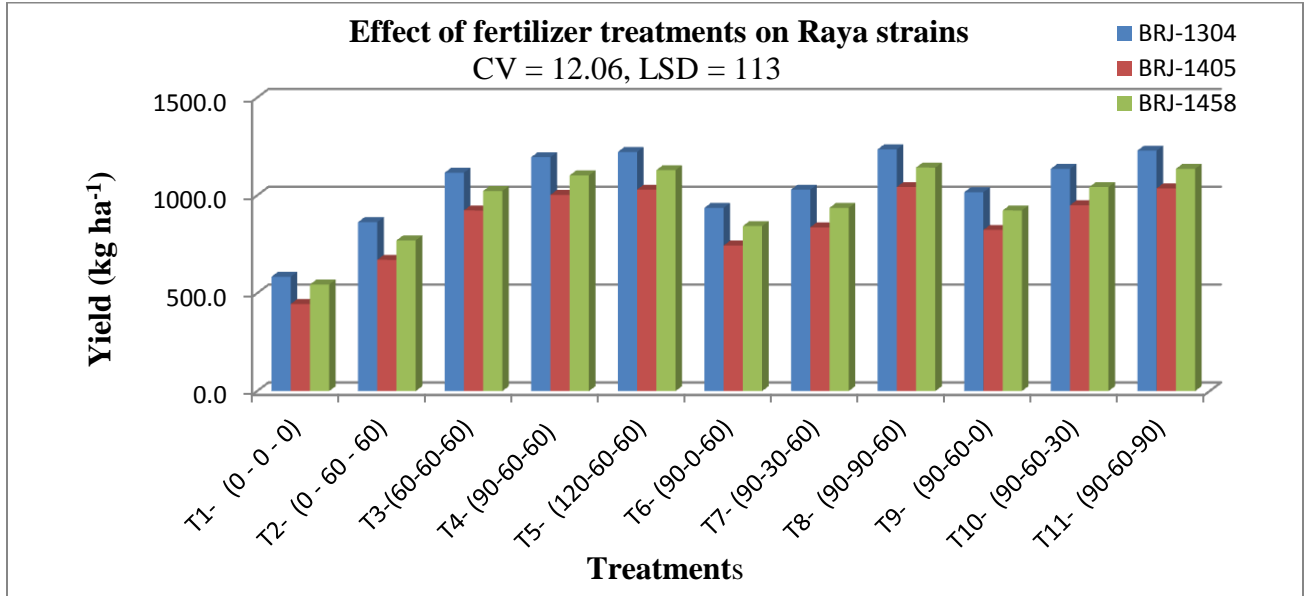


Fig. 27. Effect of fertilizer treatments on Raya strains.

5.7.14. FERTILIZER REQUIREMENT OF PROMISING DESI CHICKPEA STRAINS UNDER BAHAWALPUR CONDITIONS:

In this study, the effect of fertilizer application on Chickpea strains and the most suitable dose were investigated in field under the Bahawalpur conditions. Newly evolved Chickpea strains BRC-446 and BRC-474 were tested with five combinations of NPK in a Split Plot Design with a plot size of 27 m². All P, K and ½ N was applied at sowing on 24-10-2019 and remaining ½ N was applied at 1st Irrigation. Cultural practices and plant protection measures was adopted as per recommendations. Data on plant growth/yield were recorded upon harvesting on 14-04-2019. Soil samples were analyzed before sowing and after harvesting. The statistical analysis showed that maximum yield of 1275 and 1200 kg ha⁻¹ was obtained in T₅ which was statistically at par with T₂, T₃, and T₄ treatments. According to results obtained, T₃ was found to be the best/economical dose for chickpea. However, the yield difference between varieties was statistically non-significant (Fig. 28).

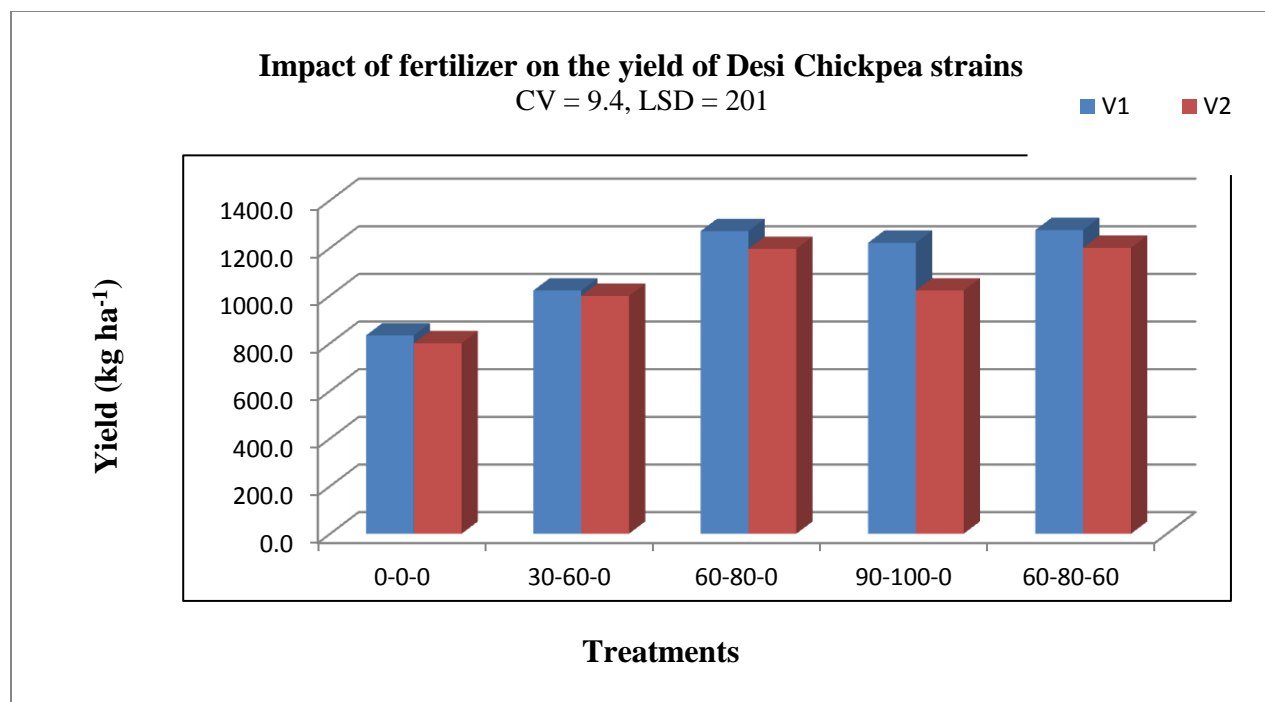


Fig. 28. Impact of fertilizer on the yield of Desi Chickpea strains.

5.7.15. FERTILIZER REQUIREMENT OF PROMISING KABULI CHICKPEA STRAINS UNDER BAHAWALPUR CONDITIONS

This experiment was conducted to find a response curve of Chickpea crop to different levels of NPK fertilizers applied. Newly evolved Chickpea strain BRC-408 was tested against five combinations of NPK in three replications following an RCBD lay out with a plot size of 22.5 m². All P, K and ½ N was applied at sowing on 24-10-2019 and remaining ½ N was applied at 1st irrigation. Cultural practices and plant protection measures was adopted as per recommendations. Data on plant growth/yield parameters were recorded on 14-04-2020 at harvesting. Soil samples were analyzed before sowing and after harvesting. The statistical analysis showed that maximum yield of 1436 Kg ha⁻¹ was obtained in T₅ which is statistically at par with T₂ and T₃, T₄ treatments. According to results obtained, T₃ was found to be the best economical dose for chickpea (Fig. 29).

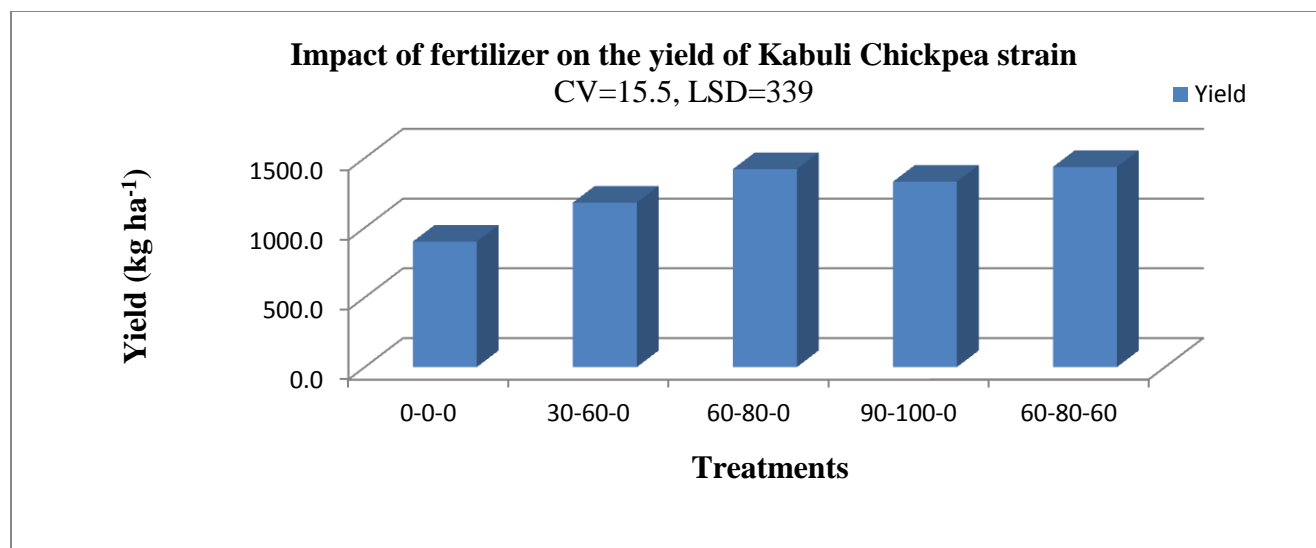


Fig. 29. Impact of fertilizer on the yield of Kabuli Chickpea strain.

5.8 PLANT PATHOLOGY SECTION

5.8.1. SCREENING OF WHEAT VARIETIES/LINES AGAINST LEAF RUST (*Puccinia recondita*) UNDER ARTIFICIAL DISEASE PRESSURE.

Two hundred and sixty (260) wheat varieties/lines received from Wheat Section and previous years selected lines were sown in one row of 2m length with 30cm row to row spacing. One parallel line of susceptible check for Leaf rust (Sahar-02) alongside of test entries was sown for equal distribution of disease for each entry. While universal susceptible check (Morocco) for all three rusts was sown all around the trial. Both checks facilitated the natural inoculum spread. The experiment was sown during normal sowing time 11.11.2019. All the test entries were inoculated by spraying fresh spore suspension of brown rust on leaves, injecting into tillers and already rust infected plants collected from September/October sown spore trap nursery were transplanted between border rows in order to achieve rapid and continuous infection of rusts in the field. Disease data were recorded by following the Modified Cobb's scale during the maximum disease appearance period. The result of Leaf Rust Disease Screening Nursery (LRDSN) is given as under:

Reaction	No. of entries	Name of promising varieties/lines
Disease free (0)	24	A3-180041, A4-180059, A5-180077 etc.
TR	30	NARC-11, Ujala-15, 17A1-180003, 17A1-180011 etc.

TS	01	17A1-180004
R	11	Durum-97, Punjab-11, Johar-16, 17B-554, 17A2-180020 etc.
MR	52	Blue Silver, Benazir-13, Bakhar-02, Fareed-06, AAS-09 etc.
MRMS	03	A9-193966, 193968 etc.
MS	27	Inqlab-91, Lasani-08, Galaxy-13, A3-180050 etc.
MSS	29	BWP-00, Iqbal-00, Millat-11, Pir-Sabak-15, Zincol etc
S	83	Lu-26, Kohi noor, Maxi-pak-65, Pak-81, BWP-97, WL-711, AS-02 etc
Total	260	

According to the results shown above, twenty four (24) were disease free, eleven (11) were resistant, thirty (30) varieties/lines showed TR response, fifty two (52) varieties/lines showed moderately resistant (MR) response and eighty three (83) varieties/lines showed susceptible (S) response.

5.8.2. SCREENING OF WHEAT VARIETIES/LINES AGAINST YELLOW RUST (*Puccinia striiformis*) UNDER ARTIFICIAL DISEASE PRESSURE

Two hundred and Sixty (260) wheat varieties/lines received from Wheat section and previous years selected lines were sown in one row of 2m length with 30cm row to row spacing. One parallel line of susceptible check for Yellow rust (Inqlab-91) alongside of test entries was sown for equal distribution of disease for each entry. While universal susceptible check (Morocco) for all three rusts was sown all around the trial. Both checks facilitated the natural inoculum spread. The experiment was sown at 11.11.2019. Test entries were inoculated by spraying fresh spore suspension of yellow rust on leaves and injecting into tillers. The diseased plants were transplanted between border rows to obtain rapid and continuous infection in the field. Disease data were recorded following Modified Cobb's Scale on the appearance of disease. The result of Yellow Rust Disease Screening Nursery (YRDSN) is given as under:

Reaction	No. of entries	Name of promising varieties/lines
Disease Free (0)	23	Pir Sabak-15, Zincol, 12B-2559, 17A1-180004 etc.

TR	34	17A1-180005, A4-180060, A9-193821, 193825 etc,
TS	00	00
R	03	A9-193838, A9-193978 etc
MR	50	Benazir-13, BWP-00, Pak-81, Iqbal-00, Uqab-00 , Derawar-97, Sehar-06 etc.
MRMS	00	00.
MS	30	Maxi Pak-65, BWP-97, Fareed-06, AAS-09, AARI-10, Punjab-11, Millat-11 etc
MSS	50	Blue silver, Punjnad-1, Chakwal-50, Borloug-16, 12B-2557 etc
S	70	Inqlab-91, Lu-26, Kohi noor, W.L-17, Bhakhar-02, AS-02, Lasani-08, Ufaq-00, NARC-11, Pakistan-13 etc
Total	260	

According to the results, twenty three (23) were disease free, thirty seven (37) fell under TR-R category, eighty (80) varieties/lines showed MS-MSS response. All well-known commercial varieties fell into susceptible (S) category.

5.8.3. SCREENING OF WHEAT VARIETIES/LINES AGAINST STEM RUST (*PUCCINIA GRAMINIS TRITICI*) UNDER NATURAL CONDITIONS

Two hundred and sixty (260) wheat varieties /lines received from Wheat section and previous years selected lines were sown in single row of 1m length with 30cm row to row spacing. One parallel line of local susceptible check for stem rust (Faisalabad-08) alongside of test entries was sown for equal distribution of disease for each entry strictly under natural condition. While universal susceptible check (Morocco) for all three rusts was sown all around the trial. Both checks facilitated the natural inoculum spread. The sowing was done on 04.12.2019. Stem rust did not appear on any entry during the whole crop period.

5.8.4. DETERMINATION OF KARNAL BUNT (*TILLETIA INDICA*) IN WHEAT SEED LOTS COLLECTED FROM FARMER FIELDS

Sixty five (65) wheat seed samples were collected during 2020 harvest season from different seed lots at farmer's field. These were tested to examine karnal Bunt spores in wheat seed samples on the basis of soaking method. Wheat seed samples are soaked in 0.2% NaOH solution for 24 h at 20°C. Disease data were recorded by calculating the Coefficient Infection

(CI) of infected seeds. Observations of the disease incidence were recorded on healthy and bunted grains basis by following disease rating scale of Aujla *et al.*, 1989.

The results of farmers seed lots samples for karnal bunt disease are given as under:

CI (coefficient of infection)	Category	No. of Samples	Coefficient infection of seven Infected samples
0	Highly Resistant (1R)	10	0
0.1-5	Resistant (2R)	55	0.025, 0.05, 0.75 etc
5.1-10	Mod. Susceptible(1S)	0	0
10.1-20	Susceptible (2S)	0	0
20.1 and Above	Highly Susceptible(3S)	0	0
Total		65	

The results given in above table showed that the samples obtained from farmers field fell into resistant (R) and highly resistant (HR) category. No sample showed susceptible (S) response due to unfavorable epidemiological conditions for karnal bunt to appear.

5.8.5. GENETIC RESISTANCE IN WHEAT GERMPLASM AGAINST SPOT BLOTCH (*BIPOLARIS SOROKINIANA*) OF WHEAT.

Two hundred and sixty (260) wheat varieties/lines received from Wheat Section, Regional Agricultural Research Institute Bahawalpur and previous years selected lines were sown in one row of 2m length with 30cm row to row spacing. One parallel line of susceptible check for spot blotch (Bhakhari-02) was sown after every five entries and in between the repeats as spreaders for leaf blotch. The check facilitated the natural inoculum spread.

The experiment was sown during normal sowing time 11-11-2019. Diseases data was recorded at the time of disease appearance.

TABLE-1: The result of Spot blotch from Disease Screening Nursery

S. No.	Reaction	No. of entries	Name of promising varieties/lines
1	0	81	Durum-97, Fareed-06, 17B-2149 etc.

2	R	78	Pir.Sabak-15, Zincol, 12B-2511, 12B-2557, 13B-2809 etc
3	MR	64	BWP-97, W.L-711, BWP-2000, Bakhar-2002, A.S-2002, Uqab-2000, Punjnad-1 etc
5	MS	37	Blue silver, Inqlab-91, Lu-26, Maxi Pak , Benazir ,Pak-81 etc.
6	S	00	00
Total		260	

Eighty one (81) entries out of 260 test entries were disease free while seventy eight (78) entries showed resistant reaction, similarly sixty four (64) entries showed moderately resistant response. Thirty seven entries (37) entry shows Moderately Susceptible, No one showed Susceptible and Highly susceptible response towards leaf blotch disease due to less humidity this year.

5.8.6. SCREENING OF WHEAT VARIETIES/LINES AGAINST KARNAL BUNT (*TILLETIA INDICA*) UNDER NATURAL CONDITON

Seventy seven (77) different wheat varieties/lines received from Wheat Section were sown in single row of 1m length with 30cm row to row. After every 2 test entries, one row was kept fallow to facilitate the inoculation pressure. The experiment was sown on 11.11.2019. Observations on the disease incidence were recorded at the time of maturity on healthy and bunted grains basis. The final results of Karnal Bunt Disease Screening Nursery (KBDSN) are given as under:

CI (coefficient of infection)	Category	Varieties/Lines	Promising Cultivars/Lines
0	Highly Resistant (1R)	71	Fareed-06, Shafaq-06, Lasani-08, AARI-11, NARC-11, Gold-16, T.D-1, Ujala-15 etc
0.1-5	Resistant (2R)	06	AAS-09, Millat-11, Punjab-11, WL-711, 12B-2557, 12B-505 etc
5.1-10	Moderately Susceptible(1S)	0	0

10.1-20	Susceptible (2S)	0	0
20.1 and Above	Highly Susceptible(3S)	0	0
Total		77	

Results showed that all well known commercial varieties/lines fell into highly resistant (HR) category. About seventy seven varieties/lines showed HR response towards kernel bunt. No variety/line showed susceptible (S) response.

5.8.7. SCREENING OF WHEAT VARIETIES/LINES AGAINST LOOSE SMUT (*USTILAGO TRITICI*) OF WHEAT

Two hundred and fifty four (254) previous year inoculated wheat varieties/lines were sown on 11.11.2019 for loose smut disease screening. The sowing was done in two (2) meter long single rows with 30 cm Row to Row 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 were recorded at the time of maturity on diseased and healthy tiller basis. The final results of Loose Smut Disease Screening Nursery (LSDSN) are given as under:

Category	Rating	No. of var./lines	Promising varieties/lines
Disease free	0	0	0
Resistant (R)	1% or less	00	0
Moderately Resistant (MR)	1-10%	30	Benzir-13, BWP-97, Durum-97, FSD-08, Millat-11, Ufaq-00 etc.
Moderately Susceptible (MS)	11-20%	145	Bakhtawar-92, FSD-85, Inqilab-91, Kiran-95, Lu-26, Kohi Noor, Parrwaz-94, Maxi Pak-65, Tandojam-83, Pak-81, MH-97, Anmol-91, BWP-00 etc.
Susceptible (S)	21-50%	79	Blue Silver, Pasban-90, Bakhar-02, Marvi-00, AS-02, Uqab-00, Punjnad-1, Derawar-97, Satluj-86, Chakwal-50, Lasani-08, AAS-09, AARI-10, S.K.D-1, Punjab-11, NARC-11 etc
Highly Susceptible (HS)	>51%	00	0
Total		254	

Out of 254 varieties/lines, no variety/line was disease free or resistant, thirty (30) were Moderately resistant, one forty five (145) were Moderately susceptible reaction while seventy

nine (79) varieties/lines showed susceptible (S) response towards loose smut. Most of the varieties fell into moderately susceptible category (MS) response towards the disease as they showed 21-50 percent disease reaction.

5.8.8. MAINTENANCE OF ISOGENIC LINES OF LEAF RUST (*Puccinia triticina*), YELLOW RUST (*Puccinia striiformis*) AND STEM RUST (*Puccinia graminis tritici*) AT DIFFERENT LOCATIONS FOR PREVAILING RUST RACES MONITORING

Thirty two (32) wheat varieties/lines with known genes along with eighty five (85) LR, eighty (80) YR and eighty five (85) SR isogenic lines were sown in 2m long rows with 30cm row to row spacing in single replication and one row of universal susceptible check of each three rusts (Morocco) was sown after every 5th test entry as well as around the whole trial. The trials were sown at three different locations of Southern Punjab. The sowing was done on different dates of the month of November 2019. Observations on the disease incidence were recorded at the time of disease appearance detailed as under:

A. LEAF RUST (LR) ISOGENIC LINES

S. No.	Pedigree / Origin / Lr	Varieties/lines	Disease response
1		Triticale	5MR
2		Morocco	10 RMR
3	Syria	Cham 4	0
4	Syria	Cham 6	0
5	Syria	Cham 8	0
6	Syria	Cham 10	0
7	Algeria	Hidhab	0
8	Morocco	Aguilal	10R-MR
9	Morocco	Arrehane	0
10	Syria	Salamoni	0
11	West Asia	Roomy	TR
12	North Africa	Florance Aurour	0
13	North Africa	Potam	0
14	North Africa	Nesma	10MS
15		Serie 87	0
16		PBW 343	0
17		Bohouth 6	0
18		Bohouth 8	0
19		Babaqa	0
20		MaxiPak	0
21	ICW09-0004-OAP-oBr-2AP-OTS-OAP	Cham 4/CA8055	0
22	Syria	Morocco	0
23	Syria	Cham 1	0

24	Syria	Cham 3	0
25		Cham 5	0
26		Safra maan	0
27	Algeria	Oued Zenati	0
28	North Africa	Senatori Capelli	0
29	Tunisia	Chili	0
30	Tunisia	Karim	0
31	ICD95-1302-C-3AP-0AP-1AP-0AP-5AP-AP-5AP-0AP	Geruftel-1	0
32	ICD95-0169-C-0AP-2AP-0AP-4AP-0AP	Tunsyer-2	0
33	ICD95-1174-C-3AP-0AP-9AP-0AP	Geromtel-1	0
34	ICD95-0169-C-0AP-3AP-0AP-5AP-0AP	Icasyer-1	TR
35		Sebou	0
36		Belikh-2	0
37		Atlas-1	0
38		Ammar-3	0
39		ICA Rasha-1	0
40		Aghram	0
41		Bohouth 9	0
42		Bohouth 11	0
43	ICD91-0811-AB-3AP-0AP-5AP-0AP	Otb-06	0
44		Morocco	10MRMS
45	Lr22b	Thatchex	60S
46	Lr1	RL6003	70S
47	Lr2a	RL 6016	0
48	Lr2b	RL6019	40S
49	Lr2c	RL6047	60S
50	Lr3	RL6002	10S
51	Lr3Ka	RL6007	0
52	Lr3Bg	RL6042	40S
53	Lr9	RL6010	60S
54	Lr10	RL6004	0
55	Lr11	W976	60S
56	Lr12	RL6011	70S
57	Lr13	Manituou	80S
58	Lr14a	RL6013	80S
59	Lr14b	RL6006	70S
60	Lr15	RL6052	80S
61	Lr16	RL6005	80S
62	Lr17	RL6008	80S
63	Lr18	RL6009	80S
64	Lr19	RL6040	10MSS
65	Lr20	W203	0
66	Lr21	RL6043	70S
67	Lr22a	RL6064	60S
68	Lr23	RL6012	10MS
69	Lr24	Agent (RL6064)	20S
70	Lr25	Transec (Awned)	30S
71	Lr26	RL6078	70S

72	Lr10,Lr27+Lr31	Gatchar (w3201)	40S
73	Lr28	CS2D-2M	70S
74	Lr29	RL6080	80S
75	Lr30	RL6049	TMS
76	Lr32	RL5497	0
77	Lr33	RL6057	70S
78	Lr34	RL6058	40S
79	Lr35	R711	70S
80	Lr36	E84018	70S
81	Lr37	RL6081	60S
82	Lr B	RL6051	60S
83	Lr13	WL711	0
84		Morocco	0
85		Triticale	0

SUMMARY OF RESULTS

S. No.	Reaction	No. of entries	Name of promising varieties/lines
1	Disease Free (0)	46	Cham-4, Cham-6, Cham-8, Cham-10, Hidhab, Aguilal, Florance aurour, Potam etc.
2	TR	02	Roomy, Icasyr.
3	R	02	Triticale, Morocco.
4	MRMS	01	Morocco
5	MSS	04	Nesma, Lr-19, Lr-23, Lr-30 etc.
6	S	30	Thatcher, Lr-1, Lr-2b, Lr-11, Lr-12, Lr-13, Lr-15 etc.
Total			85

B. YELLOW RUST (YR) ISOGENIC LINES

S. No.	Pedigree / Origin / Lr	Varieties/lines	Disease response
1		Triticale	30MSS
2	F	Morocco	10MR
3	Yr1	YR 1/6Avocetes	0
4	NIL 1	YR 1/6Avs	0
5	(W;Yr1)	Chinese 166 (WYR-1)	TR
6	Yr1	Chinese 166	5MRMS
7	Yr2	Kalyansona	0
8	(W;Yr2+?)	Heines VII	0
9	(W;Yr3a,4a+other)	Vilmorin23	0
10		Morocco	0
11	(W;Yr4)	Hybrid46	0
12	Yr5	YR 5/6Avs	0

13	Yr5	Triticumspelta	0
14	Yr6	YR 6/6Avocetes	0
15	(S; Yr6+1)	Heines kolben	10MRMS
16	(S; Yr6+?)	Heines peko	10MRMS
17	Yr6,Yr20	Fielder	0
18	Yr7	YR 7/6Avs	20MRMS
19	(S;Yr7)	Lee	30MSS
20		Morocco	10R
21	(W;Yr7+?)	Reichersberg42	5R
22	Yr7	Thatcher	TR
23	Yr8	YR 8/6Avs	20MRMS
24	(S;Yr8)	Compare	20MSS
25	Yr9	YR 9/6Avs	10MSS
26	Yr9	Fed.4/Kavkaz	0
27	(W;Yr9+Yr2+?)	Clement	0
28		Federation	40S
29	Yr10	YR 10/6Avs	0
30		Morocco	0
31	(W; Yr10)	Moro	30S
32	Yr15	YR 15/6Avs	0
33	Yr17	YR 17/6Avs	40S
34	(W;2-more?)	Strubes Dickopf	5MRMS
35	(W)	Suwon92xomax	0
36	(W;YrND)	Nord Desprez	0
37	Yr32	YR 32/6Avs	0
38	(W,Yr32)	Carstens V	0
39	YrSP	YR SP/6Avs	0
40		Morocco	0
41	(W;YrSP)	Spaldings Prolific	0
42	YrA	Avocetes R	0
43	YrA	Inia 66	0
44		Aocetes S	0
45		Tres/6Avs	0
46	Yr18	YR 18/3Avs	0
47	Yr18+	Jupateco R	0
48		Jupateco S	0
49	YrA,Yr18	Anza	0
50		Morocco	20MSS
51	APR	Cook	30MSS
52	Yr21	Lemhi	20MSS
53		TP981	0
54	Yr25	TP1295	0
55	Yr27	YR 27/6Avs	0
56	Yr27	Ciano 79	0
57	Yr27+?	ATT II A CM85836-50Y	0
58	Yr27+Yr18	Opata 85	0
59	Yr28	Avocet-YRA 3/3 Altar	0
60		Morocco	0
61	Yr29	Lal Bahadur pavan	5R
62	Yr31	AVOCET-YRA 3/PASTOR	0
63	Yr31+APR	PASTOR	0
64		Pollmer.2.1.1	30MRMS

65	DW	Cham 1	0
66		Cham 4	30MSS
67		Cham 6	0
68		Cham 8	20R
69		Gobustan	40MSS
70		Morocco	0
71		Sardari	0
72		Alamout	60S
73		Bohouth 6	0
74		Gereck 79	0
75		Hugenoot	0
76		Gun91	0
77		Dustlik	0
78		TATARA CM85836-50Y	0
79		Suwon 92/omar	5MSS
80		Triticale	10R

SUMMARY OF RESULTS

S. No.	Reaction	No. of entries	Name of promising varieties/lines
1	Disease Free (0)	51	Hybrid-46, Yr-5, Yr-6, Clement, Yr-32, Yr-SP etc.
2	TR	02	Chinese-166, Thatcher
3	R	05	Triticale, Cham-8, Yr-29 etc.
4	MRMS	08	Pollmer, Yr-1, Heines Kolhen, Heines Peko etc.
5	MSS	10	Triticale, Lee, Compair, Yr-9 etc.
6	S	04	Federation, Moro, Yr-17, Alamout etc
Total		80	

C. STEM RUST (SR) ISOGENIC LINES

S. No.	Pedigree / Origin / Lr	Varieties/lines	Disease response
1			0
2	Thatcher/Chinese Spring	ISr5-Ra CI 14159	0
3	Red Egyptian/Chinese Spring	ISr6-Ra CI 14163	0
4		Na 101/6*Marquis	0
5	Hope/Chinese Spring	ISr7b-Ra CI 14165	0
6	Red Egyptian/CS (CI 14167)	CI 14167/9*LMPG-6 DK04	0
7		Barleta Benvenuto (CI 14196)	0

8	Red Egyptian/Chinese Spring	ISr9a-Ra CI 14169	0
9	Kenya 117A	Prelude*4/2/Marquis*6/ Kenya 117A	0
10	Hope/Chinese Spring	ISr9d-Ra CI 14177	0
11	Little Club //3* Gabo /2* Charter /3/3* Steinwedel / CI 7778	Vernstein PI 442914	0
12	Selection from Kubanka (CI 1516)	Chinese Spring*7/Marquis 2B	0
13	Marquis*4/Egypt NA95/2/2*W2691	W2691Sr10 CI 17388	0
14	Lee (CI 12488)	Lee/6*LMPG-6 DK37	0
15		Chinese Spring*5/Thatcher 3B	0
16		Prelude*4/2/Marquis*6/ Khapstein	0
17		W2691*2/Khapstein	0
18		Prelude*2/Norka	0
19		Thatcher/CS (CI 14173)	0
20			0
21	Esp 518/9	Prelude/8*Marquis*2/2/E sp 518/9	0
22		Little Club/Sr18Mq Marquis "A"	0
23		94A 236-1 Marquis "B"	0
24		94A 237-1 Marquis "C"	0
25	VA 2001 Increase	McNair 701	0
26	Einkorn CI 2433	T. <i>monococcum</i> /8*LMPG-6 DK13	0
27		Mq*6//Stewart*3/RL 5244	0
28		Exchange CI 12635	0
29	Little Club/Agent (CI 13523)	LcSr24Ag	0
30		Agatha (CI 14048)/9*LMPG-6 DK16	0
31		Eagle Sr26 McIntosh	0
32		WRT 238-5 (1984) Roelfs	0
33		Kota RL471	0
34		Prelude/8*Marquis/2/Etio le de Choisy	0
35	Webster CI 3780	Selection from Webster F3:F4 #6	0
36	Benno (Sr31)	Sr31 (Benno)/6*LMPG-6 DK42	0
37		ER5155 S-203 (1995)Roelfs	0
38		RL 5405 (1192) Kerber	0
39		RL 6098 (1997) Dyck	0
40			0
41		RL 6099 (1995) Dyck	0

42	CI 12632 T. timopheevii	W2691SrTt-1 CI 17385	0
43		Prelude*4/Line W (W3563)	0
44	08 Aberdeen Inc. Source Z. Pretorius	Trident Sr38	0
45	07GH	Trident	0
46		RL 5711 Kerber	0
47		RL 6087 Dyck	0
48	Hard red winter	TAM 107	0
49	Hard red winter	Amigo	0
50	Hard red winter	Siouxland	0
51	Hard red winter	Roughrider	0
52	Soft red winter	Sisson	0
53	Soft red winter	Fleming	0
54		Chris	0
55	08 Aberdeen Inc. Source: 06 AB YJ	CsSSrTmp	0
56		Bt/Wld	0
57		Pavon 76	0
58		Einkorn	0
59		Seri 82	0
60		Morocco	0
61		PBW343 = Attila with Sr31	0
62		Kubsa = Attila	0
63	Iran	Chamran = Attila	0
64	Syria	Cham 6	0
65		Cham 8	0
66	Syria	Cham 10 = Kauz//Kauz/star	0
67		Bacanora = Kauz's'	0
68		Cook	0
69		Coorong (Triticale)	0
70		Satu	0
71		SrNin	0
72		Karim	0
73		Imillo	0
74		Altar	0
75	Sudan	EL Nielain	0
76	Algeria	Hidhab	0
77	Egypt	Gemmeiza 9	0
78	Egypt	Giza-168	0
79	Morocco	Arrehane	0
80		Morocco	0
81	Sudan	Debeira	0
82	Morocco	Aguilal	0
83		Thatcher	0
84		Guard	0
85		Triticale	0

Stem rust infection was not observed on any differential line

5.8.9. SURVEILLANCE OF WHEAT RUSTS IN SOUTHERN PUNJAB (INCIDENCE AND SEVERITY OF WHEAT RUSTS.

The main objective for the rust monitoring and surveillance activity was to record the status of prevailing rust infection in farmer field and varietal resistance/susceptibility status. Surveillance of wheat rust pathogens included assessments of rust incidence surveys. It provided basic information that helped in formulating and adopting appropriate policies, investments and strategies in plant protection, plant breeding, seed systems, and in rust pathogen research. Surveillance of wheat rusts was carried out in major districts of Southern Punjab. The representative sites to be visited and probable dates were decided and a route plane developed that mentioned the priority areas to be visited for the surveillance activities. At each site, 3-5 representative sites were visited, the data regarding GPRS location, name of cultivar, disease incidence and intensity were recorded and sampling of the diseased plant was done. Followed the specific route according to plane, made observation after every 15 to 20 kilometer. In total, 174 sites were visited during the year 2020. The detail of surveillance activities for the year 2020 is given as under:

S. No.	Date	GPRS location	Place of observation	Stem Rust	Yellow Rust	Leaf Rust	Severity (%)	Variety observed
BAHAWALPUR								
1	25/01/2020	Elevation.85M N 28.84653 E070.67660	Bahawalpur	Nil	Nil	Nil	Nil	Unknown
2	Do	121M N 29.06084 E071.55359	140 DB, Bahawalpur	Nil	Nil	Nil	Nil	Anaj-1
3	Do	99M 29.26764 071.57264	Adda Budha Khoh, Rangpur, Bahawalpur	Nil	Nil	Nil	Nil	Unknown
4	Do	98M 29.06084 071.55359	Chak-38, Yazman	Nil	Nil	Nil	Nil	Unknown
5	Do	166M 28.99300 071.66124	98 DB, Chanan Peer Yazman	Nil	Nil	Nil	Nil	Unknown
6	Do	103M 29.21727 071.71029	Pul 27, Derawar Road	Nil	60S	Nil	5	Gandum-1*
7	26/01/2020	102M 29.13027 071.14584	Naizampur, Qulab wala. Ahmed Pur East	Nil	60S	Nil	10	Gandum-1*

8	Do	72M 29.23271 071.04271	Lalo wali mori, Uch Sharief	Nil	Nil	Nil	Nil	Unknown
9	27/01/2020	103M 29.65339 071.59269	Lodhran	Nil	Nil	Nil	Nil	Unknown
10	Do	105M 29.78660 071.59201	Makhdom Wali, Lodhran	Nil	Nil	Nil	Nil	Gandum-1
11	Do	96M 29.78522 071.75882	Dunya Pur, Lodhran	Nil	Nil	Nil	Nil	Unknown
12	Do	115M 29.73740 071.80686	Chak 11 M, Kehror Paka, Lodhran	Nil	Nil	Nil	Nil	Unknown
13	Do	107M 29.73255 072.81654	Chak 9 M, K. Paka, Lodhran	Nil	Nil	Nil	Nil	Unknown
14	04-02-2020	107M 29.58526 071.62692	Parmat, Lodhran bypass	Nil	Nil	Nil	Nil	unknown
15	Do	109 M 29.66325 071.59217	Basti Malook	Nil	Nil	Nil	Nil	unknown
16	11-02-2020	107M 29.44907 071.58117	Champ Kalyar, Bahawalpur	Nil	5MS	Nil	5	Unknown
17	17-02-2020	105M 29.56543 071.65310	Lodhran bypass	Nil	60S	Nil	40	Mixture
18	Do	104M 29.65339 071.59342	Ada Mishal, Lodhran	Nil	20MS	Nil	10	Unknown
19	Do	104M 29.78263 071.58409	Makhdoom Wali	Nil	40S	Nil	20	Gandum-1
20	18-02-2020	90 M 29.09022 071.08351	Ahmad Pur East	Nil	20MS	Nil	5	Unknown
21	19-02-2020	108M 29.33385 071.64731	11 BC, Bahawalpur	Nil	60S	Nil	40	Unknown
22	Do	116M 29.22795 071.77671	44 DB Bahawalpur	Nil	20S	Nil	20	Galaxy-13

23	Do	117M 29.19283 071.92018	Kudwala, Yazman	Nil	40S	Nil	20	Gandum-1
24	Do	121M 29.05925 072.12370	Mauj Garh Deep Cholistan	Nil	20S	Nil	10	Galaxy-13
25	24-02-2020	135M 29.64687 072.57678	Lodhran	Nil	20S	Nil	20	AS-02
26	Do	118M 29.58997 071.78211	Lodhran	Nil	40S	Nil	10	Galaxy-13
27	Do	108M 29.64448 071.91980	Kehror Paka	Nil	20S	Nil	10	Galaxy-13
28	25-02-2020	106M 29.36902 071.61149	Azam Chowk, Bahawalpur	Nil	20S	Nil	20	FSD-08
29	Do	104M 29.31984 071.55976	Khanqah Sharief	Nil	5MS	Nil	5	Unknown
30	Do	99M 29.21958 071.42580	Noor Pur Nauranga, Bahawalpur	Nil	20S	Nil	10	Galaxy-13
31	Do	90M 29.09028 071.08283	Channi Goth	Nil	20S	Nil	100	TD-1
32	Do	84M 29.07302 071.00577	Rizwan Abad, Channi Goth	Nil	20S	Nil	5	Unknown
33	Do	88M 28.86065 071.18451	Deep Cholistan	Nil	10MS	Nil	20	Mixture
34	Do	83M 28.82846 071.24024	Deep Cholistan	Nil	10S	Nil	10	Unknown
35	Do	94M 028.83007 071.33672	Qila Derawar	Nil	50S	Nil	40	Unknown
36	Do	90M 29.00715 071.34925	Khuthri Bangla, Yazman	Nil	10MS	Nil	10	Johar-16
37	Do	95M 29.10577 071.55486	Head Rajgan	Nil	5MS	Nil	5	Unknown

38	Do	106M 29.14680 071.74420	56 DB, Yazman	Nil	Nil	Nil	Nil	FSD-08 (Sprayed)
39	Do	105M 29.30130 071.71044	25 BC, Bahawalpur	Nil	40S	Nil	20	FSD-08 (Sprayed)
40	26-02-2020	109M 29.35780 071.72659	Bahawalpur	Nil	20S	Nil	5	FSD-08
41	Do	113M 29.41870 071.86613	Dera Bakha, Bahawalpur	Nil	5MS	Nil	5	Johar-16
42	Do	121M 29.57098 072.19884	Khair Pur Tamewali	Nil	20S	Nil	2	Unknown
43	Do	132M 29.67583 072.44442	Ada Qaim Pur	Nil	20MS	Nil	10	Unknown
44	Do	130M 29.70454 072.58228	Hasil Pur	Nil	40S	Nil	10	FSD-08
45	Do	131M 29.70129 072.63633	59 Fateh, Hasil Pur	Nil	20MS	Nil	10	Galaxy-13
46	Do	136M 29.69279 072.64729	57 Fateh, Hasil Pur	Nil	80S	Nil	80	FSD-08
47	10-03-2020	106M 29.36951 071.61203	Chowk Azam, Bahawalpur	Nil	80S	Nil	80	FSD-08*
48	Do	103M 29.29864 071.53068	Habib Missan	Nil	20S	Nil	40	Akbar-19
49	Do	102M 29.21567 071.41961	Zahoor Abad, Ahmad Pur East	Nil	Tr	Nil	1	Mixture
50	Do	80M 29.11727 071.17482	Mauza Sukhail, Ahmad Pur East	Nil	60S	5S	80 5	FSD-08*
51	11-03-2020	107M 29.45983 071.61161	Chamb Moor, Lodhran	Nil	40S	Nil	50	Mixture
52	Do	- 29.47137 071.60574	Chak-98M, Lodhran	Nil	80S	Nil	80	Johar-16

53	Do	- 29.49505 071.64174	Lodhran	Nil	10MSS	Nil	5	Johar-16
54	Do	150M 29.61314 072.28051	Khair Pur Tamewali	Nil	10S	Nil	20	Mixture
55	19-03-2020	215 Ft 29.30383 071.53212	Maqbool Abad, Bahawalpur	Nil	50S	Nil	80	FSD-08
56	Do	262 Ft 29.19953 071.52205	Mauza Chandrani Sharqi, Bahawalpur	Nil	Nil	Nil	Nil	Unknown
57	Do	176 Ft 29.23683 071.06839	Ahmad Pur East Road, Uch Sharief	Nil	80S	Nil	80	Unknown
58	Do	- 2925479 071.05331	Uch Sharief	Nil	Nil	Nil	Nil	Unknown
59	Do	125M 30.14295 071.85424	Jahanian	Nil	Nil	Nil	Nil	Unknown
60	06-02-2020	136M 29.71948 072.64156	Chak-12 Ford wa, Hasilpur	Nil	Nil	Nil	Nil	Unknown
61	Do	132M 29.56462 072.68253	Chak 153 Murad, Hasil Pur	Nil	Nil	Nil	Nil	Unknown
62	Do	130M 29.64686 072.57679	Chak 86/ Fateh, Hasil Pur	Nil	5MSS	Nil	5	Unknown
MULTAN								
63	Do	115M 29.63895 071.96970	Meep Pur Station, Mailsi, Multan	Nil	Nil	Nil	Nil	Galaxy-13
64	Do	104M 29.77954 071.53693	Kotli Wajwa, Shujah Abad	Nil	60S	Nil	20%	Gandum-1
65	Do	106M 30.00908 071.36037	Shujah Abad	Nil	Nil	Nil	Nil	Unknown
66	08-02-2020	104M 29.80203 071.55129	Makhdum Wali	Nil	Nil	Nil	Nil	Unknown
67	Do	101M 29.43255 071.54794	Jalal Pur Peer wala	Nil	10S	Nil	5	FSD-8

68	Do	108M 29.52033 071.23871	Jalal Pur Peer wala	Nil	5MS	Nil	5	Unknown
69	Do	104 M 29.83110 071.62499	Chak-358, Dunya Pur	Nil	Nil	Nil	Nil	Unknown
70	Do	109 M 29.99691 071.49688	Basti Malook	Nil	Nil	Nil	Nil	Unknown
71		109 M 30.09757 071.48949	Multan	Nil	20MS	Nil	5	Unknown
72	Do	118M 29.72640 072.05371	Basti Sultan, Mailsi	Nil	5MS	Nil	5	Unknown
73	Do	123M 29.91619 072.33686	Mailsi	Nil	80S	Nil	1	Unknown*
74	Do	108M 29.98115 071.88219	Tiba Sultan Pur	Nil	TS	Nil	1	Galaxy-13
75	Do	113M 30.03870 071.75130	Deen Pur, Jahanian	Nil	40S	Nil	20	Galaxy-13
76	Do	110M 30.07887 071.67844	Mauza Ghariaala, Multan	Nil	60S	Nil	20	Galaxy-13
77	Do	107M 29.98136 071.50137	Chak 5 Faiz, Multan	Nil	10MS	Nil	10	Unknown
78	Do	132M 29.82259 071.54570	Basti Malook	Nil	10S	Nil	20	Unknown
79	10-02-2020	127M 30.09900 072.30358	Vehari	Nil	Nil	Nil	Nil	Unknown
80	Do	124M 30.12990 072.27584	Vehari	Nil	40MS	Nil	10	Unknown
BAHAWALNAGAR								
81	Do	140M 29.85947 072.94998	Chak Abdulla Chishtian	Nil	20S	Nil	10	Watan
82	Do	150M 29.93813 073.13013	Takht Mahal, Bahawalnagar	Nil	Nil	Nil	Nil	Unknown

83	Do	119M 29.18552 072.23733	Mansora, Maroot	Nil	5S	Nil	5	Galaxy-13
84	Do	124M 29.22556 072.37748	Chak 327/HR, Maroot	Nil	10MS	Nil	5	Unknown
85	Do	129M 29.24238 072.54653	Chak 305/HR, Maroot	Nil	TMS	Nil	2	Unknown
86	Do	134M 29.22515 072.83441	77 Moor, Fort Abbas	Nil	80S	Nil	60	Gandum-1*
87	Do	129M 29.30486 072.82761	181/7R, Fort Abbas	Nil	40S	Nil	20	Unknown
88	Do	142M 29.39114 072.84233	Latif Abad, Haroon Abad	Nil	5MSS	Nil	5	Unknown
89	Do	133M 29.50322 072.84982	Chak 431/6R Haroon Abad	Nil	50S	Nil	30	Gandum-1*
90	Do	138M 29.66764 072.73376	93 Fateh, Chishtian	Nil	10MSS	Nil	5	Unknown
91	Do	131M 29.68840 072.79829	96 Fateh, Bahawalnagar	Nil	5MS	Nil	1	Akbar-19 (Sprayed)
92	Do	145M 29.69391 072.87112	100 fateh, Bahawalnagar	Nil	80S	Nil	70	FSD-08*
93	Do	141M 29.32034 073.09218	Noor Sar, Bahawal Nagar	Nil	20S	Nil	20	Unknown
94	Do	144M 29.68846 073.17413	Mauza Paka Moor, Haroon Abad	Nil	40S	Nil	5	Akbar-19*
95	Do	134M 29.23433 072.90534	Chak.268, Fort Abbas	Nil	5MS	Nil	2	Unknown
96	Do	147M 29.21993 072.85021	Fort Abbas	Nil	40S	Nil	2	Unknown
97	Do	109M 29.24753 072.57316	Chak 304, Maroot	Nil	20S	Nil	10	Unknown

98	Do	145M 29.64126 072.56961	Hasil Pur	Nil	20S	Nil	20	FSD-08
99	Do	142M 29.58954 072.60782	Dhran wala, Hasil Pur	Nil	40S	Nil	40	Unknown
100	Do	148M 29.55969 072.75513	Chak- 165/Murad, Hasil Pur	Nil	60S	Nil	60	FSD-08
101	Do	152M 29.61398 072.84059	Dahran Wala	Nil	40S	Nil	40	FSD-08*
102	Do	145M 29.82409 072.89467	Bahawalnagar	Nil	30S	Nil	30	Unknown
103	Do	137M 29.85843 072.94789	Bahawalnagar	Nil	20S	Nil	20	Watan
DERA GHAZI KHAN								
104	18-02-2020	108 29.80473 070.52317	Kot Chutta	Nil	TMS	Nil	2	Unknown
105	Do	97M 29.75159 070.88617	Fauji Rakh, Head Bakaini, Shah Jamal, Dera Ghazi Khan	Nil	Nill	Nil	Nill	Johar-16
106	Do	99M 29.44365 071.0093	Mud Wala, Alipur	Nil	Nill	Nil	Nill	Unknown
107	Do	93M 29.58110 072.88543	Kotla Rehm Ali Shah, Jatoi	Nil	Nill	Nil	Nill	Unknown
108	Do	116M 30.06322 070.83285	Ghazi Ghat, Dera Ghazi Khan	Nil	20S	20S	5 5	FSD-08
109	Do	109M 29.92343 070.67724	Ali Wala, Dera Ghazi Khan	Nil	Nill	Nil	Nill	Unknown
110	Do	115M 29.75806 070.62096	Ghazi Chowk, Jampur, Rajan Pur	Nil	Nill	Nil	Nill	Unknown
111	Do	68 M 28.90656 070.43564	Right side River, Chachraan Sharief, Kot Mithan sharief	Nil	60S	Nil	40	TD-1, Ujala-13
112	Do	85 M 28.93440 070.24428	Mauza Giamil, Rojhan	Nil	Nil	Nil	Nil	unknown
113	Do	88M 28.91724 70.21542	Umar Kot, Rojhan	Nil	Nil	Nil	Nil	AS-02

114	Do	116M 30.26225 071.22749	Muzafar Garh	Nil	10S	Nil	5	FSD-08
115	Do	119M 30.40842 071.16803	Dogar Munda, Muzafar Garh	Nil	80S	Nil	80	Gandum-1*
116	Do	168M 30.33442 071.28463	Zulfiqar Abad, Muzafar Garh	Nil	Nil	Nil	Nil	Unknown
117	Do	100M 29.79539 071.07702	Muzafar Garh	Nil	40S	Nil	10%	Unknown
118	Do	117M 29.61286 071.01984	Sontray Wala, Alipur	Nil	Nil	Nil	Nil	Unknown
119	Do	95M 29.51492 070.98664	Shehar Sultan, Muzafar Garh	Nil	Nil	Nil	Nil	FSD-08
120	Do	- 29.34481 071.01988	Head Panjnad	Nil	40S	Nil	30	Johar-16
121		137M 29.83196 070.62975	Kot Chutta	Nil	Nil	Nil	Nil	FSD-08
122		97M 29.20663 071.39894	Kot Chutta	Nil	20S	Nil	20	AS-02
123		101M 29.78502 070.54531	Choti Zareen	Nil	Nil	Nil	Nil	Punjab-11
124	19-02-2020	104M 29.83189 07062940	Jampur	Nil	5S	Nil	0.2	Jalandhar
125		104M 29.51288 070.56418	Jampur	Nil	10S	Nil	10	AS-02
126		89M 29.58297 070.56418	Jampur	Nil	10S	Nil	10	FSD-08
127	24-02-2020	94M 29.58256 070.60102	Dera Ghazi Khan	Nil	40S	Nil	10	Rustum
128		138M 30.52061 070.67465	Taunsa Sharief	Nil	50S	Nil	30	Johar-16
129		120M 30.41454 070.73097	Dera Ghazi Khan	Nil	TMS	Nil	0.5	Aas-11
130		150M 30.52575 070.66105	Dera Ghazi Khan	Nil	30MSS	Nil	30	Johar-16
131		167M 30.63785 070.67240	Dera Ghazi Khan	Nil	20MSS	Nil	15	Unknown

132		144M 30.61068 070.68034	Dera Ghazi Khan	Nil	30MSS	Nil	30	Rustum
133		116M 30.33236 070.70039	Dera Ghazi Khan	Nil	40S	Nil	35	Gandum-1
134	25-02-2020	86M 29.19098 070.39170	Rajan Pur	Nil	20S	Nil	5	Unknown
135		104M 28.93996 070.27602	Rajan Pur	Nil	5S	Nil	5	AS-02
136		87M 28.93398 070.24337	Rajan Pur	Nil	20MSS	Nil	10	Unknown
137		69M 28.84943 070.61258	Rajan Pur	Nil	20S	Nil	10	AS-02
Rahim Yar Khan/ Saddiqabad								
138	29/01/2020	116M 29.91744 070.92457	Liaqat Pur, rahim Yar Khan	Nil	Nil	Nil	Nil	Unknown
139	Do	96M 29.12004 071.16971	KLP Road, Ahmad Pur East	Nil	Nil	Nil	Nil	Unknown
140	Do	83M 28.74537 070.79025	Feroza, Liaqat Pur, Rahim Yar Khan	Nil	Nil	Nil	Nil	Unknown
141	Do	84M 28.64784 070.59067	Mauza Saiwa Raam, Khan Pur	Nil	Nil	Nil	Nil	TD-1
142	Do	84M 28.66596 070.39424	Mian wali Qureshian, Rahim Yar Khan	Nil	Nil	Nil	Nil	Unknown
143	Do	73 M 28.82270 070.53616	Zahir Peer, Rahim Yar Khan	Nil	Nil	Nil	Nil	Unknown
144	Do	83M 28.90117 070.43616	Maouza Pahoor, Rahim Yar Khan	Nil	Nil	Nil	Nil	Ujala-13
145	07-02-2020	89M 28.87517 070.62959	Fateh Pur Kamal, Khanpur	Nil	Nil	Nil	Nil	Unknown
146	Do	77M 28.38627 070.41886	Chak 101, Rahim yar Khan	Nil	20S	5S	20%	TD-1
147	Do	86 M 29.04959 070.96418	Mauza Tarakri, Liaqat Pur	Nil	20MS	Nil	10	Unknown
148	Do	86 M 29.03699 070.96494	Mauza Tarakri, Liaqat Pur	Nil	80S	Nil	50	Gandum-1
149	Do	97 M 29.04109	Basti Darkhan, Liaqat Pur	Nil	20S	Nil	10	Gandum-1

		070.94505						
150	Do	97M 28.94934 070.86172	Allah Abad, Liaqat Pur	Nil	5MS	Nil	5	Unknown
151	Do	88 M 29.91703 070.78849	Ameen Abad, Liaqat Pur	Nil	5S	Nil	5	Galaxy-13
152	Do	92 M 28.85932 070.74791	Paka Lara, Khan Pur	Nil	20MSS	Nil	50	Galaxy-13
153	Do	77M 29.84439 070.66198	Nawan Kot, Khan Pur	Nil	5MSS	Nil	10	Ujala-16
154	Do	82 M 28.79207 070.52448	Chowk Zahir Peer, Rahim yar Khan	Nil	5MSS	Nil	5	Unknown
155	Do	75 M 28.49147 070.23306	Iqbal Abad, Rahim Yar Khan	Nil	10MS	Nil	5	Unknown
156	Do	83 M 28.46332 070.22546	Chowk bahadur, Rahim Yar Khan	Nil	5 MSS	Nil	5	TD-1
157	Do	80 M 28.35121 070.15151	Basti Shah Muhammad, Sadiq Abad	Nil	5MS	Nil	5	TD-1
158	Do	77 M 28.33390 070.10453	Sadiq Abad	Nil	60S	Nil	60	Sahar-02
159	Do	85M 29.02177 070.97519	Mauza Tarakri, Liaqat Pur	Nil	20S	Nil	20	Unknown
160	Do	78M 28.91641 070.92287	Liaqat Pur	Nil	60S	Nil	60	Galaxy-13
161	Do	89M 28.89591 070.90774	Rahim Yar Khan	Nil	40	Nil	40	Unknown
162	Do	85M 28.86123 070.89697	Rahim yar Khan	Nil	50S	Nil	50	Unknown
163	Do	88M 28.86839 070.94106	Head 42, Liaqat Pur	Nil	20S	Nil	10	Unknown
164	Do	90M 28.87678 071.01657	Chak 140-A, Liaqat Pur	Nil	10MS	Nil	20	TD-1
165	Do	94M 070.99780	Chani Goth	Nil	20S	Nil	40	Unknown
166	Do	81M 29.07129 070.87841	Taranda Muhammad Panah	Nil	10S	Nil	5	Unknown
167	Do	114M	Khan Baila,	Nil	80S	Nil	80	Johar-16*

		28.93835 070.71559	Rahim yar Khan					
168	Do	89M 28.81473 070.55413	Zahir Peer	Nil	80S	Nil	60	Unknown
169	Do	115M 28.73973 070.46637	Sardar Garh, Rahim Yar Khan	Nil	40S	5S	20 5	Unknown
170	Do	89M 28.68991 070.50100	Mauza Dhuda gagri, Khan Pur	Nil	80	Nil	80	FSD-08*
171	Do	107M 28.65943 070.57838	Chak-90 NP, Khan Pur	Nil	40S	Nil	40	Unknown
172	Do	70M 28.70315 070.706024	Jaitha Botha, Khan Pur	Nil	60S	Nil	80	Unknown
173	Do	80M 28.81669 070.82394	Mauza Rasheed Abad, Liaqat Pur	Nil	10MS	Nil	20	Punjab-11
174	Do	85M 29.05117 070.97883	Laloo Naich, Liaqat Pur	Nil	60S	Nil	50	Watan

The data presented in above table revealed that Yellow rust infection was observed everywhere and no variety was disease free. The first intense colony developed on variety Gandum-1 was detected in Yazman area. Infection was present and noted on all the existing wheat varieties in varying degrees. Yellow rust infection flare up had been experienced since last few years that was gradually increasing due to induction of highly susceptible wheat varieties, especially Gandum-1 and few old varieties such as Galaxy-13 and Faisalabad-08 especially which are grown on larger areas in Punjab. Above mentioned three varieties had typical fungus hosting capability (Colony formation), which is very dangerous as it provides millions of fungal spores and can result in disaster for the wheat crop. Furthermore, the climatic factors (humidity, temperature, clouds and rainfall) and cultivation of susceptible varieties everywhere can further contribute to yellow rust spread in vast areas as colonization of the pathogen is available for adjacent wheat plants.

5.8.10. SCREENING OF MUNGBEAN VARIETIES/LINES AGAINST MUNGBEAN YELLOW MOSAIC VIRUS (MYMV)

Ten (10) 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 2 repeats by keeping plot size of 9.0 m².

One row of highly susceptible check (Mash bean) was planted after every two entries. Presence of the insect vector i.e. white fly was also recorded before and on the onset of the disease. Disease data of the Mungbean yellow mosaic virus were recorded as under:

Scale	%age infection	Infection category	Reaction group	No. of entries	Names of Varieties/ Lines
0	0 %	Immune	I	00	00
1	1-10 %	Highly Resistant	HR	00	00
2	11-20 %	Resistant	R	05	BRM-350 BRM-365 NM-2011 BRM-366 BRM-374
3	21-30 %	Moderately Resistant	MR	04	BRM-349 BRM-372 BRM-373 Azri-06
4	31-50 %	Moderately susceptible	MS	01	BRM-343
5	50% and above	Susceptible	S	00	00

The above table showed that out of 10 varieties/lines screened out against MYMV, five (05) exhibited resistant (R), four (04) moderately resistant (MR), one (01) moderately susceptible (MS) response towards the disease.

5.8.11. SCREENING OF SORGHUM VARIETIES/LINES AGAINST GRAIN SMUT (*SPHACELOTHECA SORGHII*)

Ten (10) varieties/lines received from Millet Section were sown (10.07.19) in two rows keeping the plot size of 10.8m². 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 were recorded on the basis of diseased and healthy heads at the time of maturity and is tabulated as under:

Reaction	Reaction type	No. of entries	Varieties/lines
I (Immune)	0	00	-

HR (Highly Resistant)	1	08	YSS-98, BR-319, RARI-S-3, RARI-S-14, RARI-S-16, RARI-S-17, RARI-S-18, RARI-S-22
R(Resistant)	3	02	S-5, Jowar-86
MR (Moderately Resistant)	5	00	00
MS (Moderately Susceptible)	7	00	00
S (Susceptible)	9	00	00

It is clear from the above table that out of 10 varieties/lines of sorghum including check (Jowar-319) screened out against grain smut (*Sphecilothea sorghi*), none was found immune. Eight (08) were highly resistant (HR) , two (02) were Resistant (R) and no one was Moderately Resistant (MR), Moderately Susceptible (MS) and susceptible (S) to grain smut disease.

5.8.11. SCREENING OF GUAR LINES, AGAINST BACTERIAL BLIGHT AND ALTERNARIA BRIGHT

Five entries of guar were sown at Guar Research Station Research area. The experiment was sown On 11.07.2019. Three replications of each variety were sown. Entry to entry spacing was kept 60-cm while line to line spacing was kept 45-cm. Disease data were recorded at the time of disease appearance and are given as under:

BACTERIAL BLIGHT:

Reaction	No. of entries	Varieties/lines
I	00	00
R	00	00
MR	03	S-6384 S-6154 BR-2017
MS	02	S-6161 S-6165
S	00	00
HS	00	00

ALTERNARIA BLIGHT:

Reaction	No. of entries	Varieties/lines
I	00	0
R	01	S-6161
MR	04	S-6384, S-6159, S-6165, BR-2017
MS	00	00
S	00	00
HS	00	00

In case of Bacterial Blight, out of 5 test entries, three (3) showed moderately resistant response while two (2) entries showed moderately susceptible response towards disease.

In case of Alternaria Blight, out of 5 test entries, four (4) showed moderately resistant response while one (1) entry showed resistant response towards disease.

5.8.12. SCREENING OF MUSTARD GERMPLASM AGAINST ALTERNARIA BLIGHT (*ALTERNARIA BRASSICAE*), WHITE RUST (*ALBUGO CANDIDA*) AND POWDERY MILDEW (*ERYSIPHE POLYGONI*).

The trial was composed by the Director Oilseed Research Institute, Faisalabad and consisted of 35 strain/genotypes. This trial was sown in this institute on 17.10.2019 under RCBD design with three (3) replications and plot size was 6.0 m². The disease date were taken on 04.05.2020. The data of Alternaria blight, Powdery mildew and white rust are presented in the following tables:

ALTERNARIA BLIGHT

Scale	Reaction	Disease severity	No. of Entries	Entry
0	I	0	00	00
1	HR	1-6	00	00
2	R	6.1-12	04	E3, E12, E14, E16
3	MR	12.1-25	24	E1, E2, E4, E5, E6 etc
4	MS	25.1-50	07	E7, E8, E9, E24, E33, E34, E35
5	S	50 ABOVE	00	00

Among thirty five (35) test entries, four (04) varieties showed resistant response, twenty four (24) varieties showed moderately resistant and seven (07) varieties showed moderately susceptible response towards Alternaria Blight. No one was Immune and Highly resistant against Alternaria blight.

POWDERY MILDEW

Scale	Reaction	Disease severity	No. of Entries	Entry
0	I	0	00	00
1	HR	1-6	09	E3, E11, E12, E14, E15, E20, E28, E30, E35
2	R	6.1-12	21	E1, E2, E5, E6, E7, E8, E9, E10, E16, 17, E19, E21, E22, E23, E24, E26, E27, E29, E31, E32, E34
3	MR	12.1-25	05	E4, E13, E18, E25, E33
4	MS	25.1-50	00	00
5	S	50 ABOVE	00	00

In case of Powdery Mildew, among all 35 entries, nine (09) varieties showed Highly Resistance response towards Powdery Mildew, twenty one (21) showed resistant response while five (05) varieties showed moderately susceptible response. No one showed moderately susceptible, susceptible and highly susceptible response.

WHITE RUST

Scale	Reaction	Disease severity	No. of Entries	Entry
0	I	0	00	00
1	HR	1-6	11	E3, E5, E12, E14, E15, E16, E19, E20, E24, E30, E31,
2	R	6.1-12	18	E1, E4, E6, E8, E9, E10, E11, E13, E17, E18, E21, E22, E25, E26, E28, E29, E30, E32
3	MR	12.1-25	06	E2, E23, E27, E33, E34, E35
4	MS	25.1-50	00	00
5	S	50 ABOVE	00	00

In case of white rust, among all 35 entries, eleven (11) varieties showed Highly Resistant response towards white rust while eighteen (18) varieties showed Resistance response. Similarly, six (06) showed moderately resistant response towards disease. No one showed moderately susceptible, susceptible and highly susceptible response towards white rust.

5.9 ENTOMOLOGY SECTION

5.9.1. EVALUATION OF VARIOUS STRAINS/VARIETIES OF MUNG AGAINST WHITEFLY (*Bemisia tabaci* Genn.) UNDER NON SPRAYED CONDITIONS

The experiment was conducted for screening of mung strains/ varieties for whitefly population under natural conditions (i.e. non-sprayed). There were ten entries, three replications

with plot size of 6.0 m². The experiment was laid out in RCBD. The sowing date was 11.07.2019 and harvesting was done on 24.10.2019.

The results are as under:

Strains	Av. Whitefly/leaf
BRM-343	9.33
BRM-349	9.11
BRM-350	8.44
BRM-365	14.64
BRM-366	9.32
BRM-372	5.10
BRM-373	8.66
BRM-374	9.33
AZRI-M-2006	11.55
NM-2011	12.44



The maximum attack was recorded on BRM-365 i.e.14.64. Minimum population of whitefly per leaf was recorded on BRM-372 i.e.5.10.

5.9.2. EFFICACY OF DIFFERENT INSECTICIDES AGAINST WHITEFLY ON MUNG BEAN

The experiment was conducted to find out the efficacy of different insecticides against whitefly. The experiment was laid out in RCBD with plot size of 4.8 m² with three replications. Sowing was done on 11.07.2019 and harvesting on 24.10.2019. The data of whitefly were recorded before and after spray by counting whitefly population per leaf. All the insecticides proved effective. The result of insecticidal efficacy are given below:



Insecticides	Percentage Mortality
Pyriproxifen 10EC	75
Chlorfenapyr 360SC	58
Metrine 0.5AS	68
Beprofezon 25 WP	60
Diafenthuran 500SC	70

All the tested insecticides showed better results. The maximum control was recorded by the insecticides Pyriproxifen 10 EC and Diafenthran 500SC which gave 75 and 70% mortality, respectively.

5.9.3. FIELD EFFICACY OF DIFFERENT INSECTICIDE AGAINST STEM BORER [*Chillo partellus* (Swinhoe)] ON SORGHUM CROP

The experiment was conducted to find out most effective insecticides to control the stem borer. There were five treatments with three replication in RCBD, RARI-S22 was sown for this purpose using plot size of 7.2 m². The experiment was sown on 10.07.2019. Attacked plants were counted before and after spray and damage percentage was calculated. Recommended doses of insecticides were applied on the crop. The results are given below:

Insecticides	Percentage Mortality
Lambdacyclothrin 2.5EC	70
Emanection bezoate1.9EC	68
Bifenthrin 10 EC	63
Chlorpyrifos 40 EC	75
Lufenuran 50 EC	58



All treatments were found effective. The maximum control (75%) was recorded by Chlorpyrifos 40 EC followed by Lambda cyhalothrin 2.5 EC i.e. 70% mortality against stem borer.

5.9.4. RESPONSE OF WHEAT VARIETIES/STRAINS AGAINST APHIDS UNDER NATURAL CONDITIONS.

The objective of this experiment was to screen out wheat varieties/ strains against aphid under natural field condition in normal and late sown crop. There were 10 entries with plot size 4.8 m² using RCBD with 3 replications. The data of aphid per tiller were recorded. The results are given as under:

varieties/ strains	Av. Aphid tiller ⁻¹	
	Normal planting	Late planting
14B1030	11.2	13.2
BF-1705	10.2	15.4
17554	13.2	18.2
17588	14.8	20.2
172149	13.2	16.6
172185	12.4	14.2
172190	14.6	18.6
12B2511	11.4	14.2
Ghazi-19 (check)	14.6	19.4
FSD-08 (check)	15.0	21.2



Maximum population of aphid tiller⁻¹ was observed in V-7588 and V-2190 in normal and late sown conditions, respectively. Minimum aphids tillers⁻¹ were observed on V-1705 in both normal and late planting.

5.9.5. EVALUATION OF SORGHUM STRAINS/VARIETIES AGAINST STEM BORER [*Chillo partellus* (Swinhoe)] UNDER NON SPRAYED CONDITIONS.

This experiment was conducted to evaluate ten sorghum varieties/ strains against stem borer under non-sprayed field conditions by using RCBD layout with three replications and plot size of 14.4 m². The %age damage of borer was recorded. The results are given below:

Varities/ Strains	Av. % damage
RARI-S3	30
RARI-S5	33
RARI-S14	40
RARI-S16	36
RARI-S17	34
RARI-S18	32
RARI-S22	38
Jowar-86 (check)	44
Y-SS-98 (check)	43
BR-319 (check)	41



The average damage percentage ranged from 30-44% due to *Chillo partellus*.

Maximum damage was found on strain BR-319 (41%) followed by strain RARI-S14 i.e. 40%. RARI-S3, showed minimum damage by stem borer with average damage of 30%.

5.9.6. STUDY OF APHID ON BRASSICA UNDER NON SPRAYED CONDITION

This experiment was conducted to screen raya varieties/strains against aphid under non-sprayed field conditions. There were 25 entries having 3 replications and plot size of 8.4 m². The experiment was laid out in RCBD and data were recorded on aphid populations from 5cm length of inflorescence. The recorded data are given below:

Varieties/strains	Avg. Aphid/ 5cm length	
	Normal sown	Late sown
BRJ-1003	9.39	15.28
BRJ-1101	10.58	14.23
BRJ-1301	11.92	17.68
BRJ-1665	11.32	14.73
BRJ-1666	10.86	12.68
BRJ-1667	11.46	15.16
BRJ-1669	12.06	14.8
BRJ-1670	9.79	14.7
BRJ-1671	8.59	15.29
BRJ-1672	10.33	18.8
BRJ-1773	8.86	14.7
BRJ-1774	11.59	20.0
BRJ-1775	11.65	14.9
BRJ-1776	7.3	14.6
BRJ-1777	11.32	15.25
BRJ-1779	10.79	15.34
BRJ-1881	10.46	14.8
BRJ-1882	9.25	14.6
BRJ-1883	11.72	15.0
BRJ-1102	11.0	14.3
BRJ-1885	11.6	16.7
BRJ-1886	12.86	23.66
BRJ-1304	11.53	15.6
BWP RAYA (check)	13.26	16.6
SUPPER RAYA (check)	11.86	16.4



Minimum aphid infestation was found on BRJ-1776 (7.61) in normal sown and on BRJ-1666 (10.86) on late sown conditions. Maximum aphid infestation was observed on strain BRJ-1886 (12.86) in normal and late plantings (23.66), respectively.

5.9.7. EFFICACY OF DIFFERENT INSECTICIDES AGAINST APHID ON BRASSICA

The experiment was conducted to find out the efficacy of different insecticides against aphid on brassica. The experiment was laid out in RCBD alongwith three replications having plot size 8.4 m². The data of aphid on brassica were recorded before and after spray. The results are given below:

Insecticides	Percentage Mortality
Pyriproxifen 10 EC	54.38
Nitenpyram 10 AS	65.85
Carbosulfan 20 EC	74.55
Imidacloprid 200 SL	75.40
Bifenthrin 10 EC	70.0

All the insecticides showed promising results. Carbosulfan was found to be the most effective against aphid on brassica with 74% mortality followed by imidacloprid 200SL i.e. 75% mortality against aphid.

5.9.8. RESPONSE OF PROMISING CHICKPEA LINES TO *Helicoverpa armigera* Hb, UNDER NATURAL FIELD CONDITIONS

This experiment was conducted to evaluate the chickpea varieties/ strains against gram pod borer under non-sprayed field conditions. There were ten eateries with three replications and plot size of 4.8 m². The trial was conducted according to RCBD. The %age damage of pod borer was recorded. The results are given below:

Varities/ Strains	Av. Pod damage %age
BRC-501	18.8
BRC-503	13.0
BRC-505	20.0
BRC-509	19.0
BRC-510	12.0
BRC-474	11.0
BRC-408	7.6
BRC-B-16	10
BHAKAR-2011 (check)	9.0
PUNJAB-2008 (check)	13.0



The average pod damage percentage ranged from 7-20% due to *Helicoverpa armigera*. Maximum damaged pods were observed on BRC-505 i.e. 20 percent. BRC-408 showed minimum damage by gram pod borer with average pod damage percentage of 7.6%.

5.9.9. EFFICACY OF DIFFERENT INSECTICIDE AGAINST GRAM POD BORER (*Helicoverpa armigera* Hb)

The experiment was conducted to find out the efficacy of various insecticides against gram pod borer on chickpea. BRC-446 was sown in RCBD with 3 replications having plot size of 4.8 m². Data of pod borer were recorded before and after the application of insecticides. The results are shown in following table:

Insecticides	Percentage Mortality
Emamectin benzoate 1.9 EC	72
Chlorpyrifos 40 EC	76
Lambdacyhalothrin 2.5 EC	66
Profenofos 50 EC	55
Bifenthrin 10 EC	41



All the tested insecticides were found effective in controlling the gram pod borer. However, maximum mortality i.e. 76 percent was observed by Chlorpyrifos 40 EC followed by Emamectin benzoate 1.9 EC i.e. 72 percent.

6. ON GOING DEVELOPMENT PROJECTS

6.1. PROJECT NO. PARB-904

There is worldwide issue of malnutrition. The wheat varieties of Pakistan contain 13-14% protein, **34-66ppm Fe & 28-46ppm Zn** in its grain, which is far less than the daily human requirement i.e. **8 -18 mg Fe & 12-16 mg Zn**. Keeping in view the issue, PARB has funded a project no. 904 aiming at enhancing the contents of Fe & Zn in new perspective wheat varieties so that the nation could be fed with a high quality wheat. For this purpose a regular study comprising of hybridization, filial generation study and evaluation of homozygous genotypes in on station and out station yield trials were carried out during 2019-20. Targeted and random crosses of about 300 heads were attempted, out of which 140 heads were selected which will be sown in next season. Two A and B trials comprising of 20 genotypes with three different treatments (a) controlled (b) soil fertilizer application (c) foliar fertilizer application; with three replications including two checks (Zincol & Ghazi-19) were conducted. The fertilizers ($ZnSO_4$ & $FeSO_4$) were applied at the rate of 10 kg ha^{-1} in soil application at the time of sowing and 0.3% solution of both fertilizers at the stage of booting. The results showed that the yield and quality traits were enhanced under foliar application condition.

Yield comparison of **A-trial** (20) entries under three different treatments during the year 2019-20 is given below:

Entries	T₁	T₂	T₃	Mean
BF-1901	4833	5222	4611	4889
BF-1902	4611	5056	4333	4667
BF-1903	5306	4778	4556	4880
BF-1904	5333	5222	4222	4926
BF-1905	4333	3583	4611	4176
BF-1906	4917	4361	4111	4463
BF-1907	3361	3222	3333	3306
BF-1908	4083	3792	3250	3708
BF-1909	2778	2333	3333	2815
Zincol-16 (Check)	3292	4167	4833	4097
BF-1910	3750	5500	5500	4917
BF-1911	4000	3667	3833	3833
BF-1912	2278	2833	2667	2593
BF-1913	3417	3500	3000	3306

BF-1914	4472	3750	3889	4037
BF-1915	2722	3111	3333	3056
BF-1916	3250	2111	4500	3287
BF-1917	3361	3750	2667	3259
BF-1918	2889	4667	3556	3704
Ghazi-19 (Check)	4750	4222	4944	4639

These high yielder genotypes from A-trial of biofortification project will be sent in PUWYT 2020-21 in next year. The purpose of B trial was only for the confirmation of previous year results. The best lines BF-1807 & BF-1808 from B trial (previous year A-trial) were already sent to PUWYT.

The outcome of this project is given as under:

- In NUWYT result 2019-20 the average yield of BF-1705 under **irrigated condition** was 4537 kg ha⁻¹ in Punjab (20 locations) and average yield in Pakistan (33 locations) was 4252 kg ha⁻¹; while the best check was Ghazi-19 whose yield was 4638 kg ha⁻¹ under irrigated condition in Punjab (20 locations) and average yield in Pakistan (33 locations) was 4369 kg ha⁻¹.

In NUWYT result 2019-20 the average yield of BF-1705 under **rainfed condition** was 4491 kg ha⁻¹ in Punjab (06 locations) and average yield in Pakistan (10 locations) was 4141 kg ha⁻¹; while the best check under rainfed condition was also Ghazi-19 whose yield was 4296 kg ha⁻¹ under rainfed condition in Punjab (06 locations) and average yield in Pakistan (33 locations) was 3827 kg ha⁻¹.

The results showed that the genotype BF-1705 performed better than the best check (Ghazi-19) under rainfed condition. So this genotype may be release as a new line in rainfed/water stress environment.

- Another entry BF-1807 ranked 5th in PUWYT 2019-20 out of 50 entries. Average yield of BF-1807 in PUWYT 2019-20 was 4538 kg ha⁻¹ on basis of average of 29 locations.

6.2. PROJECT NO. PARB-911

It was funded by PARB for three years i.e. 2017-18 to 2019-20. The year 2019-20 is its last year and will end on 30.10.2020. This project aimed at the following:

- Improvement in productivity of Wheat (*Triticum aestivum*), Sohanjna (*Moringa olifera*), Castor Bean (*Ricinus communis*), Taramera (*Eruca sativa*), Mustard (*Brassica juncea*),

Pearl Millet (*Pennisetum glaucum*) and Sesame (*Sesamum indicum*) by identifying biotic and abiotic stress tolerant genotypes for marginal lands of lesser Cholistan.

- Increase in the grain/seed production of farmers of Cholistan by adopting the multiple cropping system and efficient use of water, crop management, crop protection and post-harvest technology.
- Creating awareness among the farming community of Cholistan and agriculture workers of the area.

The research activities conducted during Kharif 2019 and Rabi 2019-20 are elaborated as under:

KHARIF-2019

Selected genotypes of Pearl Millet, Sesame & Castor bean were sown at farm area of this institute and at farmer's field in lesser Cholistan during July, 2019 and necessary data were recorded. Detail is given as under:

Sr. No	Crop name	Genotypes	Sites	Yield (kg ha ⁻¹)(Avg. of all sites)
RARI, Bahawalpur				
1	Pearl Millet	Cholistani Bajra	1	960
2	Pearl Millet	Barani Bajra	1	940
3	Sesame	TH-06	1	175
4	Castor bean	Local	1	494
Lesser Cholistan				
1	Pearl Millet	Cholistani Bajra	06	898
2	Pearl Millet	Barani Bajra	06	885
3	Sesame	TH-06	07	172
4	Castor bean	Local	10	430

RABI, 2019-20

Experiments/demonstration blocks of selected genotypes of various crops were sown at the experimental area of this institute and selected farmer's fields in lesser Cholistan during Rabi, 2019-20. Detail is given as under:

Sr. No	Crop name	Genotypes	sites	Yield (kg ha ⁻¹)(Avg. of all sites)
RARI, Bahawalpur				
1	Wheat	Aas-11	1	5631
		Gold-16		5829
		Johar-16		6125
		Ghazi-19		6718

2	Mustard	Super Raya	1	2668
		Bwp Raya		2914
		Khan Pur Raya		2519
		Rohi Sarsoon		2371
3	Taramera	Taramera-A	1	741
4	Moringa	Cuttings	1	20-50 cuttings/site
Lesser Cholistan				
1	Wheat	Aas-11	18	4594
		Gold-16		4752
		Johar-16		4989
		Ghazi-19		5355
2	Mustard	Super Raya	15	2096
		Bwp Raya		2173
		Khan Pur Raya		1492
		Rohi Sarsoon		1561
3	Taramera	Taramera-A	09	670
4	Moringa	Cuttings	14	20-50 cuttings/site

Ghazi-19 performed well among all Wheat varieties under Bahawalpur as well as under lesser Cholistan condition. Bwp Raya and Super Raya gave better seed yield than Khanpur Raya and Rohi Sarsoon indicating better adaptability of these genotype in lesser Cholistan areas.

Soil and water samples were collected from all the selected sites and subjected to analysis during the season. Water samples of tube wells were found marginal fit. However, soil condition was normal from each site due to partial supply of irrigation water.

SOIL ANALYSIS REPORT OF MILLET & SESAME TRIALS KHARIF-2019

Sr. No	Name of Farmer	Location	Depth (cm)	EC (dS/m)	ph	OM %	P (available)	K (available)	Sat. % age	Texture	Remarks
1	Muhammad Hafeez S/O Ghulam Muhammad	Toba Warnawali, khairpur, Bahawalpur	0-15	3.8	8.2	0.39	6.4	95	29	S. Loam	Normal
			15-30	3.4	8.0	0.35	5.9	75	28	S. Loam	Normal

2	Shabir Ahmad S/O Karamat Ali	Chak No. 43/db Yazman, Bahawalpur	0-15	5.1	8.3	0.48	6.8	125	41	Loam	Saline
			15-30	4.7	8.0	0.45	6.0	129	42	Loam	Saline
3	Qayyaum Ali & Umer Deen	Chak No. 153/db, Kudwala, Yazman, Bahawalpur	0-15	5.0	8.3	0.49	6.7	120	43	Loam	Saline
			15-30	4.5	8.0	0.42	6.0	110	41	Loam	Saline
4	Qayyaum Ali	Chak No. 153/db, Kudwala, Yazman, Bahawalpur	0-15	3.1	8.2	0.38	6.4	93	31	S. Loam	Normal
			15-30	2.9	8.1	0.34	5.8	75	28	S. Loam	Normal
5	Liaqat Ali	Chak No. 95/db, Near Channan peer	0-15	3.8	8.4	0.39	6.4	105	43	S. Loam	Normal
			15-30	3.5	8.0	0.38	6.2	126	39	S. Loam	Normal
6	Muhammad Zahid	Chak No. 59/db, Yazman, Bahawalpur	0-15	3.3	8.2	0.50	6.6	139	43	Loam	Normal
			15-30	2.7	8.1	0.43	6.6	125	46	Loam	Normal

WATER ANALYSIS REPORT OF MILLET & SESAME TRIALS KHARIF-2019

Sr. No	Name of Farmer	Location	EC (Us/cm)	Ca +Mg	Na	Co ₃	HCO ₃	Cl	SAR	RSC	Remarks
1	Muhammad Hafeez S/O Ghulam Muhammad	Toba Warnawali, khair pur, Bahawalpur	10500	ND	ND	ND	ND	ND	ND	ND	Unfit
2	Shabir Ahmad S/O Karamat Ali	Chak No. 43/db Yazman, Bahawalpur	11230	ND	ND	ND	ND	ND	ND	ND	Unfit

3	Qayyaum Ali	Chak No. 153/db, Kudwala, Yazman, Bahawalpur	1245	4.5	7.0	NIL	4.96	ND	5.25	0.36	M/Fit
4	Umer Deen	Chak No. 68/db, Kudwala, Yazman, Bahawalpur	1167	ND	ND	ND	ND	ND	ND	ND	M/Fit
5	Liaqat Ali	Chak No. 95/db, Near Channan peer	9500	ND	ND	ND	ND	ND	ND	ND	Unfit
6	Muhammad Zahid	Chak No. 59/db, Yazman, Bahawalpur	8550	ND	ND	ND	ND	ND	ND	ND	Unfit

7. INTERNSHIP OF STUDENTS

The students of final year of BSc (Hons) Agriculture from various agricultural universities/colleges are sent to this institute for their internship. The students conduct research projects under the super vision of research scientists of this institute. The detail of students who completed their internship during 2019-20 is given as under:

8. VISIT OF GRADUATE CLASSES

Classes from different agricultural universities visited the RARI, Campus to explore their knowledge and research experience. The scientist of Regional Agricultural Research Institute, Bahawalpur brief the classes about their research activities. Detail is given as under:

Department/University	Date of visit	No. of Students
Agronomy (UAF)	29.01.2020	120
Burewala campus Vehari	13.02.2020	124
Horticulture (UAF)	24.03.2020	92
Plant Pathology (UAF)	12.03.2020	113

9. VISIT OF DIGNITARIES AND THEIR VIEWS

Many farmers and dignitaries visited the Regional Agricultural Research institute, Bahawalpur at different times during the year and appreciated the Research work being carried out. Some views are reproduced as under:

i) Delegation of Agriculture Extension/Research from Sindh province (29.11.2019)

We visited the RARI, Bahawalpur. The brief was delivered by Mr. Saeed. The visit remain fruitful. We also appreciate the research work of the institute.

ii) Naveed Ahmad, Chairman R&D Board (18.02.2020):

From last seven years I am visiting this institute. I have witnessed the progress here in each aspect at every visit. The scientists and their respected Director at this time visit have performed much more in each department. The RARI is now famous all over the country at the same level of other institutes. Wishing for leaps and bounds progress of institute and its respected scientists.

iii) Syed Sami-ul-Hasan Gilani (MNA-174) (13.03.2020):

Today I visited research center. Before coming here, I was of the opinion that we are lacking behind in research and our institutions are not performing up to the mark but I must appreciate the services and contribution of our scientists and staff under the leadership of Dr. Lal, Director Research who are performing well and the new varieties of wheat, gram and sorghum, etc. are amazing. Despite of lack of resources, our team is doing well. Keep it up. We expect a lot from you as this is the best contribution towards the economy.

iv) Javed Khan Daulat Zai, Chairman Chief Minister Complaint Cell, Bahawalpur

Javed Khan Daulat Zai, Chairman Chief Minister Complaint Cell, Bahawalpur accompanied by Miss Sumaira Malik, MPA visited this Institute. The delegation appreciated the research activities and achievements of this Institute.

10. CLIMATIC DATA

Month	Temperature (°C)		Rainfall (mm)	Humidity (%)
	Minimum	Maximum		
July, 2019	25	44	00	88
August, 2019	24	40	96	74
September, 2019	27	38	16	86
October, 2019	25	35	86	93
November, 2019	25	30	22	79
December, 2019	08	19	23	72
January, 2020	05	14	19	62
February, 2020	08	20	00	75
March, 2020	19	25	103	82
April, 2020	17	33	13	78
May, 2020	23	44	00	76
June, 2020	27	48	00	75

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- Muhammad Tariq Mahmood, Mushtaq Ahmad, Imtiaz Ali. 2019. Chickpea blight: former efforts on pathogenicity, resistant germplasm and disease management. *Gomal University Journal of Research*, 35(1): 1-10.
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11. **TRAININGS OBTAINED**

Name of Officer	Title of Training	Host Institute	Duration
Dr. Rana Tauqeer Ahmad, AB (Veg.)	Innovation in vegetable production	RAEDC, Vehari	18.11.2019 to 21.11.2019
Mr. Naeem Arshad Maan (ARO)	Classification of novel insecticides	RAEDC, Vehari	18.11.2019 to 21.11.2019
Mrs. Madiha Mobeen (ARO)	Citation Management by Using Mendeley-Referance Management Software	Via Zoom	17.06.2020
Mr. Abid Ali (ARO)	Citation Management by Using Mendeley-Referance Management Software	Via Zoom	17.06.2020

12. **MEETINGS OF R&D BOARD**

Two meetings of Research and Development Board of this Institute were held under the chairmanship of Malik Naveed Ahmad, the Chairman on 20.09.2019 and 28.02.2020 to discuss and finalize Annual Program of Research Work for Kharif 2019 and Rabi 2019-20.

13. **VISITS OF FARMERS**

A large number of farmers visited the institute with the cooperation of WWF on 13.07.2019 and 05.12.2019. They were briefed about the research activities and achievements of the Institute. Which were appreciated by them.

14. TRAININGS OF MASTER TRAINERS OF EXTENSION DEPARTMENT

Yellow rust of wheat has emerged as a major threat for our main food crop since last few year. The wheat varieties which were highly resistant have becomes susceptible and highly susceptible now. The only management strategy for short term disease control, is the timely use of fungicides. As fungicides are protectant not curative, so timely application was our main goal in order to avoid over use of fungicides which economically burdened the farmers and responsible to make fungus resistance against the chemical. Capacity building of Agriculture Extension staff of districts of Bahawalpur, Rahim Yar Khan, Bahawalnagar, Lodhran, Muzafar Garh, Dera Ghazi Khan, Vehari and Khanewal was organized through one day training on wheat rusts diseases. The training was imparted by our Plant Pathology scientists, mainly focused on identification of wheat rust especially yellow rust, its mode of infection and effective management strategies which should be adopted for timely management of yellow rust disease of wheat which caused immense yield losses during the last couple of years.

15. MONITORING OF WHEAT COMPAIGN

Monitoring of farmers training program for the year 2019-20 for wheat crop was launched by Agriculture Department (Extension) in the Districts of Bahawalpur, Bahawalnagar and Lodhran was done. Duty was performed by two scientists of this institute i.e. Dr. Muhammad Arshad Hussain, Assistant Plant Pathologist and Mr. Muhammad Safdar, Assistant Botanist (Millets). Detail of monitoring is given as under:

1. BAHAWALPUR

S. No.	Parameters	Remarks of the Monitor			
		No. of Training Programs checked	No. of Training Programs verified		
1.	Implementation status of training schedule in the District	22	22		
2.	Quality of training imparted by the training officer	No. of trainings where trainer have command on the subject	No. of trainings where trainer have not command on	No. of trainings where Extension tools was used	No. of trainings where Extension tools

			the subject		was not used
		22	-	22	-
		No. of trainings where literature was distributed	No. of trainings where literature was not distributed	Average No. of participants in the trainings	Views of the farmers about the trainings
		18	04	25-30	Good
3.	Pest management campaign, pest scouting (infestation level) and treatment of hot spot.	N.A			
4.	Condition of the crop	Crop condition is almost good.			
5.	Any specific problem relating to the condition of the crop in the District.	Input supply is satisfactory. There is not any specific problems regarding wheat crop growing. Yellowing of leaves found in some fields, overall satisfactory situation.			
6.	Other observation	Low temperature, less rains			

2. BAHAWALNAGAR

S. No.	Parameters	Remarks of the Monitor			
1.	Implementation status of training schedule in the District	No. of Training Programs checked		No. of Training Programs verified	
		36		30	
2.	Quality of training imparted by the training officer	No. of trainings where trainer have command on the subject	No. of trainings where trainer have not command on the subject	No. of trainings where Extension tools was used	No. of trainings where Extension tools was not used
		36	-	36	-

		No. of trainings where literature was distributed	No. of trainings where literature was not distributed	Average No. of participants in the trainings	Views of the farmers about the trainings
		36	-	20-25	Good
3.	Pest management campaign, pest scouting (infestation level) and treatment of hot spot.	N.A			
4.	Condition of the crop	Crop condition is almost good.			
5.	Any specific problem relating to the condition of the crop in the District.	Input supply is satisfactory. There is not any specific problems regarding wheat crop growing.			
6.	Other observation	Shortage of canal irrigation water.			

3. LODHRAN

S. No.	Parameters	Remarks of the Monitor			
		No. of Training Programs checked	No. of Training Programs verified		
1.	Implementation status of training schedule in the District	12		12	
2.	Quality of training imparted by the training officer	No. of trainings where trainer have command on the subject	No. of trainings where trainer have not command on the subject	No. of trainings where Extension tools was used	No. of trainings where Extension tools was not used
		12	-	12	-
		No. of trainings where literature was distributed	No. of trainings where literature was not distributed	Average No. of participants in the trainings	Views of the farmers about the trainings

		9	3	25-30	Good
3.	Pest management campaign, pest scouting (infestation level) and treatment of hot spot.	N.A			
4.	Condition of the crop	Crop condition is almost good.			
5.	Any specific problem relating to the condition of the crop in the District.	Input supply is satisfactory. There is not any specific problems regarding wheat crop growing..			
6.	Other observation	Low temperature, less rainfall during period			

16. MONITORING OF LOCUSTS

Desert locust (*Schistocerca gregaria*) is the world most dangerous, destructive and migratory pest that affects the food security by feeding on valuable crop and grasses and other wild vegetation. Early detection is critical in locust management because they possess very high mobility in later stage and it is difficult to control mass migrating insect. It is imperative to control successfully the desert locust infestation as it appeared in cultural areas of Southern Punjab. For this purpose, monitoring and surveillance of locust started in district Rajanpur to highlight ground reality concerning locust swarm presence, breeding areas and egg laying activity of locust for the safeguard of national food security and also creating mass awareness activity among farming community to combat serious threat to agriculture from desert locust. The surveillance was carried out in three tehsils of Rajanpur, Jampur and Rojhan in district Rajanpur. The data were recorded to evaluate the presence of locust in the cropped and non-cropped area, stages of locust and movement of locust swarm. In total, more than 200 sites were visited during surveillance. The locust attack started in the month of March with eggs hatching on area (8sqkm) of “Thulsaerak” in Tehsil Jampur and in wast area (22000ha) of “Patti Shah Wali” in Tehsil Rojhan. These are tribal areas adjoining to mountain of Koh Sulaiman. In Tehsil Rojhan, very high population of hopper and adults were present in the month of April- 2020. A very big combat operation was carried out in Barra, Chack Sorri, Patti Shah Wali, Uzman, Ghoth Mazari, Aribi Tibbi, Gaddan Narr, Mianni Patak, and Katchi Canal to meance the locust

invasion in which one army helicopter and two air crafts were used. Several training/seminar sessions were also launched to create awareness among farmer community. These session played a vital role in controlling desert locust successfully which appeared in cropped areas of district Rajanpur.

Surveillance activities are expensive. However, an activity that supports National action plan for locust and without surveillance, it was impossible to predict locust migration and control the locust. Thus monitoring and surveillance played a key role in overall control program of locust in district Rajanpur. Now the area is clear from the locust. Surveillance is in progress, threats from Kashmor (Sindh), sui, Dera Bugti (Blochistan) still persists as district Rajanpur is situated along eastern side of Koh-e-Sulman and Blochistan is aligning along the western side of Koh-e-Sulman.

17. VARIETY APPROVAL

A promising line of Wheat 122559 was approved as a commercial variety during 2019 as Ghazi-19. The salient features of this variety are as under:

- The variety has improved yield potential.
- Variety is tolerant of all three rusts.
- Good grain quality with high protein percentage (15%).
- Tolerant to medium salinity level.

18. SPOT EXAMINATION (WHEAT, RAYA AND GRAM)

Spot examination of three promising lines of wheat, raya and chickpea was conducted on 26.03.2020. The salient traits of these lines are given as under:

- **RAYA (BRJ-1304)**

Plant traits	BRJ-1304	BWP Raya
Days of flowering	47	48
Days of maturity	146	152
Plant height (cm)	160	165
Lodging	Resistant	Resistant
Shattering	Resistant	Resistant
Seeds per slique	13-16	11
000 seed weight (grams)	4.7-5.1	4.6-4.9
Oil (%)	40	37.14
Maturity status	Early maturing	Normal/ Early maturing
Yield potential (kg ha ⁻¹)	3200	2950

- **Wheat (12B2511)**

Traits	Description
Growth behavior	Semi erect
Plant color	Green
Head color	White
Days to heading	95-105
Days to maturity	135-140
Plant height (cm)	90-100
Thousand kernel weight (g)	38-40
Protein percentage	13-15
Disease reaction	Tolerant
Yield potential (kg ha ⁻¹)	6000-6500

- **Chickpea (BRC-408)**

Plant Traits	BRC-408 (Kabuli)	Noor-2013 (Kabuli Check)
Plant height (cm)	65-85	60-80
100-seed weight (g)	27-28	24-25
Days to 50% flowering	80-100	80-110
Days to maturity	135-147	155-160
Pods plant ⁻¹	60-70	55-65
Seed pod ⁻¹	01-02	01-02
Seed size	Bolder	Bold
Yield potential (kg ha ⁻¹)	2500	-

19. SEED PRODUCTION

Crops	Pre-basic Seed Production (kg)
Wheat	18000
Raya	80

20. RADIO/TV TALKS

The Scientists of this institute participate in different Radio/TV talks according to the government schedule. They deliver talks on field problems and issues of farmers. They also reply the farmer calls in live program.