

## 1. RAPESEED AND MUSTARD

### A. ZAID KHARIF BRASSICA

#### Project 1. MAINTENANCE OF GENE POOL

182 entries of *B. juncea* were studied.

#### Project 2. DEVELOPMENT OF FRESH CROSSES

Fourteen crosses were made keeping ZBJ-08051 and AARI Canola as male parents, having low Erucic acid and low Glucosinolates while other parental lines having good traits.

<u>S.No.</u>	<u>Crosses</u>		
1.	ZBJ-18003	x	ZBJ-08051
2.	ZBJ-18007	x	ZBJ-08051
3.	ZBJ-18023	x	ZBJ-08051
4.	ZBJ-19001	x	ZBJ-08051
5.	ZBJ-19006	x	ZBJ-08051
6.	ZBJ-19011	x	ZBJ-08051
7.	ZBJ-19021	x	ZBJ-08051
8.	ZBJ-18003	x	AARI Canola
9.	ZBJ-18007	x	AARI Canola
10.	ZBJ-18023	x	AARI Canola
11.	ZBJ-19001	x	AARI Canola
12.	ZBJ-19006	x	AARI Canola
13.	ZBJ-19011	x	AARI Canola
14.	ZBJ-19021	x	AARI Canola

Seed of each cross was collected at maturity to raise F<sub>1</sub> generation.

#### Project 3. STUDY OF FILIAL GENERATIONS

The crosses studied in different generations are given in Table 1.1.

**Table 1.1**

**Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>6</sub> Summer Mustard generations during 2019-20 at Oilseeds Research Institute, Faisalabad.**

Generation	No. of crosses studied	No. of progenies studied	No. of plants selected	No. of lines selected for PYT
F <sub>1</sub>	20	-	-	-
F <sub>2</sub>	09	Whole material	101	-
F <sub>3</sub>	20	167	126	-
F <sub>4</sub>	13	133	78	-
F <sub>5</sub>	15	57	34	-
F <sub>6</sub>	12	24	-	11

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 09 F<sub>2</sub> crosses, 101 desirable plants were selected. In F<sub>3</sub> to F<sub>5</sub> generations, the best progenies were selected and from each of

those, one desirable plant was selected to raise next generation. In F<sub>6</sub>, 11 progenies were selected for seed yield evaluation in preliminary yield trial.

**Project 4. PRELIMINARY YIELD TRIAL (*B. juncea*)**

Eighteen *B. juncea* lines were tested along with the standard variety “AARI Canola”. The data collected on seed yield and other agronomic traits are given in Table 1.2.

**Table 1.2**

**Performance of 18 entries of *B. juncea* in Preliminary Yield Trial at Oilseeds Research**

**Institute, Faisalabad during Zaid Kharif 2019-20.**

Rank	Entry Name	DF	DM	Oil content (%)	Plant height (cm)	Branches /plant	Silique length (cm)	Seeds /silique	1000 seed weight (g)	Seed yield (kg/ha)
1	ZBJ-17017	51	150	38.04	206	9	5.50	14	2.93	2681
2	ZBJ-19003	56	146	36.15	236	9	5.36	15	3.39	2059
3	ZBJ-19008	50	147	38.09	227	10	5.33	15	3.00	1852
4	ZBJ-19015	51	145	41.09	222	11	4.82	14	2.69	1852
5	ZBJ-17003	53	150	37.52	209	7	4.61	14	2.99	1800
6	ZBJ-19038	56	149	39.02	225	11	4.31	14	2.97	1778
7	AARI Canola (C)	51	145	38.46	202	8	4.41	16	3.26	1778
8	ZBJ-19004	56	147	35.22	242	8	5.07	15	2.69	1770
9	ZBJ-19005	51	145	34.2	206	8	5.19	15	2.77	1756
10	ZBJ-18023	55	147	39.02	213	9	4.44	14	2.64	1741
11	ZBJ-19001	55	147	35.49	217	9	5.37	14	3.04	1593
12	ZBJ-19014	51	145	40.01	221	9	4.83	13	3.37	1585
13	ZBJ-19079	54	147	39.65	220	9	5.30	16	3.46	1578
14	ZBJ-19002	56	147	36.77	242	11	4.91	14	3.57	1533
15	ZBJ-19021	53	150	37.14	213	9	4.96	14	2.62	1511
16	ZBJ-19016	52	147	37.91	215	7	4.82	13	2.64	1504
17	ZBJ-17002	56	149	37.89	231	11	4.47	15	2.98	1496
18	ZBJ-19018	52	148	37.79	242	10	4.05	15	2.25	1185
<b>LSD 5%</b>										210

Design  
Plot size  
Row spacing  
Fertilizer  
Sowing date

R.C.B  
5 x 0.9 m  
45 cm  
80: 60:60 NPK kg/ha  
20.09.2019

The perusal of table 1.2 indicates that ZBJ-17017 gave highest yield i.e, 2681 kg/ha followed by ZBJ-19003 i.e, 2059 kg/ha. Days to flowering ranged from 50-56 and days to maturity 145 - 150. Plant height ranges from 202-242cm. Number of branches ranged from 7-11. Maximum silique length was observed by ZBJ-17017 and maximum seeds per silique was observed by AARI Canola. 1000 grain weight ranged from 2.25-3.57.

**Project 5. ADVANCED SEED YIELD TRIAL (*B. juncea*)**

Nine *B. juncea* lines were evaluated along with “AARI Canola”. The results are presented in table 1.3.

**Table 1.3**

**Performance of 09 entries of advanced seed yield trial, 2019-20 at Oilseeds Research Institute, Faisalabad.**

Rank	Entry Name	DF	DM	Oil content (%)	Plant height (cm)	Branches /plant	Silique length (cm)	Seeds /silique	1000 seed weight (g)	Seed yield (kg/ha)
1	ZBJ-17008	53	147	33.38	194	10	4.25	16	3.10	1738
2	ZBJ-18008	56	148	31.19	239	10	4.31	14	2.45	1625
3	ZBJ-17014	53	147	31.58	225	10	4.48	14	3.26	1481
4	AARI Canola (C)	53	147	31.97	185	9	4.32	15	2.93	1457
5	ZBJ-16011	53	147	32.08	194	12	4.27	15	3.19	1393
6	ZBJ-18007	56	146	33.17	230	10	3.85	15	1.56	1348
7	ZBJ-18009	54	151	30.64	241	11	4.26	15	2.83	1309
8	ZBJ-18003	56	145	30.47	218	11	3.94	15	2.92	1200
9	ZBJ-17013	51	146	32.07	235	11	4.09	15	3.18	1190
<b>LSD 5%</b>										152

Design R.C.B  
 Plot size 5 x 1.35 m  
 Row spacing 45 cm  
 Fertilizer 80: 60:60 NPK kg/ha  
 Sowing date 20.09.2019

The perusal of Table 1.3 indicates that ZBJ-17008 gave highest yield i.e. 1738 kg/ha. Days to flowering ranged from 51 to 56. Days to maturity ranged from 145 to 151. ZBJ-18009 was last in maturity (151 days). Number of branches ranged from 9-12 and plant height 185-

241cm. 1000 grain weight ranged from 1.56-3.26. Maximum seeds per silique was observed by ZBJ-17008.

**Project 6. MICRO SEED YIELD TRIALS (*B. juncea*)**

Yield performance of ten lines of *B. juncea* was tested under different agro- climatic conditions of the province. The results obtained from five locations are given in table 1.4 (a) and 1.4 (b).

**Table 1.4 (a)**

**Performance of *B. juncea* strains at different locations in the Punjab during  
Zaid Kharif 2019-20**

Rank	Entry Name	Faisalabad	Karor	Khanpur	Bahawalpur	Piplan	Average
1	ZBJ-17019	2644	1430	1811	1333	1917	1827
2	AARI Canola (C)	1704	1381	2081	1715	1731	1722
3	ZBJ-17022	2085	1443	1593	1556	1602	1656
4	ZBJ-16002	1778	1057	1804	1296	1593	1506
5	ZBJ-16008	1759	1024	1722	1296	1644	1489
6	ZBJ-16003	1593	1407	1352	1778	1281	1482
7	ZBJ-10021	1630	1067	1393	1593	1619	1460
8	ZBJ-15023	1567	1154	1589	1519	1404	1446
9	ZBJ-11002	1641	957	1593	1537	1500	1446
10	ZBJ-17006	1685	1019	1767	1333	1361	1433
LSD 5%		249	203	226	225	285	

Perusal of the table 1.4 (a) indicated that ZBJ-17019 surpassed all the entries included in the trial by giving average seed yield of 1790 kg/ha while lowest yield was obtained by ZBJ-17006 (1433 kg/ha).

**Table 1.4 (b)**  
**Others parameters of advanced lines of Micro seed yield trial, 2019-20 recorded at**  
**Oilseed Research Institute, Faisalabad.**

Rank	Entry Name	DF	DM	Oil content %	Plant height (cm)	Branches /plant	Silique length (cm)	Seeds /silique	1000 seed weight (g)	Seed yield (kg/ha)
1	ZBJ-17019	51	93	38.03	221	9	4.0	16	3.82	2644
2	ZBJ-17022	51	94	38.19	227	9	3.9	14	3.94	2085
3	ZBJ-16002	56	94	37.57	233	9	3.9	15	2.68	1781
4	ZBJ-16008	56	87	40.29	224	10	3.6	16	2.72	1759
5	AARI Canola (C)	53	90	41.17	222	10	3.7	15	2.72	1704
6	ZBJ-17006	51	94	38.68	219	10	3.8	15	3.09	1685
7	ZBJ-11002	53	98	39.87	220	9	4.0	15	2.93	1641
8	ZBJ-10021	51	94	38.82	210	12	3.7	15	2.99	1630
9	ZBJ-16003	56	92	34.38	231	10	3.6	16	2.55	1593
10	ZBJ-15023	53	94	38.55	209	9	3.9	14	2.77	1567
<b>LSD 5%</b>										249

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	80:60:60 N:P:K kg/ha
Sowing date	20.09.2019

Perusal of the table 1.4 (b) indicated that six lines surpassed the standard variety AARI Canola in seed yield. Days to flowering ranged from 51-56 days and days to maturity 87-98. Minimum days to maturity were taken by ZBJ-16008. Number of branches per plant ranged from 9-12. ZBJ-16003 and ZBJ-16008 exhibited maximum silique length (3.6 cm) and seeds per silique (16). 1000 grain weight ranged from 2.55-3.94.

## **B. WINTER RAPESEED- FAISALABAD**

### **Project 1. DEVELOPMENT OF FRESH CROSSES**

Following crosses were made keeping RBN-13028 as male parent having canola quality, high yielding and lodging resistant traits. Enough seed of each cross was saved for growing F<sub>1</sub> generation.

<u>Sr. No.</u>	<u>Crosses</u>
1.	RBN-14017 x Super Canola
2.	RBN-17014 x Super Canola
3.	RBN-18001 x Super Canola
4.	RBN-18006 x Super Canola
5.	RBN-18007 x Super Canola
6.	RBN-18008 x Super Canola
7.	RBN-18009 x Super Canola
8.	RBN-18010 x Super Canola
9.	RBN- 18011 x Super Canola
10.	RBN- 18013 x Super Canola
11.	RBN- 18021 x Super Canola

## **Project 2. STUDY OF FILIAL GENERATIONS**

The breeding material studied in F<sub>1</sub> to F<sub>7</sub> generations is given in table 1.5.

**Table 1.5**

<b>Generations</b>	<b>No. of crosses studied</b>	<b>No. of progenies studied</b>	<b>No. of plants selected</b>	<b>No. of lines selected for PYT</b>
<b>F<sub>1</sub></b>	10	-	<b>Whole material</b>	-
<b>F<sub>2</sub></b>	13	Whole material	51	-
<b>F<sub>3</sub></b>	12	70	46	-
<b>F<sub>4</sub></b>	08	57	27	-
<b>F<sub>5</sub></b>	12	62	20	-
<b>F<sub>6</sub></b>	04	44	14	-
<b>F<sub>7</sub></b>	11	64	-	09 Lines

Each F<sub>1</sub> cross was harvested separately to advance the generation. Selection in F<sub>2</sub> to F<sub>7</sub> generations was based on desirable phenotypic manifestation of traits such as vigor of the plants, earliness and tolerance to diseases and insects along with seed yield and quality of the selected plants.

31 plants were selected from 10 crosses of F<sub>2</sub> generation to raise F<sub>3</sub> generation. In F<sub>3</sub> generation, 46 plants were selected to raise F<sub>4</sub> in the next year. In F<sub>4</sub> generation, 27 plants were selected to raise F<sub>5</sub> generation. In F<sub>5</sub> generation 20 plants from 62 progenies derived from 12 crosses were selected. In F<sub>6</sub> generation 14 plants from 44 progenies derived from 4 crosses were selected. In F<sub>7</sub> generation, 09 lines were selected for PYT out of 64 progenies of 11 crosses.

**Project 3. PRELIMINARY SEED YIELD TRIAL (*B. napus*)**

Eighteen *B. napus* lines were tested along with the standard variety “Super Canola” in two sets. The data collected on seed yield and other agronomic traits are given in table 1.6 (a) and (b).

**Table 1.6 (a)**

**Performance of 10 entries of *Brassica napus* in Preliminary Yield Trial Set-1 at Oilseeds Research Institute, Faisalabad during Rabi 2019-20.**

Rank	Entry Name	DF	DM	Oil content (%)	1000 seed weight (g)	Seed Yield /plot (grams)			Average	Yield (kg/ha)
						R1	R2	R3		
1	RBN-18008	64	158	38	4.28	1760	1594	1748	1701	3779
2	RBN-18009	61	159	37	3.98	1538	1656	1722	1639	3641
3	RBN-18001	85	160	37	3.15	1394	1598	1360	1451	3224
4	RBN-18013	62	159	37	3.10	1484	1282	1470	1412	3138
5	Super Canola (C)	85	159	36	2.42	1342	1448	1410	1400	3111
6	RBN-19017	62	163	42	4.19	1368	1226	1162	1252	2782
7	RBN-19016	83	164	37	2.81	1010	1150	1070	1077	2393
8	RBN-19021	64	159	37	4.26	1050	1138	986	1058	2351
9	RBN-19018	79	160	39	4.51	1000	916	1080	999	2219
10	RBN-19015	65	161	37	2.84	872	1016	886	925	2055
									<b>LSD 5%</b>	165

**Table 1.6 (b)**

**Performance of 10 entries of *Brassica napus* in Preliminary Yield Trial Set-2 at Oilseeds Research Institute, Faisalabad during Rabi 2019-20.**

Rank	Entry Name	DF	DM	Oil content (%)	1000 seed weight (g)	Seed Yield /plot (grams)			Average	Seed Yield (Kg/Ha)
						R1	R2	R3		
1	RBN-19038	59	157	38	3.51	1816	1688	1872	1725	3834
2	Super Canola (C)	83	159	35	2.35	1216	1366	1154	1245	2767
3	RBN-19032	76	157	39	4.21	1286	1138	1210	1211	2692
4	RBN-19035	83	162	36	3.30	1260	1072	1266	1199	2665
5	RBN-19037	60	159	37	3.43	1112	1074	1082	1089	2421
6	RBN-19029	64	158	39	4.12	972	1164	998	1045	2321
7	RBN-19030	64	159	39	4.40	936	1046	1020	1001	2224
8	RBN-19031	79	160	36	3.26	990	872	1066	976	2169
9	RBN-19033	78	159	38	3.72	1078	992	848	973	2161
10	RBN-19036	85	160	37	3.15	802	1000	1090	964	2142
									<b>LSD 5%</b>	178

**Project 4. ADVANCED SEED YIELD TRIAL (*B. napus*)**

Nine *B. napus* lines were evaluated along with “Super Canola”. The results are presented in table 1.7.

**Table 1.7**

**Performance of 09 entries of *Brassica napus* for advanced seed yield trial, 2019-20 at Oilseeds Research Institute, Faisalabad.**

Rank	Entry Name	DF	DM	Oil content (%)	1000 seed weight (g)	Seed Yield /plot (grams)			Average	Seed Yield (Kg/Ha)
						R1	R2	R3		
1	RBN-16014	64	156	38	3.85	2122	2482	2208	2271	3364
2	RBN-18006	60	159	40	4.52	2066	2056	1888	2003	2968
3	RBN-18021	77	158	42	3.43	2064	2034	1912	2003	2968
4	RBN-18007	64	157	38	4.18	1840	1904	1952	1899	2813
5	RBN-18010	63	159	40	3.76	1844	1816	1944	1868	2767
6	RBN-13012	85	160	39	3.03	1700	1826	1992	1839	2725
7	RBN-18011	65	158	41	4.06	1746	1926	1798	1823	2701
8	RBN-17003	64	154	37	3.02	1666	1746	1648	1687	2499
9	Super Canola (C)	81	159	36	2.81	1674	1542	1440	1552	2299
<b>LSD 5%</b>										187

The perusal of table 1.7 indicates that RBN-16014 gave highest yield i.e. 3364 kg/ha. Days to flowering ranged from 60-85. RBN-18006 took minimum days to flower. Days to maturity ranged from 154-160. 1000 grain weight ranged from 2.81-4.52.

Design	R.C.B.
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	90: 85:60 kg NPK kg/ha
Sowing date	11.10.2019

**Project 6. MICRO YIELD TRIAL (*B. napus*)**

Ten *B. napus* strains were evaluated along with Super canola for seed yield & other agronomic traits. The data recorded are given in table 1.8 (a).



**Table 1.8 (a)**  
**Seed Yield (kg/ha) of eleven entries of *B. napus* in Micro Yield Trial conducted over 7**  
**locations in Punjab, 2019-2020**

Rank	Entry Name	Fsd	K/pur	Karor	Piplan	B/pur	F/jang	Chkwl	Average
1	RBN-18021	2583	2407	3081	2046	2257	894	1074	2212
2	RBN-16001	2398	2593	2837	2148	1969	1014	1148	2160
3	RBN-14017	1910	2870	2352	1546	2157	1037	1574	1979
4	RBN-18007	2364	2352	2804	1861	1515	903	1056	1966
5	RBN-17014	1841	2148	2519	1269	2111	995	1611	1814
6	KN-338	1594	2059	2337	1704	1937	718	1500	1725
7	Chakwal Sarson (C)	1221	2593	2567	1843	1170	634	1296	1671
8	17CBN 007	1563	2126	2333	1426	1706	833	1000	1665
9	Super Canola (C)	1771	2137	2685	1394	1144	671	1426	1634
10	KN-331	1724	2022	2289	1517	1283	815	1185	1608
11	17CBN 004	1336	1481	2430	1352	1443	856	1100	1483
	LSD 5 %	113	199	204	111	157	84	159	

Perusal of the table 1.8 (a) indicated that RBN-18021 surpassed all the entries included in the trial by giving seed yield of 2212 kg/ha closely followed by RBN-16001 (2160 kg/ha).

**Table 1.8(b)**  
**Other parameters of advance lines of micro seed yield trial recorded at the Oilseeds**  
**Research Institute, Faisalabad during 2019-2020**

Rank	Entry Name	DF	DM	Oil content (%)	1000 seed weight (g)	Seed Yield /plot (grams)			Average	Seed Yield (Kg/Ha)
						R1	R2	R3		
1	RBN-18021	63	151	42	3.62	2408	2248	2318	2325	2583
2	RBN-16001	79	155	36	3.65	2110	2110	2254	2158	2398
3	RBN-18007	63	150	38	3.39	2108	2146	2128	2127	2364
4	RBN-14017	62	152	38	3.56	1738	1646	1774	1719	1910
5	RBN-17014	77	156	36	4.51	1782	1546	1642	1657	1841
6	Super Canola (C)	89	159	39	3.07	1564	1620	1598	1594	1771
7	KN-331	77	162	40	3.37	1618	1572	1466	1552	1724
8	KN-338	80	160	39	3.28	1398	1494	1412	1435	1594
9	17CBN 007	84	160	35	2.97	1436	1356	1428	1407	1563
10	17CBN 004	62	158	36	2.94	1214	1104	1290	1203	1336
11	Chakwal Sarson (C)	84	167	38	3.02	1120	1042	1134	1099	1221
<b>LSD 5%</b>										113

Design	R.C.B.
Repeats	3
Plot size	5 x 1.80 m
Row spacing	45 cm
Fertilizer	90: 85:60 NPK kg/ha
Sowing date	11.10.2019

The perusal of table 1.8(b) indicates that RBN-18021 gave highest yield i.e. 2583 kg/ha. Days to flowering ranged from 62-89, days to maturity from 150-167, Highest 1000 grain weight (4.51) was observed in RBN-17014.

### Project 7. NATIONAL UNIFORM RAPESEED YIELD TRIAL (NURYT)

The objective of this trial was to test the performance of rapeseed varieties under Faisalabad environmental conditions. This trial was sown with the material supplied by the Pakistan Agricultural Research. The data recorded are given in table 1.9.

**Table 1.9**

Results of National Uniform Rapeseed Yield Trial conducted at 08 locations during Rabi 2019-20

Rank	Entry Name	ARI DI Khan	AZRC DI Khan	BARI Chakwal	NIFA Peshawar	ORI FSD	ORI Tandojam	RARI Bwp	NARC Isb.	Mean
1	RR-8-1	2422	2350	2517	4178	2274	5221	2372	2162	2937
2	HOPE-9	2174	2762	2550	4557	1988	5530	1686	2032	2910
3	ZCA-13	2489	2009	2356	3911	2862	5132	2006	2391	2895
4	C-1	3133	2415	2563	3388	2646	4501	1558	2714	2865
5	RR-8-2	1926	2329	2446	4060	2697	5237	1778	1736	2776
6	CHS-2	2304	2139	2378	4251	2201	5275	2036	1624	2776
7	CHYB3393TT	<b>2156</b>	<b>2067</b>	2611	4095	2022	5049	2136	1973	2764
8	HC-21C	2267	2238	2078	3947	2083	4911	2061	2401	2748
9	HC-022B	2852	2359	2745	3703	1302	4390	1972	2370	2712
10	16CBN007	2256	2364	2006	4233	2319	5295	1550	1510	2692
11	Super Canola (C)	2337	3047	2189	4255	1655	5097	1692	1032	2663
12	AA-131	1870	1144	2610	4333	1943	5276	1578	2247	2625
13	KN-339	2333	2320	2467	3634	1574	4406	1622	2235	2574
14	CHS-9	2263	2137	2133	3541	2097	4482	1675	2242	2571
15	RBN-13017	2233	1994	2561	3330	2585	4419	1903	1405	2554
16	KN-209	2500	1837	2041	3669	2155	4637	1681	1743	2533
17	RM-193-1	1822	2107	2194	3642	2227	4633	1700	1727	2507
18	Hyola-401 (C)	<b>2326</b>	<b>923</b>	2210	4334	1494	5128	2086	1459	2495
19	RBN-13016	2033	2031	2231	3634	1680	4442	2214	1306	2446
20	16CBN002	2263	2536	2114	3449	1656	4237	1508	1392	2394
21	14CBN009	2322	1789	2189	3509	1734	4327	1536	1299	2338
	<b>Location Mean</b>	2299	2138	2342	3888	2057	4839	1826	1857	

A perusal of table 1.9 shows that the differences of means due to varieties are highly significant. RBN-13017 gave the seed yield of 2554 kg/ha and check i.e. Super Canola gave the yield of 2663 kg/ha.

### C. WINTER MUSTARD, FAISALABAD (2019-20)

#### Project 1. DEVELOPMENT OF FRESH CROSSES

Following fresh crosses were made. Enough seed of each cross was saved for growing F<sub>1</sub> generation.

1.	RBJ-18002	x	ZBJ-08051
2.	RBJ-18003	x	ZBJ-08051
3.	RBJ-18004	x	ZBJ-08051
4.	RBJ-18007	x	ZBJ-08051
5.	RBJ-18008	x	ZBJ-08051
6.	RBJ-18009	x	ZBJ-08051
7.	RBJ-18010	x	ZBJ-08051
8.	RBJ-18011	x	ZBJ-08051
9.	RBJ-18015	x	ZBJ-08051
10.	RBJ-18017	x	ZBJ-08051

#### Project 2. STUDY OF FILIAL GENERATIONS

The breeding material studied in F<sub>1</sub> to F<sub>7</sub> generations is given in table 1.10.

**Table 1.10**

Generations	No. of crosses studied	No. of progenies studied	No. of plants selected	No. of lines selected for PYT
<b>F<sub>1</sub></b>	20	-	<b>Whole material</b>	-
<b>F<sub>2</sub></b>	13	Whole material	95	-
<b>F<sub>3</sub></b>	12	95	80	-
<b>F<sub>4</sub></b>	10	89	63	-
<b>F<sub>5</sub></b>	10	65	42	-
<b>F<sub>6</sub></b>	12	41	17	-
<b>F<sub>7</sub></b>	08	23	-	10

Each F<sub>1</sub> cross was harvested separately to advance the generation. Selection in F<sub>2</sub> to F<sub>7</sub> generations was based on desirable phenotypic manifestation of traits such as vigor of the plants,

earliness and tolerance to diseases and insects along with seed yield and quality of the selected plants.

95 plants were selected from 12 crosses of F<sub>2</sub> generation to raise F<sub>3</sub> generation. In F<sub>3</sub> generation, 80 plants were selected to raise F<sub>4</sub> in the next year. In F<sub>4</sub> generation, 63 plants were selected to raise F<sub>5</sub> generation. In F<sub>5</sub> generation 42 plants from 65 progenies derived from 10 crosses were selected. In F<sub>6</sub> generation 17 plants from 41 progenies derived from 12 crosses were selected. In F<sub>7</sub> generation, 10 lines were selected for PYT out of 23 progenies of 8 crosses.

### Project 3. PRELIMINARY YIELD TRIALS (*B. juncea*)

Fifteen *B. juncea* strains were evaluated along with Super Raya as standard variety. The data obtained are given in table 1.11.

**Table 1.11**

**Performance of 15 entries of *Brassica juncea* in Preliminary Yield Trial at Oilseeds  
Research Institute, Faisalabad during Rabi 2019-20.**

Rank	Entry Name	DF	DM	Oil Content (%)	1000 seed weight (g)	Yield/Plot (grams)				Yield (kg/ha)
						R1	R2	R3	Average	
1	RBJ-18003	74	164	32	2.58	966	722	900	863	1917
2	RBJ-19003	82	168	34	2.71	616	860	700	725	1612
3	RBJ-19022	75	160	33	2.47	700	592	728	673	1496
4	Super Raya (C )	60	158	31	2.58	634	762	624	673	1496
5	RBJ-18002	61	161	32	2.77	754	534	724	671	1490
6	RBJ-19002	83	165	35	2.60	578	644	700	641	1424
7	RBJ-19019	81	167	32	2.63	400	546	604	517	1148
8	RBJ-18011	73	168	31	2.72	400	504	634	513	1139
9	RBJ-19006	62	158	36	2.23	602	430	504	512	1138
10	RBJ-18010	75	165	39	2.50	452	404	400	419	930
11	RBJ-19020	59	157	31	2.25	462	340	414	405	901
12	RBJ-19012	61	159	33	2.39	308	396	444	383	850
13	RBJ-19013	79	166	34	2.36	380	388	266	345	766
14	RBJ-19001	80	167	31	2.45	286	362	370	339	754
15	RBJ-19010	74	167	33	2.38	300	274	206	260	578
<b>LSD 5%</b>										146

Design	R.C.B.
Plot size	5 x 0.90 m
Row spacing	45 cm
Fertilizer	90: 85:60 kg NPK/ha
Sowing date	13.10.2019

The perusal of table 1.11 indicates that RBJ-18003 gave highest yield i.e, 1917 kg/ha followed by RBJ-19003 i.e, 1612 kg/ha. Days to flowering ranged from 59-83 and days to maturity 158-168.

**Project 4. ADVANCED SEED YIELD TRIAL (*B. juncea*)**

Nine *B. juncea* lines were evaluated along with “Super Raya”. The results are presented in table 1.12.

**Table 1.12**  
**Performance of 09 entries of *Brassica juncea* for advanced seed yield trial, 2019-20 at Oilseeds Research Institute, Faisalabad**

Rank	Entry Name	DF	DM	Oil Content (%)	1000 seed weight (g)	Yield/Plot (grams)				Yield (kg/ha)
						R1	R2	R3	Average	
1	RBJ-15013	55	159	33	3.03	940	1060	888	963	1426
2	RBJ-15017	61	159	31	3.12	820	1000	834	885	1311
6	RBJ-17003	64	161	32	2.55	994	852	782	876	1298
9	Super Raya (C)	61	158	32	3.53	818	996	788	867	1285
5	RBJ-16012	57	156	33	2.82	856	1000	722	859	1273
8	RBJ-18008	60	159	32	2.88	956	804	748	836	1239
4	RBJ-15018	59	160	31	2.26	800	870	722	797	1181
7	RBJ-17004	60	160	32	2.19	654	718	695	689	1021
1	RBJ-14017	57	158	30	2.49	566	690	698	651	965
<b>LSD 5%</b>										138

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	90: 85:60 NPK kg/ha
Sowing date	13.10.2019

The perusal of table 1.12 indicates that RBJ-15013 gave highest yield i.e. 1426 kg/ha. Days to flowering ranged from 55-64 and days to maturity from 156-161.

**Project 5. MICRO SEED YIELD TRIAL (*B. juncea*)**

Twelve *B. juncea* strains were evaluated along with Super Raya for seed yield and other agronomic traits. The data recorded are given in table 1.13(a).

**Table 1.13 (a)**

**Seed Yield (kg/ha) of twelve entries of *B. juncea* in Micro Yield Trial conducted over 7 locations in Punjab, 2019-2020**

Rank	Entry Name	Fsd	K/pur	Karor	Piplan	B/pur	F/jhang	Chkwl	Average
1	BRJ-1501	2207	1956	2646	1935	2320	796	1161	1860
2	KJ-282	2198	1889	2148	2528	1996	588	1444	1827
3	Super Raya (C)	2027	1963	2395	1722	2130	1093	1361	1813
4	KJ-274	2177	1870	2037	1898	2283	1060	1222	1793
5	BRJ-15019	1909	1678	2222	1972	1956	981	1311	1718
6	RBJ-16007	2668	1578	2185	1481	1980	616	1400	1701
7	RBJ-17005	2782	1393	1807	1594	2039	671	1289	1654
8	17CBJ 007	1716	1467	1963	1481	2289	815	1556	1612
9	RBJ-17013	1860	1170	2049	2065	2080	704	1194	1589
10	17CBJ 001	1386	1241	1621	1926	1974	838	1361	1478
11	RBJ-17015	1259	1437	1408	1593	1881	801	1370	1393
12	17CBJ 002	1069	1226	1630	1611	2061	727	1067	1342
	LSD 5%	170	254	190	132	134	107	147	

Perusal of the table 1.13(a) indicated BRJ-1501 surpassed all the entries included in the trial by giving seed yield of 1860 kg/ha.

**Table 1.13 (b)**

**Other parameters of advance lines of micro seed yield trial recorded at the Oilseeds  
Research Institute, Faisalabad during 2019-2020**

Rank	Entry Name	DF	DM	Oil Content (%)	1000 seed weight (g)	Yield/Plot (grams)				Yield (kg/ha)
						R1	R2	R3	Average	
1	<b>RBJ-17005</b>	80	160	32	1.98	2305	2400	2500	2402	2782
2	<b>RBJ-16007</b>	64	159	29	2.09	2469	2604	2439	2504	2668
3	<b>BRJ-1501</b>	59	157	33	3.53	1527	1674	1821	1674	2207
4	<b>KJ-282</b>	61	159	34	3.24	1024	1168	1207	1133	2198
5	<b>KJ-274</b>	79	158	33	2.91	890	903	1095	963	2177
6	<b>Super Raya (C )</b>	58	157	33	3.06	1193	1366	1182	1247	2027
7	<b>BRJ-15019</b>	59	158	32	3.24	2032	1818	2108	1986	1909
8	<b>RBJ-17013</b>	60	158	32	2.66	1761	1556	1837	1718	1860
9	<b>17CBJ 007</b>	62	158	33	2.48	1893	2000	1984	1959	1716
10	<b>17CBJ 001</b>	61	158	30	1.89	2048	1826	2060	1978	1386
11	<b>RBJ-17015</b>	63	159	30	1.97	1539	1593	1500	1544	1259
12	<b>17CBJ 002</b>	70	160	32	2.14	1817	1790	1865	1824	1069
									<b>LSD 5%</b>	170

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	90: 85:60 NPK kg/ha
Sowing date	13.10.2019

The perusal of table 1.13(b) indicates that RBJ-17005 gave highest yield i.e. 2782 kg/ha followed by RBJ-16007 i.e. 2668 kg/ha. Days to flowering ranged from 58-79 and days to maturity 157-160. Minimum days to flowering were taken by Super Raya. Maximum 1000 grain weight (3.53) was observed in BRJ-1501.

#### **Project 6. NATIONAL UNIFORM MUSTARD SEED YIELD TRIAL (NUMYT)**

The objective of this trial was to observe the behavior of different Mustard varieties under Faisalabad environmental conditions. The Pakistan Agricultural Research Council, Islamabad, supplied seed. The data recorded are presented in table 1.14.

**Table 1.14**  
Results of National Uniform Mustard Yield Trial conducted at 09 locations during Rabi 2019-20

Rank	Entry name	ARI DI Khan	AZRC DI Khan	BARI Chakwal	NIFA Peshawar	ORI FSD	ORI Tandojam	RARI BWP	Pioneer Sahiwal	NARC Isb	Average
1	SD-40550	2329	1215	1750	3227	2956	4433	3103	3022	1541	<b>2620</b>
2	Dhoom	2189	1566	1649	3108	2681	4213	3286	2940	1942	<b>2619</b>
3	YG-solo super	2342	2072	1472	3025	2707	4133	2931	2917	1519	<b>2569</b>
4	IS-381	2395	1786	1822	2859	2577	3913	3350	2983	1116	<b>2533</b>
5	MM-31-5	1856	1888	1289	3587	2017	4505	3011	3373	1195	<b>2525</b>
6	45S46	2309	1559	2005	2610	3127	3830	2858	3205	1044	<b>2505</b>
7	Sarson-313	2021	1364	1617	2951	2831	4097	3061	2943	1163	<b>2450</b>
8	MS-007	1988	1386	2161	2573	2499	3582	2772	3168	1908	<b>2449</b>
9	SD-3024	2560	1074	1622	2702	2551	3737	2520	3237	1284	<b>2365</b>
10	MS-012	1942	1148	1461	2563	2878	3697	3150	2890	1387	<b>2346</b>
11	ZS-4445	2074	1150	2061	2719	2281	3665	2903	2920	1080	<b>2317</b>
12	7860	1984	1081	1456	2905	2670	3993	2464	3203	1023	<b>2309</b>
13	GS-787	1749	1625	1533	2480	2479	3476	3408	2515	1487	<b>2306</b>
14	BRJ-1405	1864	1616	1872	2693	2432	3687	2520	3007	1008	<b>2300</b>
15	Rustam Mustard	2366	1434	1478	2684	2717	3773	3089	1870	1112	<b>2280</b>
16	KJ-290	2292	1245	1556	2523	2281	3456	2861	2907	1320	<b>2271</b>
17	M-444	2309	1420	1344	2453	2499	3454	2517	3017	1212	<b>2247</b>
18	LG-96	1819	1790	1250	3328	2515	4394	2675	1525	902	<b>2244</b>
19	BRJ-1458	2169	1349	1494	2389	2473	3376	3103	2722	1089	<b>2240</b>
20	22566	2091	1835	1439	2075	2567	3072	3006	2702	1161	<b>2216</b>
21	RBJ-15015	2239	1264	1328	2638	2126	3526	2736	2838	1241	<b>2215</b>
22	KJ-288	1712	1182	1589	3421	1877	4281	2683	2127	944	<b>2202</b>
23	Super Raya (C)	2284	1342	1258	2121	2479	3093	2872	3385	939	<b>2197</b>
24	MS-57	1774	1189	1628	2204	2644	3236	2317	3395	1286	<b>2186</b>
25	BK-3036	2251	1381	1278	2545	2810	3655	2228	2065	1365	<b>2175</b>
26	Sona Super	1745	1319	1328	2737	2437	3737	2075	3066	1118	<b>2174</b>
27	As-8293	1687	1714	1778	2140	2696	3184	2392	3045	869	<b>2167</b>
28	5.58E+03	1872	1282	1944	2583	2240	3506	2345	2887	815	<b>2164</b>
29	AS-207	1609	1415	1572	2204	2577	3214	2767	2842	1247	<b>2161</b>
30	45M47	2333	1288	1550	2583	2266	3515	2258	2235	1250	<b>2142</b>
31	MM-31-3	1914	1259	1722	2231	2074	3075	2922	3053	884	<b>2126</b>
32	Coral-432 (C)	2156	1409	1520	2417	2567	3438	2772	1670	1108	<b>2117</b>
33	13CBJ004	1337	1621	1544	2444	1504	3112	3075	3435	923	<b>2111</b>
34	BS-19	1358	1579	1638	2425	2437	3403	2545	2703	799	<b>2099</b>
35	KJ-289	2099	1477	1556	2088	2110	2934	2239	2992	1267	<b>2085</b>
Mean		2029	1438	<b>1588</b>	<b>2635</b>	<b>2474</b>	<b>3640</b>	<b>2766</b>	<b>2823</b>	<b>1187</b>	



Varietal behaviors were statistically highly significant. Table 1.14 further shows that SD-40550 produced the maximum seed yield of 2620 kg/ha, followed by Dhoom with seed yield 2619 kg/ha.

#### **D. HYBRID CANOLA PROGRAMME**

##### **Project 1. MAINTENANCE OF INBRED LINES (*Brassica napus*)**

20 “A” & their maintainer “B” lines and 24 restorer inbred lines were planted to maintain the genetic stock and their utilization in developing new hybrids. “A” lines were maintained by crossing with their respective “B” lines whereas “B” and restorer lines were maintained through selfing.

##### **Project 2. DEVELOPMENT OF EXPERIMENTAL HYBRIDS**

A set of six “A” lines and one “R” line whereas another set with same “A” lines and a different “R” line were planted in two isolation tunnels to avoid foreign pollen contamination. “A” lines were hand pollinated with the respective “R” line. In this way, following 12 single crosses were developed and seed was harvested.

<b>S. No.</b>	<b>Name of Cross</b>	<b>Name of hybrid</b>
1	786-012 x 96038 R	FHC-162
2	786-013 x 96038 R	FHC-163
3	786-015 x 96038 R	FHC-164
4	786-016 x 96038 R	FHC-165
5	786-010 x 96038 R	FHC-166
6	786-003 x 96038 R	FHC-167
7	786-012 x 96050 R	FHC-168
8	786-013 x 96050 R	FHC-169
9	786-015 x 96050 R	FHC-170
10	786-016 x 96050 R	FHC-171
11	786-010 x 96050 R	FHC-172
12	786-003 x 96050 R	FHC-173

**Project 3. TESTING OF NEW CANOLA HYBRIDS**

An experiment was conducted to test the performance of local canola hybrids in comparison with the imported canola hybrid Hyola-401 as standard for seed yield. The data recorded are given in table 1.15.

**Table 1.15**

<b>Rank</b>	<b>Entry Name</b>	<b>R1</b>	<b>R2</b>	<b>R3</b>	<b>Average</b>	<b>Seed yield (kg/ha)</b>
<b>1</b>	<b>FHC-160</b>	1950	1750	1800	1833	4074
<b>2</b>	<b>FHC-157</b>	1700	1500	1800	1667	3704
<b>3</b>	<b>FHC-154</b>	1550	1450	1650	1550	3444
<b>4</b>	<b>FHC-151</b>	1550	1300	1650	1500	3333
<b>5</b>	<b>FHC-152</b>	1500	1400	1600	1500	3333
<b>6</b>	<b>FHC-158</b>	1600	1350	1450	1467	3259
<b>7</b>	<b>FHC-155</b>	1350	1500	1400	1417	3148
<b>8</b>	<b>FHC-153</b>	1300	1550	1300	1383	3074
<b>9</b>	<b>FHC-156</b>	1300	1450	1200	1317	2926
<b>10</b>	<b>FHC-161</b>	1200	1450	1300	1317	2926
<b>11</b>	<b>Hyola-401 (C)</b>	1100	1250	1300	1217	2704
<b>12</b>	<b>FHC-150</b>	1000	1300	1150	1150	2556
<b>13</b>	<b>FHC-159</b>	950	550	1500	1000	2222
<b>LSD 5%</b>						<b>301.87</b>

Perusal of the table 1.15 indicated that FHC-160 surpassed all the entries included in the trial by giving seed yield of 4074 kg/ha. The standard canola hybrid “Hyola-401” gave 2704 kg seed yield per hectare.

**2. OILSEEDS RESEARCH STATION, KHANPUR  
PLANT BREEDING & GENETIC**

**A. MUSTARD (*Brassica juncea*)**

**01. TITLE: MAINTENANCE AND EVALUATION OF GERMPLASM (*Brassica juncea*)**

One hundred and forty five (145) lines were maintained and evaluated for further utilization in breeding programme. True to type plants were selected for pure seed production to maintain the germplasm.

**02. TITLE: GENETIC IMPROVEMENT IN *Brassica juncea* THROUGH HYBRIDIZATION**

Ten crosses were made keeping KJ-282 and AARI Canola as male parents, having low Erucic acid and low Glucosinolates while other parental lines having good traits. Crosses were attempted among parental lines selected on the basis of superior traits.

	<b>High Yielder</b>		<b>High Yielder</b>
1.	KJ-287	×	KJ-282
2.	KJ-288	×	KJ-282
3.	KJ-289	×	KJ-282
4.	KJ-290	×	KJ-282
5.	KJ-294	×	KJ-282
	<b>High Yielder</b>		<b>Low Erucic acid</b>
1.	KJ-287	×	AARI Canola
2.	KJ-288	×	AARI Canola
3.	KJ-289	×	AARI Canola
4.	KJ-290	×	AARI Canola
5.	KJ-294	×	AARI Canola

Seed of each cross was collected at maturity to rise F<sub>1</sub> generation.

**03. TITLE: STUDY OF FILIAL GENERATIONS (*B. juncea*)**

The crosses studied in different generations are given in Table 1.

**Table 1: Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>6</sub> Mustard generations during 2019-20 at Oilseeds Research Station, Khanpur.**

Generation	No. of crosses	No. of progenies	No. of plants selected	No. of lines selected for PYT
F <sub>1</sub>	10	Whole material	-	-
F <sub>2</sub>	11	-do-	98	-
F <sub>3</sub>	5	68	75	-
F <sub>4</sub>	5	48	52	-
F <sub>5</sub>	4	39	19	-
F <sub>6</sub>	3	29	-	-
F <sub>7</sub>	3	15	-	-

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 11 F<sub>2</sub> crosses, 98 desirable plants were selected. In F<sub>3</sub> to F<sub>5</sub> generations, the best progenies were selected and from each of those, one desirable plant was selected to rise next generation. In F<sub>6</sub>, 10 progenies were selected for seed yield evaluation in preliminary yield trial.

#### **04. TITLE: PRELIMINARY YIELD TRIAL (*B. juncea*)**

Sixteen *B. juncea* lines were tested along with the standard variety “Super Raya”. The data collected on seed yield and other agronomic traits are given in Table 2.

**Table 2: Performance of 16 entries of *B. juncea* in Preliminary Yield Trial at Oilseeds Research Station, Khanpur during 2019-20.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KJ-326	50	77	130	154	2991
2	KJ-321	50	77	125	145	2944
3	KJ-319	52	79	140	178	2889
4	KJ-327	50	77	134	174	2889
5	KJ-320	49	77	129	142	2870
6	KJ-322	52	83	125	176	2852
7	Super Raya	51	81	128	192	2796
8	KJ-315	49	80	129	167	2759
9	KJ-316	52	82	125	184	2759
10	KJ-324	53	82	123	209	2741
11	KJ-325	55	85	119	176	2722
12	KJ-317	53	81	124	180	2704
13	KJ-318	52	78	123	196	2630
14	KJ-323	52	79	124	192	2611
15	KJ-328	53	82	130	178	2593
16	KJ-329	51	74	131	147	2370
<b>LSD %</b>						352

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	19.09.2018

The perusal of table 2 indicates that KJ-326 gave highest yield i.e., 2991 kg/ha followed by KJ-321 i.e., 2944 kg/ha. Days to flowering (50%) ranged from 49-53 while days to flowering (100%) 74-85 and days to maturity 119-140. The maximum plant height (209 cm) was observed by KJ-324 and minimum (142cm) by KJ-320.

### 05. TITLE: ADVANCED SEED YIELD TRIAL (*B. juncea*)

Thirteen *B. juncea* lines were evaluated along with “Super Raya”. The results are presented in table 3.

**Table 3: Performance of 13 entries of Advanced seed yield trial, 2019-20 at Oilseeds Research Station, Khanpur.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KJ-284	55	81	131	203	3611
2	KJ-294	51	77	129	201	3389
3	Super Raya	56	84	128	193	3264
4	KJ-287	55	85	115	203	3139
5	KJ-286	56	84	128	188	3128
6	KJ-288	56	83	127	206	3122
7	KJ-290	55	87	135	215	3111
8	KJ-292	51	77	118	168	3014
9	KJ-289	52	77	116	173	2986
10	KJ-283	46	75	119	160	2931
11	KJ-293	52	82	127	177	2861
12	KJ-280	54	88	117	205	2806
13	KJ-291	55	86	130	209	2597
<b>LSD %</b>						379

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	19.09.2018

The perusal of Table 3 indicates that KJ-284 gave highest yield i.e. 3611 kg/ha. Days to flowering 50% and 100% was ranged from 46-56 and 75-88 respectively. Days to maturity ranged from 115 to 135. The maximum plant height (215 cm) was observed by KJ-290 and minimum (160cm) by KJ-283.

### 06. TITLE: MICRO SEED YIELD TRIALS (*B. juncea*)

Yield performance of ten lines of *B. juncea* was tested under different agro- climatic conditions of the province. The results obtained from five locations are given in table 4 (a)& 4 (b).

**Table 4 (a): Seed Yield (kg/ha) of twelve entries of *B. juncea* in Micro Yield Trial conducted over 7 locations in Punjab, 2019-2020**

Rank	Entry Name	Fsd	K/pur	Karor	Piplan	B/pur	F/jhang	Chkwal	Average
1	BRJ-1501	2207	1956	2646	1935	2320	796	1161	1860
2	KJ-282	2198	1889	2148	2528	1996	588	1444	1827
3	Super Raya (C)	2027	1963	2395	1722	2130	1093	1361	1813
4	KJ-274	2177	1870	2037	1898	2283	1060	1222	1793
5	BRJ-15019	1909	1678	2222	1972	1956	981	1311	1718
6	RBJ-16007	2668	1578	2185	1481	1980	616	1400	1701
7	RBJ-17005	2782	1393	1807	1594	2039	671	1289	1654
8	17CBJ 007	1716	1467	1963	1481	2289	815	1556	1612
9	RBJ-17013	1860	1170	2049	2065	2080	704	1194	1589
10	17CBJ 001	1386	1241	1621	1926	1974	838	1361	1478
11	RBJ-17015	1259	1437	1408	1593	1881	801	1370	1393
12	17CBJ 002	1069	1226	1630	1611	2061	727	1067	1342
	LSD 5%	170	254	190	132	134	107	147	

Perusal of the table 4 (a) indicate the entry BRJ-1501 with seed yield of 1860 kg/ha followed by KJ-282 (1827 kg/ha) out of all the entries included in the trial.

**Table 4 (b): Performance of *B. juncea* strains at different locations in the Punjab during Zaid Kharif 2019-20**

Rank	Entry Name	Faisalabad	Karor	Khanpur	Bahawalpur	Piplan	Average
1	ZBJ-17019	2644	1430	1811	1333	1731	1790
2	ARRI Canola (C)	1704	1381	2081	1715	1917	1760
3	ZBJ-17022	2085	1443	1593	1556	1602	1656
4	ZBJ-16002	1778	1057	1804	1296	1593	1506
5	ZBJ-16008	1759	1024	1722	1296	1644	1489
6	ZBJ-16003	1593	1407	1352	1778	1281	1482
7	ZBJ-10021	1630	1067	1393	1593	1619	1460
8	ZBJ-15023	1567	1154	1589	1519	1404	1446
9	ZBJ-11002	1641	957	1593	1537	1500	1446
10	ZBJ-17006	1685	1019	1767	1333	1361	1433
	LSD 5%	249	203	226	225	285	

**07. TITLE: NATIONAL UNIFORM MUSTARD SEED YIELD TRIAL (NUMYT)**

The objective of this trial was to observe the behavior of different Mustard varieties under Faisalabad environmental conditions. The Pakistan Agricultural Research Council, Islamabad, supplied seed. The data recorded are presented in table 5.

**Table 5: Results of National Uniform Mustard Yield Trial conducted at 09 locations during Rabi 2019-20**

Rank	Entry name	ARI DI Khan	AZRC DI Khan	BARI Chakwal	NIFA Peshawar	ORI FSD	ORI Tandojam	RARI BWP	Pioneer Sahiwal	NARC Isb	Average
1	SD-40550	2329	1215	1750	3227	2956	4433	3103	3022	1541	2620
2	Dhoom	2189	1566	1649	3108	2681	4213	3286	2940	1942	2619
3	YG-solo super	2342	2072	1472	3025	2707	4133	2931	2917	1519	2569
4	IS-381	2395	1786	1822	2859	2577	3913	3350	2983	1116	2533
5	MM-31-5	1856	1888	1289	3587	2017	4505	3011	3373	1195	2525
6	45S46	2309	1559	2005	2610	3127	3830	2858	3205	1044	2505
7	Sarson-313	2021	1364	1617	2951	2831	4097	3061	2943	1163	2450
8	MS-007	1988	1386	2161	2573	2499	3582	2772	3168	1908	2449
9	SD-3024	2560	1074	1622	2702	2551	3737	2520	3237	1284	2365
10	MS-012	1942	1148	1461	2563	2878	3697	3150	2890	1387	2346
11	ZS-4445	2074	1150	2061	2719	2281	3665	2903	2920	1080	2317
12	7860	1984	1081	1456	2905	2670	3993	2464	3203	1023	2309
13	GS-787	1749	1625	1533	2480	2479	3476	3408	2515	1487	2306
14	BRJ-1405	1864	1616	1872	2693	2432	3687	2520	3007	1008	2300
15	Rustam Mustard	2366	1434	1478	2684	2717	3773	3089	1870	1112	2280
16	KJ-290	2292	1245	1556	2523	2281	3456	2861	2907	1320	2271
17	M-444	2309	1420	1344	2453	2499	3454	2517	3017	1212	2247
18	LG-96	1819	1790	1250	3328	2515	4394	2675	1525	902	2244
19	BRJ-1458	2169	1349	1494	2389	2473	3376	3103	2722	1089	2240
20	22566	2091	1835	1439	2075	2567	3072	3006	2702	1161	2216
21	RBJ-15015	2239	1264	1328	2638	2126	3526	2736	2838	1241	2215
22	KJ-288	1712	1182	1589	3421	1877	4281	2683	2127	944	2202
23	Super Raya (C)	2284	1342	1258	2121	2479	3093	2872	3385	939	2197
24	MS-57	1774	1189	1628	2204	2644	3236	2317	3395	1286	2186
25	BK-3036	2251	1381	1278	2545	2810	3655	2228	2065	1365	2175
26	Sona Super	1745	1319	1328	2737	2437	3737	2075	3066	1118	2174
27	As-8293	1687	1714	1778	2140	2696	3184	2392	3045	869	2167
28	5.58E+03	1872	1282	1944	2583	2240	3506	2345	2887	815	2164
29	AS-207	1609	1415	1572	2204	2577	3214	2767	2842	1247	2161
30	45M47	2333	1288	1550	2583	2266	3515	2258	2235	1250	2142
31	MM-31-3	1914	1259	1722	2231	2074	3075	2922	3053	884	2126

32	<b>Coral-432 (C)</b>	2156	1409	1520	2417	2567	3438	2772	1670	1108	<b>2117</b>
33	<b>13CBJ004</b>	1337	1621	1544	2444	1504	3112	3075	3435	923	<b>2111</b>
34	<b>BS-19</b>	1358	1579	1638	2425	2437	3403	2545	2703	799	<b>2099</b>
35	<b>KJ-289</b>	2099	1477	1556	2088	2110	2934	2239	2992	1267	<b>2085</b>
Mean		2029	1438	<b>1588</b>	<b>2635</b>	<b>2474</b>	<b>3640</b>	<b>2766</b>	<b>2823</b>	<b>1187</b>	

Varietal behaviors were statistically highly significant. Table 5 further shows that our local variety KJ-288 gave grain yield of 2202 kg/ha indicating significantly better yield than the check variety Super Raya (2197 kg/ha).

## B. RAPESEED

### 08. TITLE: MAINTENANCE AND EVALUATION OF GERMPLASM *Brassica napus*

One hundred and fifteen (115) lines were maintained and evaluated for further utilization in breeding programme. True to type plants were selected for pure seed production to maintain the germplasm.

### 09. TITLE: GENETIC IMPROVEMENT IN *Brassica napus* THROUGH HYBRIDIZATION

Ten (10) crosses were made keeping KN-338 and Super Canola as male parents, having low Erusic acid and low Glucosinolates while other parental lines having good traits. Crosses were attempted among parental lines selected on the basis of superior traits.

#### *Brassica napus*

##### High Yielder

- |           |   |        |
|-----------|---|--------|
| 1. KN-312 | × | KN-338 |
| 2. KN-317 | × | KN-338 |
| 3. KN-331 | × | KN-338 |
| 4. KN-332 | × | KN-338 |
| 5. KN-339 | × | KN-338 |

##### High Yielder

- |           |   |              |
|-----------|---|--------------|
| 1. KN-312 | × | Super Canola |
| 2. KN-317 | × | Super Canola |
| 3. KN-331 | × | Super Canola |
| 4. KN-332 | × | Super Canola |
| 5. KN-339 | × | Super Canola |

##### Low Erusic acid

Seed of each cross was collected at maturity to rise F<sub>1</sub> generation.



### 10. TITLE: STUDY OF FILIAL GENERATIONS (*B. napus*)

The crosses studied in different generations are given in Table 6.

**Table 6: Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>6</sub> Rapeseed generations during 2019-20 at Oilseeds Research Station, Khanpur.**

Generation	No. of crosses	No. of progenies	No. of plants selected	No. of lines selected for PYT
F <sub>1</sub>	10	Whole material	-	-
F <sub>2</sub>	9	-do-	95	-
F <sub>3</sub>	4	56	68	-
F <sub>4</sub>	4	45	45	-
F <sub>5</sub>	3	37	15	-
F <sub>6</sub>	3	30	-	-
F <sub>7</sub>	3	15	-	10

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 11 F<sub>2</sub> crosses, 95 desirable plants were selected. In F<sub>3</sub> to F<sub>5</sub> generations, the best progenies were selected and from each of those, one desirable plant was selected to rise next generation. In F<sub>6</sub>, 10 progenies were selected for seed yield evaluation in preliminary yield trial.

### 11. TITLE: PRELIMINARY YIELD TRIAL (*B. napus*)

Sixteen *B. napus* lines were tested along with the standard variety “Rohi Sarsoon”. The data collected on seed yield and other agronomic traits are given in Table 7.

**Table 7: Performance of 16 entries of *B. napus* in Preliminary Yield Trial at Oilseeds Research Station, Khanpur during 2019-20.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KN-341	73	85	168	180	3222
2	KN-353	72	85	153	182	3093
3	KN-346	73	87	155	179	2833
4	KN-352	73	89	158	194	2815
5	KN-342	75	87	150	177	2796
6	KN-347	73	88	151	183	2787
7	KN-343	75	88	148	208	2602
8	KN-340	72	84	146	186	2593
9	KN-354	74	86	149	177	2593
10	KN-350	75	89	160	183	2574
11	KN-351	73	89	161	197	2556
12	KN-349	74	90	160	204	2537

13	KN-345	74	90	160	201	2417
14	KN-348	74	88	157	200	2315
15	KN-344	76	91	155	207	2185
16	Rohi Sarson	79	91	160	204	2111
<b>LSD %</b>						322

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	19.09.2018

The perusal of table 7 indicates that KN-341 gave highest yield i.e, 3222 kg/ha followed by KN-353i.e, 3093 kg/ha. Days to flowering (50%) was 72-79 while days to flowering (100%) was 84-91 and days to maturity ranged from 146- 168. The maximum plant height (208 cm) was observed by KN-343 and minimum (177cm) by KN-342.

## 12. TITLE: ADVANCED SEED YIELD TRIAL (*B. napus*)

Thirteen *B. napus* lines were evaluated along with “Rohi Sarsoon”. The results are presented in table 8.

**Table 8: Performance of 13 entries of Advanced seed yield trial, 2019-20 at Oilseeds Research Station, Khanpur.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KN-327	67	87	152	197	3241
2	KN-312	68	87	149	212	3119
3	KN-336	71	91	155	191	3037
4	KN-330	68	88	150	187	3000
5	KN-328	71	94	159	181	2852
6	KN-319	70	91	155	195	2722
7	KN-324	72	94	161	181	2648
8	KN-339	68	89	156	199	2648
9	KN-329	69	91	159	200	2630
10	KN-317	73	91	154	182	2574
11	KN-326	69	90	156	187	2556
12	Rohi Sarsoon	72	92	155	205	2500
13	KN-337	75	96	154	200	2370
<b>LSD %</b>						251

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	19.09.2018

The perusal of Table 8 indicates that KN-327 gave highest yield i.e. 3241 kg/ha followed by KN-312 (3119 kg/ha). Days to flowering (50%) ranged from 67 to 75 and days to flowering (100 %) was 87-96. Days to maturity ranged from 149 to 161. The maximum plant height (212 cm) was observed by KN-312 and minimum (181cm) by KN-324 & KN-328.

### 13. TITLE: MICRO SEED YIELD TRIALS (*B. napus*)

Ten *B. napus* strains were evaluated along with Super canola for seed yield & other agronomic traits. The data recorded are given in table 9.

**Table 9: Seed Yield (kg/ha) of eleven entries of *B. napus* in Micro Yield Trial conducted over 7 locations in Punjab, 2019-2020**

Rank	Entry Name	Fsd	K/pur	Karor	Piplan	B/pur	F/jang	Chkwl	Average
1	RBN-18021	2583	2407	3081	2046	2257	894	1074	2212
2	RBN-16001	2398	2593	2837	2148	1969	1014	1148	2160
3	RBN-14017	1910	2870	2352	1546	2157	1037	1574	1979
4	RBN-18007	2364	2352	2804	1861	1515	903	1056	1966
5	RBN-17014	1841	2148	2519	1269	2111	995	1611	1814
6	KN-338	1594	2059	2337	1704	1937	718	1500	1725
7	Chakwal Sarson (C)	1221	2593	2567	1843	1170	634	1296	1671
8	17CBN 007	1563	2126	2333	1426	1706	833	1000	1665
9	Super Canola (C)	1771	2137	2685	1394	1144	671	1426	1634
10	KN-331	1724	2022	2289	1517	1283	815	1185	1608
11	17CBN 004	1336	1481	2430	1352	1443	856	1100	1483
	LSD 5 %	113	199	204	111	157	84	159	

Perusal of the table 9 indicated that RBN-18021 surpassed all the entries included in the trial by giving seed yield of 2212 kg/ha closely followed by RBN-16001 (2160 kg/ha). Local variety (KN-338 showed grain yield of 1725 kg/ha indicating better yield than check variety Super Canola (1634 kg/ha).

### 14. TITLE: NATIONAL UNIFORM RAPESEED YIELD TRIAL (NURYT)

The objective of this trial was to test the performance of rapeseed varieties under Faisalabad environmental conditions. This trial was sown with the material supplied by the Pakistan Agricultural Research. The data recorded are given in table 10.

**Table 10: Results of National Uniform Rapeseed Yield Trial conducted at 08 locations during Rabi 2019-20**

Rank	Entry Name	ARI DI Khan	AZRC DI Khan	BARI Chakwal	NIFA Peshawar	ORI FSD	ORI Tandojam	RARI Bwp	NARC Isb.	Mean
1	RR-8-1	2422	2350	2517	4178	2274	5221	2372	2162	2937
2	HOPE-9	2174	2762	2550	4557	1988	5530	1686	2032	2910
3	ZCA-13	2489	2009	2356	3911	2862	5132	2006	2391	2895
4	C-1	3133	2415	2563	3388	2646	4501	1558	2714	2865
5	RR-8-2	1926	2329	2446	4060	2697	5237	1778	1736	2776
6	CHS-2	2304	2139	2378	4251	2201	5275	2036	1624	2776
7	CHYB3393TT	<b>2156</b>	<b>2067</b>	2611	4095	2022	5049	2136	1973	2764
8	HC-21C	2267	2238	2078	3947	2083	4911	2061	2401	2748
9	HC-022B	2852	2359	2745	3703	1302	4390	1972	2370	2712
10	16CBN007	2256	2364	2006	4233	2319	5295	1550	1510	2692
11	Super Canola (C)	2337	3047	2189	4255	1655	5097	1692	1032	2663
12	AA-131	1870	1144	2610	4333	1943	5276	1578	2247	2625
13	KN-339	2333	2320	2467	3634	1574	4406	1622	2235	2574
14	CHS-9	2263	2137	2133	3541	2097	4482	1675	2242	2571
15	RBN-13017	2233	1994	2561	3330	2585	4419	1903	1405	2554
16	KN-209	2500	1837	2041	3669	2155	4637	1681	1743	2533
17	RM-193-1	1822	2107	2194	3642	2227	4633	1700	1727	2507
18	Hyola-401 (C)	<b>2326</b>	<b>923</b>	2210	4334	1494	5128	2086	1459	2495
19	RBN-13016	2033	2031	2231	3634	1680	4442	2214	1306	2446
20	16CBN002	2263	2536	2114	3449	1656	4237	1508	1392	2394
21	14CBN009	2322	1789	2189	3509	1734	4327	1536	1299	2338
	Location Mean	2299	2138	2342	3888	2057	4839	1826	1857	

A perusal of table 10 shows that the differences of means due to varieties are highly significant. RBN-13017 gave the seed yield of 2554 kg/ha and check i.e. Super Canola gave the yield of 2663 kg/ha. KN-339 (2574 kg/ha) and KN-209 (2533 kg/ha) local varieties showed better yield than the 2<sup>nd</sup> check variety Hyola-401 (2495 kg/ha).

## **PLANT PATHOLOGY**

### **1. SCREENING OF BRASSICA LINES AGAINST ALTERNARIA BLIGHT, UNDER ARTIFICIAL INOCULUM CONDITIONS.**

Twelve (12) advance lines of *B. Juncea* and 13 of *B.napus* were sown on 1<sup>st</sup> week of October, 2019 in RCBD pattern keeping plot size 6 x 1.8 m. Row spacing was kept at 45 cm while Plant spacing was maintained as 15 cm. Two rows of spreaders KJ-159 and KJ-267 (1 each) were sown after each entry, in order to facilitate the maximum pressure of disease inoculum. All

cultural practices, irrigations & fertilizer applications were done as per recommendations. Artificial inoculum of *Alternaria brassicae* was prepared in the laboratory and culture suspension was sprayed on the trial by foliar application, during the month of January. Data of the diseases were recorded on the onset of the disease following 0-9 scale, as under.

**Set A =*Brassica juncea***

Score	CONDITION	Reaction	Names of lines/varieties	No. of lines/varieties
0	No disease	Immune	-	-
1	A few scattered plants blighted with 1-2 spots/plant.	Very Highly Resistant (VHR)		
2	A few scattered plants blighted with 5-10 spots/plant.	Highly Resistant (HR)		
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KJ-287	1
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)	KJ-294,KJ-288,KJ-293	3
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)	KJ-284,Super Raya	2
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)	KJ-283,KJ-289,KJ-286,KJ-291	4
7	Every plant severely infected with about 75% of leaf area and stem.	Highly Susceptible (HS)	KJ-280,KJ-290,KJ-292 KJ-267, and KJ-159	3
8	Every severely infected defoliation common and 95% of stem surface affected	Very Highly Susceptible (VHS)		-
9	Defoliation severe and 100% leaf and stem area affected and destroyed.	Completely Susceptible (CS)	-	-

**Set B =*Brassica napus***

Score	CONDITION	Reaction	Names of lines/varieties	No. of lines/varieties
0	No disease	Immune	-	-
1	A few scattered plants blighted with 1-2 spots/plant.	Very Highly Resistant (VHR)	-	-
2	A few scattered plants blighted	Highly Resistant	KN-337,KN-	5

	with 5-10 spots/plant.	(HR)	339,KN-332,KN-326,and KN-312	
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KN-317,KN-329,KN-330,KN-336, Rohi sarson	5
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)	KN-324	1
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)	KJ-159	Spreader
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)	KJ-267	Spreader
7	Every plant severely infected with about 75% of leaf area and stem.	Highly Susceptible (HS)	-	-
8	Every severely infected defoliation common and 95% of stem surface affected	Very Highly Susceptible (VHS)	-	-
9	Defoliation severe and 100% leaf and stem area affected and destroyed.	Completely Susceptible (CS)	-	-

## **2. SCREENING OF BRASSICA LINES AGAINST WHITE RUST, POWDERY AND DOWNY MILDEW DISEASES**

Brassica lines were studied for screening against Downy mildew, Powdery mildew and White rust diseases under natural condition. KJ-159 and KJ-267 were used as disease spreaders. Disease intensity was recorded according to 0-9 disease rating scale. Response/reaction of the lines is given as under:

### **Set A:*B. juncea***

#### **Reaction/category of Mustard lines against Diseases.**

S.No.	Lines Tested	Downy mildew (%)	Powdery mildew (%)	White Rust (%)
	<i>B. juncea</i>			
1	KJ-280	6	1	0
2	KJ-283	7	0	2
3	KJ-284	7	0	0
4	KJ-286	7	0	1
5	KJ-287	2	0	1
6	KJ-288	10	0	0
7	KJ-289	5	0	0

8	KJ-290	7	0	1
9	KJ-291	9	0	1
10	KJ-292	8	0	1
11	KJ-293	9	0	1
12	KJ-294	7	0	1
13	Super Raya	9	0	1
14	KJ-159	7	0	2
15	KJ-267	5	0	2

Attack of downy mildew was distinctively depicted in almost all varieties/lines with a reaction ranging between Resistant (R) to Moderately Resistant (MR) category. Powdery mildew could not appear in any of the lines except KJ-280, while rust (*Albugo candida*) incidence in almost all the lines remained within the Resistant (R) category.

**Set B: B.napus**

S.No.	Lines Tested	Downy mildew (%)	Powdery mildew(%)	White Rust (%)
1	KN-312	0	0	2
2	KN-317	0	0	0
3	KN-319	0	0	0
4	KN-324	0	0	2
5	KN-326	1	0	0
6	KN-327	1	0	0
7	KN-328	0	0	0
8	KN-329	1	0	2
9	KN-330	0	0	1
10	KN-332	0	0	2
11	KN-336	0	0	0
12	KN-337	0	0	0
13	KN-339	0	0	0
14	Rohi sarson	0	0	0
15	KJ-159	1	0	0
16	KJ-267	1	0	0

Amongst 13 promising advanced lines of *Brassica*, all the entries showed least response against the diseases under natural environmental conditions. However, white rust appeared a little bit more intensively, in some lines, as compared to the last year.

### 3. OILSEEDS RESEARCH STATION, BAHAWALPUR

#### RAPSEED AND MUSTARD

##### A. WINTER MUSTARD AND RAPSEED

###### Project 1. MAINTENANCE OF GENE POOL

50 entries of *B. juncea* were studied.

###### Project 2. DEVELOPMENT OF FRESH CROSSES

A) Eight crosses were made keeping AARI canola (low Erucic acid and low Glucosinolates) and Super raya as male parent.

1. OBJ-258 x AARI canola
2. OBJ-244 x AARI canola
3. OBJ-238 x AARI canola
4. OBJ-221 x AARI canola
5. OBJ-258 x Super raya
6. OBJ-244 x Super raya
7. OBJ-238 x Super raya
8. OBJ-221 x Super raya

Seed of each cross was collected at maturity to raise F<sub>1</sub> generation.

###### Project 3. STUDY OF FILIAL GENERATIONS

The crosses studied in different generations are given in table 1.1.

**Table 1.1: Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>6</sub> winter mustard generations during 2019-20 at Oilseeds Research Station, Bahawalpur.**

Generation	No. of crosses studied	No. of progenies studied	No. of plants selected	No. of lines selected for PYT
F <sub>1</sub>	8	-	-	-
F <sub>5</sub>	-	30	32	-
F <sub>6</sub>	-	24	-	8

All F<sub>1</sub> crosses were harvested to rise F<sub>2</sub> generation. In F<sub>5</sub> generation, the best progenies were selected and from each of those, one desirable plant was selected to rise next generation. In F<sub>6</sub>, 8 progenies were selected for seed yield evaluation in preliminary yield trial.

###### Project 4. YIELD TRIALS

###### a) Preliminary Yield Trial (*B. juncea*)

Nine *B. juncea* lines were tested along with the standard variety “Super Raya”. The data collected on seed yield are given in table 1.2.

**Table 1.2: Performance of 10 entries for seed yield in Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2019-20.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	OBJ-270	1933
2	OBJ-273	1910
3	Super Raya (C)	1899
4	OBJ-272	1877



5	OBJ-269	1877
6	OBJ-271	1833
7	OBJ-276	1822
8	OBJ-268	1710
9	OBJ-274	1688
10	OBJ-275	1544
<b>LSD 5%</b>		<b>251</b>

Design	R.C.B.
Plot size	5m x 1.8 m
Row spacing	45 cm
Fertilizer	75: 75 kg NP/ha
Sowing date	16.10.2019

The perusal of table 1.2 indicates that OBJ-270 gave highest yield i.e., 1933 kg/ha followed by OBJ-273 i.e., 1910 kg/ha.

**b) Advanced Seed Yield Trial (*B. juncea*)**

Seven *B. juncea* lines were evaluated along with Super Raya. The results are presented in table 1.3.

**Table 1.3: Performance of 8 entries of advanced seed yield trial, 2019-20 at Oilseeds Research Station, Bahawalpur.**

<b>Rank</b>	<b>Line/Variety</b>	<b>Yield (kg/ha)</b>
1	OBJ-151	1955
2	OBJ-167	1910
3	OBJ-153	1888
4	OBJ-165	1877
5	Super Raya ©	1810
6	OBJ-160	1755
7	OBJ-166	1722
8	OBJ-169	1710
<b>LSD 5%</b>		<b>120</b>

Design	R.C.B
Plot size	6 x 1.35 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha
Sowing date	16.10.2019

The perusal of table 1.3 indicates that OBJ-151 gave highest yield i.e. 1955 kg/ha followed by OBJ-167 that gave the yield 1910 kg/ha.

c) **Advanced Seed Yield Trial (*B. napus*)**

Nine *B. napus* lines were evaluated along with Super canola. The results are presented in table 1.4.

**Table 1.4: Performance of 10 entries of advanced seed yield trial, 2019-20 at Oilseeds Research Station, Bahawalpur.**

Rank	Line/Variety	Yield (kg/ha)
1	OBN-140	2166
2	OBN-109	2110
3	OBN-105	2066
4	OBN-135	1988
5	Super Canola ©	1955
6	OBN-131	1944
7	OBN-120	1855
8	OBN-141	1855
9	OBN-125	1844
10	OBN-128	1799
<b>LSD 5%</b>		<b>325</b>

Design	R.C.B
Plot size	6 x 1.35 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha
Sowing date	16.10.2019

The perusal of table 1.4 indicates that OBN-151 gave highest yield i.e. 2166 kg/ha followed by OBN-1109 that gave the yield 2110 kg/ha.

**Project 5. DEMONSTRATION PLOTS**

Demonstration plots of eight different varieties of rapeseed and mustard were sown at Oilseeds Research Station, Bahawalpur in order to evaluate the best variety of rapeseed and mustard under the agro climatic condition of Bahawalpur.

Nine *B. juncea* lines were tested along with the standard variety “Super Raya”. The data collected on seed yield and other agronomic traits are given in table 1.5.

**Table 1.5: Performance of 8 entries of rapeseed and mustard for seed yield at Oilseeds Research Station, Bahawalpur during Rabi 2019-20.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	Super Canola	1780
2	Sohni Dharti	1720
3	Rustam Canola	1600
4	Super Raya	1560
5	Faisal Canola	1380

6	AARI Canola	1265
7	Khanpur Raya	1185
8	Rohi Sarsoon	495
<b>LSD 5%</b>		<b>365</b>

Fertilizer                      75: 75 kg NP/ha  
Sowing date                    16.10.2019

The perusal of table 1.5 indicates that Super Canola gave highest yield i.e., 1780 kg/ha followed by Sohni Dharti hybrid i.e., 1720 kg/ha.

## B. SAFFLOWER

### Project 1. MAINTENANCE OF GENE POOL

125 entries of safflower were studied and properly maintained.

### Project 2. YIELD TRIALS

#### a) Preliminary Yield Trial of Safflower

Twenty safflower lines were tested along with the standard variety “Thori-78” in two trials A1 and A2. The data collected on seed yield of A1 and A2 are given in table 1.6 and 1.7 respectively.

**Table 1.6: Performance of 10 entries for seed yield in A1 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2019-20.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-205	2330
2	SAF-209	2188
3	Thori-78©	2144
4	SAF-200	2077
5	SAF-220	2066
6	SAF-208	2055
7	SAF-202	2000
8	SAF-214	1966
9	SAF-201	1900
10	SAF-216	1877
<b>LSD 5%</b>		<b>370</b>

Design                            R.C.B.  
Plot size                         5m x 1.8 m  
Row spacing                    45 cm  
Fertilizer                        75: 75 kg NP/ha  
Sowing date                    04.12.2019

The perusal of table 1.6 indicates that SAF-205 gave highest yield i.e., 2330 kg/ha followed by SAF-209 i.e., 2188 kg/ha.

**Table 1.7: Performance of 10 entries for seed yield in A2 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2019-20.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-165	2230
2	SAF-184	1922
3	SAF-168	1900
4	SAF-141	1900
5	SAF-145	1900
6	Thori-78©	1822
7	SAF-177	1810
8	SAF-135	1722
9	SAF-187	1665
10	SAF-148	1533
<b>LSD 5%</b>		<b>425</b>

Design	R.C.B.
Plot size	5m x 1.8 m
Row spacing	45 cm
Fertilizer	75: 75 kg NP/ha
Sowing date	04.12.2019

The perusal of table 1.7 indicates that SAF-165 gave highest yield i.e., 2230 kg/ha followed by SAF-184 i.e., 1922 kg/ha.

**b) Advanced Seed Yield Trial of Safflower**

Ten safflower lines were evaluated along with standard Thori-78 . The results are presented in table 1.8.

**Table 1.8: Performance of 10 entries of advanced seed yield trial, 2019-20 at Oilseeds Research Station, Bahawalpur.**

Rank	Line/Variety	Yield (kg/ha)
1	SAF-70	2600
2	Thori-78©	2553
3	SAF-115	2330
4	SAF-111	2330
5	SAF-96	2088
6	SAF-79	2066
7	SAF-72	1890
8	SAF-85	1877
9	SAF-86	1877
10	SAF-90	1710
<b>LSD 5%</b>		<b>345</b>

Design	R.C.B
Plot size	5 m x 1.8 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha
Sowing date	04.12.2019

The perusal of table 1.8 indicates that SAF-70 gave highest yield i.e. 2600 kg/ha followed by stand Thori-78 that gave the yield 2553 kg/ha.

**c) Micro Seed Yield Trial of Safflower**

Six safflower lines were evaluated along with Thori-78 as standard in seven different agro climatic conditions of Punjab to check the yield stability of safflower. The results are presented in table 1.9.

**Table 1.9: The results of zonal varietal trial of safflower conducted at different locations during Rabi 2019-20.**

S.No.	Line	Yield kg/ha						
		BWP	K/Pur	Khanewal	D.G khan	B/Nagar	Karor	Avg.
1.	SAF-45	1710	999	2407	1560	1355	696	1504
2.	SAF-50	2055	1018	2037	1466	1470	714	1460
3.	SAF-55	2300	824	926	1325	1290	744	1234
4.	SAF-62	1877	639	1759	1765	1560	781	1396
5.	SAF-64	1722	1666	2037	1855	1752	733	1627
6.	Hori-78	1533	1314	1667	1473	1468	700	1359
	LSD							

Perusal of the table 1.9 indicated that SAF-64 surpassed all the entries included in the trial by giving seed yield of 1627 kg/ha while lowest yield was taken by SAF-55 (1234 kg/ha).

Design	R.C.B
Plot size	5 m x 1.8 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha

Perusal of the table 1.9 indicated that SAF-64 surpassed all the entries included in the trial by giving seed yield of 1627 kg/ha while lowest yield was taken by SAF-55 (1234 kg/ha).

**Project 5. : Performance of Promising Safflower Strain Sown at Different Dates –2019-20**

LAY OUT	RCBD
LINE	1(SAF-65)
PLOT SIZE	5 Marla
NO OF SOWING DATES	4
IRRIGATIONS	3
DATE OF SOWING	4

	SR. #	Sowing Date	D.O. H.
	1	01-11-2019	30-05-2020
	2	20-11-2019	08-06-2020
	3	01-12-2019	08-06-2020
	4	10-12-2019	10-06-2020

**Table-1.10: Performance of Safflower Line Sown at Different Dates –Rabi 2019-20**

Line	SEED YIELD(kg/ha)			
	SOWING DATES			
SAF-65	1	2	3	4
	1474	1806	1227	925

Table 1.10 indicates that sowing date of mid November will be best for safflower under the agro climatic conditions of Bahawalpur.

### C. SESAME

#### Project 1. MAINTENANCE OF GENE POOL

80 entries of Sesame were studied and properly maintained.

#### Project 2. STUDY OF FILIAL GENERATIONS

The breeding material studied from F<sub>3</sub> to F<sub>7</sub> generations is detailed in table. The selections were made based on apparent good performance in the field for agronomic traits, diseases and seed yield per plant.

**Table 1.11: Crosses/progenies studied and selections made in F<sub>3</sub> to F<sub>7</sub> of sesame generations during 2019-20 at Oilseeds Research Station, Bahawalpur.**

Generations	No. of crosses studied
F <sub>3</sub>	07
F <sub>4</sub>	08
F <sub>5</sub>	05
F <sub>6</sub>	09
F <sub>7</sub>	03

All the segregating generations have bulked and will be studied through bulk breeding method.

#### Project 2. YIELD TRIALS

##### a) Preliminary Yield Trial of Sesame

Ten sesame lines were tested along with the standard variety “TH-6” in trial. The data collected on seed yield are given in table 1.12.

**Table 1.12: Performance of new promising strains of sesame at Oilseeds Research Station, Bahawalpur during 2019.**

Sr. No.	Line	Seed Yield (kg/ha)
1.	Sesame-7	700
2.	Sesame-10	878
3.	Sesame-12	610
4.	Sesame-15	910
5.	Sesame-20	922

6.	Sesame-24	565
7.	Sesame-28	777
8.	Sesame-32	590
9.	Sesame-35	490
10.	TH-6 (C)	522

Design	R.C.B.
Plot size	5m x 1.8 m
Row spacing	45 cm
Fertilizer	75: 75 kg NP/ha
Sowing date	02.07.2019

The perusal of table 1.12 indicates that Sesame-20 gave highest yield i.e., 922 kg/ha followed by Sesame-15 i.e., 910 kg/ha.

#### D. CASTOR BEAN

##### Project 1. MAINTENANCE OF GENE POOL

70 entries of castor bean were studied and properly maintained.

##### Project 2. YIELD TRIALS

###### a) Micro Yield Trial of Castor bean

Eight castor bean entries were tested for micro seed yield trials under the agro climatic conditions of Punjab. The data collected on seed yield of this trial are given in table 1.13.

**Table 1.13: Performance of 8 entries for seed yield in Micro Seed Yield Trial at Oilseeds Research Station, Bahawalpur during 2019-20.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	FS-2000	2065
2	S-29	1860
3	DS-30©	1770
4	S-15	1690
5	KR-20	1565
6	KR-30	1350
7	S-4	1195
8	FS-90	1190
<b>LSD 5%</b>		<b>370</b>

Design	R.C.B.
Plot size	5m x 4 m
Row spacing	1 m
Sowing date	06.08.2019

The perusal of table 1.13 indicates that FS-2000 gave highest yield i.e., 2065 kg/ha followed by S-29 i.e., 1860 kg/ha.

## 4. SUNFLOWER

### **Project No.1 Maintenance of Sunflower inbred lines**

94 A & B lines and 76 restorer lines were maintained at ORI, Faisalabad. “A” lines were maintained by crossing manually with their respective “B” lines. B & R lines were maintained through selfing by bagging with muslin cloth bags. Data were recorded on plant height, stem thickness, head diameter, days to 50% flowering, days to maturity, yield per plant, 100 achene weight and oil contents.

**Table. No. 1. Data recorded for various characters of sunflower germplasm during 2020**

Character	A & B line	R line
	Range	Range
Plant height (cm)	66-137	73-165
Stem thickness (mm)	14-34	14-25
Days to 50% flowering (days)	58-80	59-81
Head diameter (cm)	9-18	4-20
Days to maturity (days)	89-112	81-111
Yield per plant (g)	10-31	2-28
100 achene weight (g)	2.67-5.34	3.56-4.76
Oil contents (%)	34.54-43.32	35.38-42.23

### **Project No 2. Development and evaluation of new sunflower hybrid combinations**

Thirty new hybrid combinations were developed by crossing A and R Lines having good yield and oil quality parameters during 2020. Nineteen sunflower hybrids produced during Spring-2019 were evaluated in Station Yield Trial during Spring-2020 against standard check Hysun-33. Data was recorded for Plant height, Head diameter, Stem Thickness, and Seed yield (kg/ha)

Design	RCB
Replications	3
Plot size	5 m x 2.25 m
Row to Row spacing	75 cm
Plant to plant spacing	23 cm
Fertilizer	120-90-62 NPK kg/ha



**Table No. 2. Data Recorded for Station Yield Trial of sunflower hybrids during 2020**

Sr. #	Hybrids	Plant Height (cm)	Head Diameter (cm)	Stem Thickness (mm)	100 seed weight (g)	Seed Yield (kg/ha)
1	FH-865	213	17.5	28.3	6.8	3263
2	FH-866	191	16.2	23.6	6.2	3242
3	FH-850	191	15.8	21.7	5.7	3219
4	FH-862	193	16.9	21.4	4.9	3208
5	FH-863	211	19.5	28.2	4.5	2744
6	FH-864	192	15.8	20.7	4.2	2597
7	FH-856	204	16	27.6	4.1	2589
8	HYSUN-33	230	16.2	32.0	5.03	2580
9	FH-849	212	14.6	26.0	5.41	2575
10	FH-847	206	15.9	25.3	5.51	2537
11	FH-867	192	19	24.9	4.6	2513
12	FH-851	188	15.4	22.7	3.69	2508
13	FH-852	172	15.2	20.5	4.9	2494
14	FH-859	209	16.4	25.9	6.54	2493
15	FH-857	208	17	24.1	4.8	2485
16	FH-858	178	15.8	20.5	5.9	2430
17	FH-861	202	23.6	31.5		2254
18	FH-848	187	12.4	25.3	4.25	2002
19	FH-860	186	17.4	26.8	6.06	1720

Seven sunflower hybrids showed higher yield than the check hybrid Hysun-33. Highest yield was showed by FH-865 (3263 kg/ha) followed FH-866 (3242 kg/ha).

### **Project No.3. Seed production of sunflower elite hybrids**

Seed of 10 promising sunflower hybrids was increased for further testing in Micro Yield Trial, Demonstration and National Uniform Yield Trials.

**Table No.3. Seed produced of elite sunflower hybrids during 2020**

Sr. No.	Parents	Seed (kg)
1	FH-516	32
2	FH-555	27
3	FH-648	1.5
4	FH-675	5.2
5	FH-701	3.6
6	FH-741	1.44
7	FH-331	33.0
8	FH-820	3
9	FH-825	28.0
10	FH-846	9.8

**Project No.4. Seed increase of sunflower elite parents**

Seed of 6 A & B and 9 restorers were increased for further utilization in hybrid development program

**Table No. 4. Seed increase of elite parental lines during 2020.**

Sr.No.	CMS line	A (g)	B (g)	Sr.No.	Restorer line	Seed Produced
1	ORI-1	1650	300	1	RL-38	600
2	ORI-20	740	650	2	RL-39	800
3	ORI-42	1350	400	3	RL-58	190
4	ORI-90	1580	470	4	RL-67	350
5	ORI-92	4380	3040	5	RL-72	800
6	ORI-106	2380	1300	6	RL-86	2650
				7	RL-109	1800
				8	RL-114	200
				9	V-214	1600

**Project No. 5. Micro Yield Trial of sunflower hybrids 2020**

Sixteen sunflower hybrids were evaluated against check hybrid Hysun-33 under different agro ecological zones of the Punjab.

Design	RCB
Plot size	5m x 2.5m
Row to Row spacing	75cm
Plant to Plant spacing	23cm
Sowing dates	1st Jan to 15th Feb 2020

**Table No. 5. Micro Yield Trial of Sunflower hybrids during 2020**

Sr.No.	HYBRIDS	Faisalabad	Multan	Karror	Mudwala	Average kg/ha
1	FH-774	2354	2190	3180	2948	2668
2	FH-328	2165	2830	2720	2534	2562
3	T-22	2229	2630	2840	2476	2543
4	T-35	2187	2630	2800	2343	2490
5	FH-798	2164	2270	2780	2576	2447
6	GOLDEN-1	2094	2540	2643	2432	2427
7	FH-797	2211	2343	2420	2154	2282
8	Hysun-33 (c)	2155	2310	2160	2432	2264
9	FH-773	1826	2410	2580	2145	2240
10	FH-807	1917	2160	2460	2354	2222
11	BSF-2	2219	2090	2300	1956	2141
12	FH-825	1489	1980	2520	2532	2130

13	FH-784	1850	2270	2340	2045	2126
14	FH-779	1476	2350	2440	2234	2125
15	BSF-4	1761	2130	2420	2065	2094
16	BSF-1	1711	2150	1865	2154	1970
17	BSF-3	341	1280	2360	1756	1434

Eight sunflower hybrids performed better than the check hybrid Hysun-33. FH-774 gave highest yield of 2668 kg/ha followed by the hybrid FH-328 with the yield of 2562 kg/ha.

#### **Project No.6. Demonstration trial of sunflower hybrids 2020**

The performance of 8 promising sunflower hybrids were evaluated at different locations of farmer's field.

Plot size	2 Kanal (each hybrid)
Row to Row spacing	75cm
Plant to Plant spacing	23cm
Sowing dates	1st Jan to 15th Feb 2020

**Table No.6. Demonstration plots of sunflower hybrids during 2020**

Sr.#	Hybrids	Faisalabad	Alipur	Kotaddu	Multan	Average (kg/ha)
1	FH-741	2540	3265	3047	3183	3008
2	FH-701	2463	3025	2973	2875	2834
3	FH-516	2417	2965	3065	2846	2823
4	FH-675	2309	3165	3012	3345	2957
5	FH-648	2327	2943	3057	3251	2894
6	Hysun-33	2276	2836	2842	3042	2749
7	FH-555	2518	2454	2654	2564	2547
8	FH-331	2282	2365	2413	2154	2303

The sunflower hybrid FH-741 showed higher yield of 3008 kg/ha followed by the hybrid FH-701 with the average yield of 2834 kg/ha.

#### **Project No. 7. National Uniform Sunflower Yield Trial**

Three sunflower hybrids FH-732, FH-701 and FH-741 were contributed by ORI, Faisalabad to the National Uniform Sunflower Yield Trial 2020. Results of NUSYT 2019 are as under:

**Table No. 7. National Uniform Sunflower Yield Trials 2020**

Sr.No.	HYBRIDS	ORI-FSD	RARI-B.PUR	ICI-MULTAN	MEAN
1	FH-701	3004	2662	2374	2680
2	SUN-7	2946	2506	2560	2671
3	FH-516	3133	2493	2092	2573

4	US-777	2987	2119	2361	2489
5	FH-675	2998	2302	1887	2396
6	FH-648	2533	2146	1978	2219
7	GS-999	2455	2017	2183	2218
8	NKS-278(C)	2668	1462	2398	2176
9	US-444	2338	1631	2368	2112
10	AGSUN-5264(C)	2446	2026	1732	2068
11	PARSUN-3	2362	1786	1975	2041
12	SMH-0927	1953	1409	2477	1946
13	FH-699	1880	1800	2094	1925
14	FH-673	1813	1462	838	1371
15	UAF-008	1473	1484	1092	1350
16	UAF-007	1361	1737	859	1319

Four sunflower hybrids FH-701 (2680 kg/ha), FH-516 (2573 kg/ha), FH-675 (2396 kg/ha) and FH-648 (2219 kg/ha) showed higher yield than check hybrids in NUSYT 2019 at Punjab locations.

## 5. LINSEED

### Project 1. DEVELOPMENT OF FRESH CROSSES

Ten crosses were made keeping LS-2009 (white and bold seeded), LS-29 (short stature) and LS-18091 (high yielding and high oil content) as male parents while other parental lines having good traits.

1.	LS-18091	X	LS-2009
2.	LS-18084	X	LS-2009
3.	LS-18059	X	LS-2009
4.	LS-16006	X	LS-2009
5.	Roshni	X	LS-2009
6.	LS-18091	X	LS-29
7.	LS-18084	X	LS-29
8.	LS-18059	X	LS-29
9.	LS-16006	X	LS-18091
10.	LS-2009	X	LS-18091

Seed of each successful cross was collected at maturity to raise F<sub>1</sub> generation.

### Project 2. STUDY OF FILIAL GENERATIONS

The crosses studied in different generations are given in Table 1.1.

**Table 1.1**  
**Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>7</sub> generations during 2019-20 at Oilseeds Research Institute, Faisalabad.**

Generation	No. of crosses studied	No. of progenies studied	No. of plants selected
F <sub>1</sub>	08	Whole material studied	-
F <sub>2</sub>	08	"	125
F <sub>3</sub>	08	80	100
F <sub>4</sub>	08	60	83
F <sub>5</sub>	09	50	44
F <sub>6</sub>	10	40	24
F <sub>7</sub>	08	25	08 lines

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 08 F<sub>2</sub> crosses, 125 desirable plants were selected. In F<sub>3</sub> to F<sub>6</sub> generations, the best progenies were selected and from each of those, one desirable plant was selected to raise next generation. From F<sub>7</sub> 08 lines were selected for testing in PYT.

**Project 3. PRELIMINARY YIELD TRIAL**

Eight linseed lines were tested along with the check variety “Roshni”. The data collected on seed yield is given in Table 1.2.

**Table 1.2**

**Performance of 09 entries of linseed in Preliminary Yield Trial at Oilseeds Research Institute, Faisalabad during Rabi 2019-20.**

<b>Rank</b>	<b>Entry Name</b>	<b>Seed yield (kg/ha)</b>
<b>1</b>	LS-19023	2211
<b>2</b>	LS-19002	2160
<b>3</b>	LS-19014	2142
<b>4</b>	LS-19029	2140
<b>5</b>	<b>Roshni (C)</b>	<b>2137</b>
<b>6</b>	LS-19054	1830
<b>7</b>	LS-19067	1810
<b>8</b>	LS-19074	1713
<b>9</b>	LS-19080	1357
	<b>LSD at 5%</b>	<b>237</b>

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	30 cm
Fertilizer	80: 80:60 NPK kg/ha
Sowing date	11.11.2019

The perusal of table 1.2 indicates that LS-19023 gave highest yield i.e, 2211 kg/ha followed by LS-19002 i.e, 2160 kg/ha.

**Project 4. ADVANCED SEED YIELD TRIAL**

Five linseed lines were evaluated along with check variety Roshni. The results are presented in table 1.3.

**Table 1.3**

**Performance of 06 entries of advanced seed yield trial, 2019-20 at Oilseeds Research Institute, Faisalabad.**

Rank	Entry Name	Seed yield (kg/ha)
1	LS-17075	2090
2	LS-18059	2076
3	LS-18091	2073
4	LS-18084	2069
5	<b>Roshni (C)</b>	2064
6	LS-17011	1620
	<b>LSD at 5%</b>	146

Design	R.C.B
Plot size	5 x 1.2 m
Row spacing	30 cm
Fertilizer	80: 80: 60 NPK kg/ha
Sowing date	11.11.2019

The perusal of Table 1.3 indicates that LS-17075 gave highest yield i.e. 2090 kg/ha.

#### **Project 5. MICRO SEED YIELD TRIALS**

Yield performance of six linseed lines was tested under different agro- climatic conditions of the province. The results obtained from two locations are given in table 1.4.

**Table 1.4**  
**Performance of linseed strains at different locations in the Punjab during Rabi 2019-20**

Rank	Entry Name	Faisalabad	Piplan	Average
1	LS-17029	1904	2058	1981
2	<b>Roshni (C)</b>	1940	1359	1650
3	LS-16006	1894	1372	1633
4	LS-17001	1935	1330	1632
5	LS-17043	1778	1419	1598
6	LS-17089	1757	632	1194
	<b>LSD 5%</b>	190	251	

Design	R.C.B.
Plot size	5 x 1.8 m

Row spacing	30 cm
Fertilizer	80:60:60 N:P:K kg/ha
Sowing date	11.11.2019

Perusal of the table 1.4 indicated that LS-17029 surpassed all the entries included in the trial by giving average seed yield of 1981 kg/ha.



## 6. SOYBEAN

### Project 1. DEVELOPMENT OF FRESH CROSSES

Six crosses were made keeping Faisal Soybean and E-1092 as male parents, having good yield and disease tolerance while other parental lines having good traits.

1.	DGS-16	X	Faisal Soybean
2.	DGS-16	X	E-1092
3.	95-1-14	X	Faisal Soybean
4.	95-1-14	X	E-1092
5.	FS-10	X	Faisal Soybean
6.	FS-10	X	E-1092

Seed of 3 successful crosses was collected at maturity to rise F<sub>1</sub> generation.

### Project 2. STUDY OF FILIAL GENERATIONS

The crosses studied in different generations are given in Table 1.1.

**Table 1.1**

**Crosses/progenies studied and selections made from F<sub>1</sub> to F<sub>4</sub> generations in 2019 at Oilseeds Research Institute, Faisalabad.**

<b>Generation</b>	<b>No. of crosses studied</b>	<b>No. of progenies studied</b>	<b>No. of plants selected</b>
F <sub>1</sub>	03	Whole material	-
F <sub>2</sub>	02	-	50
F <sub>3</sub>	04	50	30
F <sub>4</sub>	04	30	10

All F<sub>1</sub> crosses were harvested to rise F<sub>2</sub> generation. From 02 F<sub>2</sub> crosses, 50 desirable plants were selected. In F<sub>3</sub> and F<sub>4</sub> generations, the best progenies were selected and from each of those, one desirable plant was selected to rise next generation.

### Project 3. PRELIMINARY YIELD TRIAL

Thirteen soybean lines were tested along with the check varieties Faisal Soybean and Ajmeri.

The data collected on seed yield and other agronomic traits are given in Table 1.2.

**Table 1.2**  
**Performance of 15 entries of soybean in Preliminary Yield Trial at Oilseeds Research**  
**Institute, Faisalabad in Kharif 2019.**

Rank	Entry Name	Days to 50% Flowering	Plant height (cm)	Branches /plant	Seeds /pod	Pods/plant	Seed yield (kg/ha)
1	CN-5	43	82	4	2	175	1680
2	FS-10	40	66	3	3	165	1672
3	SH-1274	41	71	4	2	180	1665
4	TN-81-27-32	37	51	3	2	124	1658
5	HS-17	41	80	3	2	126	1652
6	<b>F. Soybean (C)</b>	40	59	5	3	156	1631
7	E-1097	39	51	2	2	106	1604
8	R-315	41	47	3	2	121	1600
9	S-39-40	41	54	2	3	103	1578
10	SS-129	41	42	3	2	119	1570
11	E-402	38	42	3	2	131	1550
12	HB-17	41	65	3	2	154	1480
13	MCH-5	42	42	3	2	123	1460
14	TN-81-77	38	38	3	2	107	1389
15	<b>Ajmeri (C)</b>	37	26	2	2	84	519
<b>LSD at 5%</b>							151

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	30 cm
Fertilizer	60: 100:60 NPK kg/ha
Sowing date	03.08.2019

The perusal of table 1.2 indicates that CN-5 gave highest yield i.e, 1680 kg/ha followed by FS-10 i.e, 1672 kg/ha. Days to flowering ranged from 37-43. The maximum plant height (82 cm) was observed for CN-5. Number of branches ranged from 2-4. Maximum No. of pods per plant i.e. 180 was observed for SH-1274.

#### **Project 4. ADVANCED SEED YIELD TRIAL**

Six soybean lines were evaluated along with check varieties Faisal Soybean and Ajmeri. The results are presented in table 1.3.

**Table 1.3**

**Performance of 08 entries of advanced seed yield trial, 2019 at Oilseeds Research Institute, Faisalabad.**

<b>Rank</b>	<b>Entry Name</b>	<b>Days to 50% Flowering</b>	<b>Plant height (cm)</b>	<b>Branches /plant</b>	<b>Seeds /pod</b>	<b>Pods/plant</b>	<b>Seed yield (kg/ha)</b>
<b>1</b>	BSR-301	42	40	3	2	140	1782
<b>2</b>	HM-8468	38	53	3	2	97	1774
<b>3</b>	HM-8437	38	47	4	3	107	1770
<b>4</b>	Faisal Soybean	40	57	3	3	112	1768
<b>5</b>	Lafe-40	43	75	4	3	151	1755
<b>6</b>	249-313-D	41	40	4	2	117	1687
<b>7</b>	E-1490	38	35	3	2	80	1623
<b>8</b>	Ajmeri	37	29	3	2	104	573
<b>LSD at 5%</b>							<b>160</b>

Design	R.C.B
Plot size	5 x 1.8 m
Row spacing	30 cm
Fertilizer	60: 100: 60 NPK kg/ha
Sowing date	03.08.2019

The perusal of Table 1.3 indicates that BSR-301 gave highest yield i.e. 1782 kg/ha. Days to flowering ranged from 37 to 43. The maximum plant height (75 cm) was observed for Lafe-40. Number of branches ranged from 3-4. Maximum No. of pods per plant i.e. 151 was observed for Lafe-40.

#### **Project 5. MICRO SEED YIELD TRIALS**

Yield performance of eight soybean lines was tested under different agro- climatic conditions of the province. The results obtained from four locations are given in table 1.4.

**Table 1.4**

**Performance of soybean strains at different locations in the Punjab in  
Kharif 2019**

<b>Rank</b>	<b>Entry Name</b>	<b>Faisalabad</b>	<b>MB Din</b>	<b>Bahawalpur</b>	<b>Khanpur</b>	<b>Average</b>
<b>1</b>	95-1-14	2281	2867	964	1310	1800
<b>2</b>	E-1092	2020	2311	895	1212	1730
<b>3</b>	<b>Faisal Soybean (C)</b>	2037	2340	870	993	1656
<b>4</b>	SPK-16	1894	1778	678	1083	1506
<b>5</b>	95-2	1388	2028	639	953	1489
<b>6</b>	DGS-16	1453	1767	533	1215	1482
<b>7</b>	ESB-390A	720	600	517	840	1460
<b>8</b>	<b>Ajmeri (C)</b>	600	906	472	501	1446
	<b>LSD 5%</b>	205	240	152	175	

Design	R.C.B.
Plot size	5 x 1.2 m
Row spacing	30 cm
Fertilizer	60:100:60 N:P:K kg/ha
Sowing date	03.08.2019

Perusal of the table 1.4 indicated that 95-1-14 surpassed all the entries included in the trial by giving average seed yield of 1800 kg/ha.

**Project 6. NATIONAL UNIFORM SOYBEAN YIELD TRIAL 2019**

Yield performance of twelve soybean entries (10 test entries and 02 check varieties) sent by Pakistan Agricultural Research Council (PARC) was tested at Oilseeds Research Institute, Faisalabad. Results of Faisalabad location were reported to PARC. Final decoded results of four locations obtained from PARC are given in table 1.5.

**Table 1.5****Performance of soybean strains at different locations in Pakistan in Kharif 2019**

<b>Rank</b>	<b>Entry Name</b>	<b>Islamabad</b>	<b>Faisalabad</b>	<b>Gilgit</b>	<b>Tandojam</b>	<b>Mean</b>
<b>1</b>	PSC-60	4329	1031	1185	193	1685
<b>2</b>	NARC-2016	4330	194	1726	436	1672
<b>3</b>	SA-7260	3715	1341	1074	222	1588
<b>4</b>	<b>Ajmeri (C)</b>	3355	984	907	469	1429
<b>5</b>	<b>95-1-14</b>	<b>1537</b>	<b>2677</b>	<b>320</b>	<b>341</b>	<b>1219</b>
<b>6</b>	<b>Faisal Soybean (C)</b>	1873	2448	241	250	1203
<b>7</b>	24503	2689	658	926	153	1107
<b>8</b>	24519	2170	678	311	317	869
<b>9</b>	Swat-18	2437	610	259	55	840
<b>10</b>	17448	2074	329	236	107	687
<b>11</b>	Falaksar	1761	820	0	0	645
<b>12</b>	ESB-390A	107	530	0	0	159
<b>Mean</b>		2531	1025	599	212	

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	60:100: 60 N:P:K kg/ha
Sowing date	03.08.2019

Perusal of the table 1.5 indicated that 95-1-14 (candidate variety of ORI) gave an average seed yield of 1219 kg/ha while the check variety Faisal Soybean yielded 1203 kg/ha.

## 7. SESAME

### Project 1: MAINTENANCE OF GENE POOL

Ninety entries were maintained through rouging. At maturity, all entries were harvested and sizeable seed from each entry was collected.

### Project 2. DEVELOPMENT OF FRESH CROSSES

Fourteen crosses were made keeping parental lines having good traits.

<u>Sr.No.</u>	<u>Crosses</u>
1.	L-7 x TS-5
2.	L-7 x TIL-18
3.	L-7 x 87005
4.	L-100 x 18001
5.	L-100 x 15001
6.	No.56 x TH-6
7.	No.56 x 18001
8.	No.56 x 15001
9.	No.56 x 17005
10.	No.56 x 18003
11.	L-100 x 57
12.	L-100 x 95009
13	L-100 x 87005
14	No.56 x 57

Seed of each cross was collected at maturity to rise F<sub>1</sub> generation.

### Project 3. STUDY OF FILIAL GENERATIONS

The crosses studied in different generations are given in table 1.1.

**Table 1.1**

**Crosses/progenies studied and selections made in F<sub>1</sub> to F<sub>6</sub> sesame generations during 2019 at Oilseeds Research Institute, Faisalabad.**

<b>Generation</b>	<b>No. of crosses studied</b>
F <sub>1</sub>	14
F <sub>2</sub>	08
F <sub>3</sub>	07
F <sub>4</sub>	08
F <sub>5</sub>	02
F <sub>6</sub>	125 Plants
F <sub>7</sub>	27 progenies

All F<sub>1</sub> crosses were harvested to rise F<sub>2</sub> generation. From F<sub>2</sub> to F<sub>3</sub> generation F<sub>3</sub> to F<sub>4</sub> generation and F<sub>4</sub> to F<sub>5</sub> were selected to rise next generation. In F<sub>7</sub>, 27 were selected for seed yield evaluation in preliminary yield trial.

**Project 4. PRELIMINARY YIELD TRIAL (Sesame)**

Fourteen Sesame lines were tested along with the standard variety “TH-6 and TIL-18”. The data collected on seed yield and other agronomic traits are given in table 1.2.

**Table 1.2**  
**Performance of 12 entries for seed yield and other parameters in Preliminary Yield Trial at Oilseeds Research Institute, Faisalabad in 2019.**

Rank	Line/Variety	Days to 50% Flowering	No. of pods/plant	Branches/Plant	Plant height (cm)	Seed yield (kg/ha)
1	19001	47	39	1	172	727
2	19002	45	36	1	165	615
3	19003	46	46	1	178	937
4	19004	45	46	1	178	705
5	18002	47	42	1	179	1018
6	18005	46	43	1	183	612
7	17004	47	38	1	184	351
8	16003	47	37	1	174	534
9	16005	60	46	6	203	1166
10	17002	59	58	5	193	1223
11	TH-6(C)	47	37	1	169	859
12	TIL-18(C)	61	91	6	208	921
<b>LSD 5%</b>						228

Design	R.C.B.
Plot size	5 x 1.35m
Row spacing	45 cm
Fertilizer	60:60 NP kg/ha
Sowing date	June, 2019

The perusal of table 1.2 indicates that 17002 gave highest yield i.e, 1223 kg/ha followed by 16005 i.e, 1166 kg/ha. Days to 50% flowering ranged from 45-61. The maximum plant height (208cm) was observed by TIL-18 and minimum (165cm) by 19002. Number of pod/plant ranged from 36-91. TIL-18 showed maximum number of pod/plant 91.

**Project 5. ADVANCED SEED YIELD TRIAL (Sesame)**

Nine Sesame lines were evaluated along with “TH-6 and TIL-18”. The results are presented in table 1.3.

**Table 1.3**  
**Performance of 09 entries of advanced Sesame yield trial, 2019 at Oilseeds Research Institute, Faisalabad.**

Rank	Line/Variety	Days to 50% flowering	No. of pods/plant	Branches /Plant	Plant height (cm)	Seed yield (kg/ha)
1	17005	47	46	1	164	611
2	18003	47	52	1	163	1040
3	18001	45	43	1	174	401
4	Small Pod	46	52	1	177	663
5	18006	47	39	1	181	244
6	87005	63	50	4	189	779
7	50007	62	64	5	198	1110
8	TH-6(C)	48	40	1	159	847
9	TIL-18(C)	63	37	4	194	940
					<b>LSD 5%</b>	162

Design	R.C.B
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	60:60 NP kg/ha
Sowing date	June, 2019

The perusal of table 1.3 indicates that 50007 gave highest yield i.e. 1110 kg/ha followed by 18003 i.e. 1040 kg/ha. Days to 50% flowering ranged from 45 to 63. Number of branches ranged from 1-5 and plant height 159-198. Maximum number of branches was observed by 50007 and maximum plant height was observed by 50007.

**Project 6. MICRO SEED YIELD TRIALS (Sesame)**

Yield performance of ten lines of sesame was tested under different agro- climatic conditions of the province. The results obtained from five locations are given in table 1.4 (a) and 1.4 (b).



**Table 1.4 (a)**  
**Performance of Sesame strains at different locations in the Punjab during 2019**

Rank	Line/ Variety	Karore	F/Abad	Piplan	BWP	KHAN PUR	Average
1	17006	806	1246	333	1148	1037	914
2	17003	900	1124	454	930	1056	893
3	TS-5 (C)	937	1230	444	596	1148	871
4	86001	856	1098	361	570	1148	807
5	77011	870	564	259	885	1093	734
6	70002	670	716	259	785	1111	708
7	NIAB Sesame 2016 (C)	630	1117	278	530	981	707
8	NIAB Pearl(C)	602	992	306	496	1093	698
9	15002	852	280	435	615	1074	651
10	87006	841	379	204	707	1037	633
	LSD 5%	161	216	45	89	193	

Perusal of the table 1.4 (a) indicated that 17006 and 17003 surpassed all the entries included in the trial by giving average seed yield of 914 kg/ha and 893 kg/ha while lowest yield was taken by 87006 (633 kg/ha), whereas TS-5, the standard Variety, produced the seed yield of 871 kg/ha.

**Table 1.4 (b)**  
**Others parameters of advanced lines of Micro seed yield trial, 2019 recorded at Oilseed Research Institute, Faisalabad.**

Rank	Line/Variety	Days to 50% flowering	No of pods /plants	Branches /Plant	Plant height (cm)	Seed yield (Kg/ha)
1	87006	53	31	5	171	379
2	77011	53	39	6	176	564
3	15002	61	40	4	179	280
4	17006	64	56	1	183	1246
5	17003	62	66	1	215	1124
6	86001	63	62	6	207	1098
7	70002	64	58	6	198	716
8	TS-5 (C)	64	72	7	205	1230
9	NIAB Pearl(C)	65	34	5	212	992
10	NIAB Sesame 2016(C)	66	55	6	191	1117
					LSD 5%	216

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	60:60 N:P kg/ha
Sowing date	June, 2019

Perusal of the table 1.4 (b) Days to 50% flowering ranged from 53-66- days. Number of branches per plant ranged from 1-7 and Plant height from 171-215cm.

### **Project 7. NATIONAL UNIFORM SESAME YIELD TRIAL (NUSYT)**

The object of this trial was to test the performance of sesame varieties under Faisalabad environmental conditions. This trial was sown with the material supplied by the Pakistan Agricultural Research Council. The data recorded are given in table 1.5.

**Table 1.5**  
**Results of National Uniform Sesame Yield Trial conducted during 2019**

<b>Sr No.</b>	<b>De-Coded Entry</b>	<b>NARC ISB</b>	<b>NIAB</b>	<b>ORI-FSD</b>	<b>AZRC DI Khan</b>	<b>ARI Quetta</b>	<b>ARI Tendojam</b>	<b>Mean</b>
<b>1</b>	<b>15001</b>	207	300	1195	478	218	35	480
<b>2</b>	<b>NS-103-1</b>	291	1262	828	748	433	135	712
<b>3</b>	<b>TS-5(C)</b>	282	999	605	588	384	145	571
<b>4</b>	<b>SG-21</b>	311	370	747	571	451	134	490
<b>5</b>	<b>SG-99</b>	240	99	788	530	456	140	423
<b>6</b>	<b>CMS-202</b>	157	392	717	523	260	116	410
<b>7</b>	<b>SG-174</b>	202	258	673	597	510	107	448
<b>8</b>	<b>CMS-101</b>	174	143	1206	289	324	32	427
<b>9</b>	<b>NS-260-SP-2</b>	151	640	995	491	186	140	493
<b>10</b>	<b>Black till</b>	303	194	1303	858	483	139	628
<b>Mean</b>		<b>232</b>	<b>906</b>	<b>466</b>	<b>567</b>	<b>371</b>	<b>112</b>	
<b>LSD 5%</b>		<b>13.9</b>	<b>62.4</b>	<b>51.4</b>	<b>36.4</b>	<b>25.6</b>	<b>23.2</b>	

Perusal of the table 1.5 (a) indicated that entry NS-103-1 and ORIs entry Black till surpassed all the entries included in the trial by giving average seed yield of 712 kg/ha and 628 kg/ha while lowest yield was taken by CMS-202 (410 kg/ha), whereas TS-5, the standard Variety, produced the seed yield of 571 kg/ha.

## 8. OILSEEDS ENTOMOLOGY

### Project No. 1: Effect of different doses of Neonicotinoid on whitefly mortality in Soybean

Faisal Soybean was sown and data regarding Whitefly were recorded from upper, middle and lower leaves of five randomly selected plants in each replication. When the population of Whitefly reached at its ETL, then different doses of Acetamiprid (150-250 gram/acre) were applied on Soybean. Data were recorded before insecticide treatment. Percent mortality of whitefly were recorded after 24, 48 and 72 hours of treatment. Maximum percent mortality of whitefly was observed in dose applied at the rate of 250 g/acre (82.09%).

Sr. #	Dose Rate	B.T	24 HAT	48 HAT	72 HAT
1	150 g/acre	17	14.67 (13.70%)	17.67 (-3.94%)	19.67 (-15.70%)
2	175 g/acre	18.66	15 (19.61%)	13.33 (28.56%)	11.33 (39.28%)
3	200 g/acre	13.33	11 (17.48%)	8.33 (37.51%)	6.67 (49.96%)
4	225 g/acre	17	10 (41.18%)	9 (47.05%)	4.67 (72.53%)
5	250 g/acre	22.33	11.67 (47.74%)	8 (64.17%)	4 (82.09%)
6	Control	14.67	17.67 (-20.45%)	19.67 (-34.08%)	21 (-43.15%)

### Project No. 2: Screening of Elite Lines of *Brassica juncea* against Mustard aphid

Twenty six strains of *Brassica juncea* were sown to test their behavior against mustard aphid under natural conditions. The maximum aphid population was found on *Brassica juncea* line KJ-274 (11.73) followed by Super Raya (11.20) and BRJ-1501 (11.16) respectively. Whereas, minimum population of mustard aphid was found on 17CBJ007 (5.27). It is also revealed that the population of mustard aphid remained below Economic Threshold Level (ETL) on all the above tested *Brassica juncea* lines. Rainfall was the major factor in low incidence of mustard aphid.

Sr. #	Strain/Variety	Avg. aphid population/10 cm central shoot	Sr. #	Strain/Variety	Avg. aphid population/10 cm central shoot
1	16CBJ006	8.53	14	BRJ-1458	8.76
2	15CBJ007	8.47	15	RBJ-16007	9.33

3	RBJ-15015	8.89	16	RBJ-17005	10.02
4	15CBJ001	7.80	17	RBJ-17013	10.44
5	RBJ-14010	7.87	18	RBJ-17015	8.20
6	16CBJ001	10.44	19	17CBJ 002	9.91
7	Super Raya (C)	9.98	20	17CBJ 001	7.09
8	KJ-244	8.40	21	BRJ-1501	11.16
9	ZBJ-12011	11.07	22	BRJ-15019	8.49
10	KJ-238	7.89	23	KJ-274	11.73
11	BRJ-1452	8.89	24	KJ-282	10.02
12	KJ-258	9.69	25	17CBJ 007	5.27
13	RBJ-15019	8.02	26	Super Raya	11.20
		LSD @ 5%	4.71		

### **Project No. 3: Screening of Elite Lines of *Brassica napus* against Mustard aphid**

Twenty one entries of *Brassica napus* were sown to test their behavior against mustard aphid under natural conditions. The maximum aphid population was found on *Brassica napus* line RBN-16001 (12.78), while minimum mustard aphid population was observed on KN-294 (7.96). It is also revealed that the population of mustard aphid remained below Economic Threshold Level (ETL) on all the above tested *Brassica napus* lines. Rainfall was the major factor in low incidence of mustard aphid.

Sr. #	Strain/Variety	Avg. aphid population/10cm central shoot	Sr. #	Strain/Variety	Avg. aphid population/10 cm central shoot
1	Super Canola (C)	8.27	12	RBN-16001	12.78
2	KN-294	7.96	13	RBN-17014	8.89
3	RBN-13022	11.44	14	RBN-18007	9.76
4	RBN-16008	11.20	15	RBN-18021	10.98
5	RBN-16001	9.96	16	17CBN 004	12.69
6	KN-309	10.78	17	17CBN 007	12.27
7	RBN-16011	8.02	18	KN-331	12.49
8	16CBN007	11.16	19	KN-338	10.89
9	16CBN002	7.98	20	Super Canola	11.16
10	KN-279	12.49	21	Chakwal Sarson	12.18
11	RBN-14017	9.04	-		
		LSD @ 5%	4.05		

**Project No. 4: Identification of genetic resistance in *Brassica juncea* against Mustard aphid**

The source population was sown in the field under natural conditions. Eighteen undamaged plants, free from mustard aphid attack were selected for further testing for resistance against mustard aphid through single plant progenies during next cropping season.

**Project No. 5: Evaluation of various Plant Extracts as Biopesticides against Mustard Aphid**

Three biopesticides made from Taramera, Anmol Raya and Super Raya were tested against mustard aphid. These biopesticides were applied @ 500 ml/acre. Biopesticide made from Anmol Raya gave the highest mortality (66.99%) followed by Taramera (63.54%) and Super Raya (57.45%) respectively.

Sr. #	Insecticides	B.T	8 HAT	24 HAT
1	Taramera	982	542 (44.81 %)	358 (63.54 %)
2	Anmol Raya	830	396 (52.29 %)	274 (66.99 %)
3	Super Raya	799	493 (38.30 %)	340 (57.45 %)
4	Control	547	577 (-5.48 %)	615 (-12.43 %)
	LSD @ 5%		167.04	100.12

**Project No. 6: Evaluation of different insecticides against Mustard Aphid**

Three insecticides; Major (Nitenpyram+ Pymetrozine), Lesenta (Imidacloprid + Fipronil) and Acetamiprid were tested against mustard aphid. These insecticides were applied @ 100g/acre, 60g/acre and 150g/acre respectively. Major gave the highest mortality (96.44%) followed by Lesenta (94.43%) and Acetamiprid (8.34%) after 72 hours of application.

Sr. #	Insecticides	B.T	24 HAT	48 HAT	72 HAT
1	Major	646	307 (52.48 %)	143 (77.86 %)	23 (96.44 %)
2	Lesenta	772	403 (47.80 %)	175 (77.33 %)	43 (94.43 %)
3	Acetamiprid	767	560 (26.99 %)	617 (19.56 %)	703 (8.34 %)
4	Control	788	816 (-3.55 %)	828 (-5.07 %)	849 (-7.74 %)
	LSD @ 5%		28.22	42.95	32.01

**Project No. 7: Screening of Sunflower Hybrids for their Resistance/Susceptibility against insect pests**

Six promising hybrids of sunflower were sown to test their behavior against different insect pests of sunflower under natural conditions. The data revealed that the population of Whitefly did not reach ETL level in all hybrids, but lowest population (0.65) was found on hybrid Hysun-33 while maximum population (0.76) was observed on hybrid FH-555. The minimum population of jassid (0.94) was observed on FH-555, FH-751 and Hysun-33 while maximum population was observed on hybrid FH-516 (1.01). In case of Head moth larvae, the population remained below ETL level on all tested hybrids. Minimum head moth population (0.20) per plant was observed on FH-751. Whereas, maximum population (0.43) per plant was observed in FH-555.

Sr. #	Hybrid	Whitefly/Leaf	Jassid/Leaf	Head Moth/Plant
1	FH-516	0.74	1.01	0.37
2	FH-675	0.69	0.95	0.23
3	FH-701	0.70	0.96	0.27
4	FH-555	0.76	0.94	0.43
5	FH-751	0.74	0.94	0.20
6	Hysun-33	0.65	0.94	0.30
LSD @ 5%		0.15	0.15	0.23

**Project No. 8: Effect of different doses of Neonicotenoid on Whitefly mortality in Spring Sunflower**

Different doses of Acetamiprid (150-250 gram/acre) were applied on Spring Sunflower when the population of whitefly was abundant in field. Maximum percent mortality of whitefly was observed in dose applied at the rate of 250 g/acre (81.46 %).

Sr. #	Dose Rate	B.T	24 HAT	48 HAT	72 HAT
1	150 g/acre	59.99	54.33 (9.43 %)	58.32 (2.78 %)	62.99 (-5.00 %)
2	175 g/acre	56.66	51.66 (8.82 %)	47.66 (15.88 %)	42.66 (24.71 %)
3	200 g/acre	51.66	43.66 (15.49 %)	39.33 (23.87 %)	32.33 (37.42 %)

4	225 g/acre	55.99	40 (28.56 %)	33.66 (39.88 %)	30.33 (45.83 %)
5	250 g/acre	59.33	30.32 (48.90 %)	21.66 (63.49 %)	11 (81.46 %)
6	Control	60.66	65.66 (-8.24 %)	70.33 (-15.94 %)	74.66 (-23.08 %)
	LSD @ 5%		3.61	3.44	2.59

**Project No. 9: Induce resistance in Sunflower against the insect pests by application of Silicon**

Silicon (Sodium Silicate) was applied on sunflower crop at three doses (1000,1250 and 1500 g/acre) to induce resistance against sucking insect pests. It was observed that low populations of whitefly per leaf (0.66) and Jassid per leaf (0.70) were recorded in treatment of silicon applied at the rate of 1500 g/acre. Maximum insect population were observed in control treatment.

Sr. #	Treatment	Whitefly/Leaf	Jassid/Leaf	
1	1000 (500+500) g/acre	0.96	1.03	
2	1250 (625+625) g/acre	0.86	0.93	
3	1500 (750+750) g/acre	0.66	0.70	
4	Control	1.01	1.10	
	LSD @ 5%		0.09	0.18

**Project No. 10: Early sowing of Sunflower to escape the attack of Head Moth**

Sunflower crop was sown on four different dates (01 January, 15 January, 01 February and 15 February) to find out suitable sowing date, with the aim to escape the attack of head moth. Minimum population of head moth was observed on crop sown on 01 and 15 January.

Sr. #	Sowing Date	Head Moth/Plant	
1	01 January 2020	0.18	
2	15 January 2020	0.38	
3	01 February (Control)	1.02	
4	15 February 2020	0.93	
	LSD @ 5%		0.15

**Project No. 11: Identification of genetic resistance in Sunflower germplasm against Head moth**

The source population was sown in the field under natural conditions. 1-3 head moth larvae were released at onion stage on heads of Sunflower and were bagged. Seven undamaged plants, free from head moth larvae attack were selected for further testing during next cropping season.



## 9. OILSEEDS PATHOLOGY

### RAPESEED AND MUSTARD

#### Project-1 SCREENING OF RAPESEED/MUSTARD CULTIVARS AGAINST DIFFERENT DISEASES

11 promising cultivars of rapeseed and 12 promising cultivars of mustard were sown at Faisalabad to observe their behavior against diseases; *Alternaria* blight (*Alternaria brassicae*), powdery mildew (*Erysiphe cruciferarum*), white rust (*Albugo candida*) and downy mildew (*Peronospora parasitica*) under natural conditions.

Data on *Alternaria* blight incidence was recorded on the basis of diseased/healthy plants and intensity of the disease was recorded on 0-9 rating scale which is given below, while all other diseases were recorded on the basis of diseased/healthy plants.

**Table-1:- 0-9 Rating Scale for Estimation of Intensity of *Alternaria* Blight in Rapeseed/Mustard.**

Score	Conditions	Remarks
0	No disease	Immune
1	A few scattered plants blighted with 1-2 spots/plant.	Very Highly Resistant (VHR)
2	A few scattered plants blighted with 5-10 spots/plant.	Highly Resistant (HR)
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)
7	Every plant severely infected with about 75% of leaf area and stem.	Highly Susceptible (HS)
8	Every severely infected defoliation common and 95% of stem surface affected	Very Highly Susceptible (VHS)
9	Defoliation severe and 100% leaf and stem area affected and destroyed.	Completely Susceptible (CS)

**REFERENCE:**

Mayo, L.D and Datar, V.V., 1986. Phytopath matry. Technical bullatin-2. Special bullatin-3, Puld. Marathwada Agri. University, Porbhari- 431402, 196-97.

**Table -2:- During 2019-20, 11 cultivars of *Brassica napus* were screened against various diseases under natural conditions.**

S.No.	Variety/Line	Alternaria blight %	Alternaria blight (0-9) (intensity)	Remarks	White rust %	Remarks
1	RBN-14017	27	3	R	-	-
2	RBN-16001	25	4	MR	-	-
3	RBN-17014	22	4	MR	-	-
4	RBN-18007	25	5	MS	-	-
5	RBN-18021	26	4	MR	-	-
6	17CBN004	24	3	R	-	-
7	17CBN007	23	3	R	-	-
8	KN-331	26	3	R	-	-
9	KN-338	28	4	MR	-	-
10	Super Canola	23	3	R		
11	Chakwal Sarson	21	4	MR		

Downy mildew and powdery mildew diseases did not appear during 2019-20.

**Table -3:- During 2019-20, 12 cultivars of *Brassica juncea* were screened against various diseases under natural conditions.**

S.No.	Variety/Line	Alternaria blight %	Alternaria blight (0-9) (intensity)	Remarks	Powdery Mildew (%)	Downey mildew (%)
1	RBJ-16007	60	5	MS	-	-
2	RBJ-17005	40	4	MR	-	-
3	RBJ-17013	50	5	MS	-	-
4	RBJ-17015	52	5	MS	-	-
5	17CBJ002	58	5	MS	-	-
6	17CBJ001	40	4	MR	-	-
7	BRJ-1501	45	5	MR	-	-
8	BRJ-15019	60	6	S	-	-
9	KJ-274	50	5	MS	-	-
10	KJ-282	70	6	MS	-	-
11	17CBJ007	65	6	S	-	-
12	Super Raya	40	4	MR	-	-
13	KJ-159 (spreader)	75	7	HS	-	-

Whit rust, downy mildew and powdery mildew diseases did not appear during 2019-20.

**Project-2: EVALUATION OF VARIOUS BACTERIOCIDE AGAINST BACTERIAL SOFT ROT (*Xanthomonas spp.*) DISEASE OF BRASSICA**

In this experiment 03 bactericides were used against bacterial soft rot disease.

Kasumin gave the best control followed by Casper and Cobox.

**Table:- 4. RESULTS (in vivo)**

<b>Treatments</b>	<b>Disease %</b>	<b>% disease decrease</b>
T1 = Kasumin (Kasugamycin) @ 2.5ml/liter of water	06	94
T2 = Casper (Kasugamycin+ Copper Oxychloride) @ 1ml/liter of water	14	86
T3 = Cobox (Copper Oxychloride) @ 2.5g/liter of water	24	76
T4 = Control	96	0

**Project-3: SCREENING OF SUNFLOWER NUSYT MATERIAL FOR ITS BEHAVIOU AGAINST DISEASES DURING 2020.**

During spring 2020, 18 entries of NUSYT inbred lines/hybrids were tested to check their behavior against diseases; charcoal rot [by tooth pick method] and head rot [by injury method] under natural condition. Data for disease infection of head rot were recorded on the basis of diseased and healthy plants and data for charcoal rot were collected on the basis of A-D. Disease Rating Scale are given as under

<b>Score</b>	<b>Conditions</b>
A	After inoculation with tooth pick method, infection covered the stem length 1-10 cm only (highly resistant).
B	Infection covered the stem length 11-20 cm (resistant).
C	Infection covered the stem length 21-30 cm (moderately susceptible).
D	Infection covered the stem length 31 cm and above (susceptible)

**Reference: CDRI (NARC) Islamabad.**

**Methodology:**

Inoculation of charcoal rot disease was done by tooth pick method at flowering initiation stage on stem. Data was recorded on the basis of A to D disease rating scale measuring the disease spread after the harvest of crop by splitting stem vertically into two halves.

**Table-5:-Behavior of Sunflower hybrids against Charcoal Rot disease at ORI, Faisalabad during spring, 2020 under NUSYT.**

Score	Conditions	Remarks	Hybrids	No. of hybrids
A	After inoculation with toothpick method, infection covered the stem length 1-10cm only	Highly Resistant (HR)	0	0
B	infection covered the stem length 11-20cm	Resistant (R)	SF-20009, SF-20020, SF-20039	03
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	SF-20001, SF-20007, SF-20010, SF-20011, SF-20013, SF-20023, SF-20027, SF-20037, SF-20034, SF-20044,	10
D	infection covered the stem length 31cm or above	Susceptible (S)	SF-20005, SF-20017, SF-20025, SF-20033, SF-20040,	05
			Total	18

Out of 18 entries of NUSYT, 3 hybrids were resistant, 10 were moderately resistant and 05 were susceptible. No hybrid showed highly resistant reaction.

**Table-6:-Disease Rating Scale for the estimation of head rot disease of sunflower**

SCORE	CONDITIONS	REMARKS
0	No disease	Immune
1	1 % or less Head roted	Highly resistant (HR)
3	1-10 % Head roted	Resistant (R)
5	11-25 % Head roted	Moderately susceptible (MS)
7	26-50 % Head roted	Susceptible (S)
9	51 % Head roted	Highly susceptible (HS)

**REFERENCE:**

Mayo, L.D and Datar, V.V., 1986. Phytopathometry. Technical bulletin-2. Special bulletin-3, Puld. Marathwada Agri. University, Porbhari- 431402, 196-97.

**Table-7:-Behavior of Sunflower hybrids against Head Rot Disease at ORI, Faisalabad during spring, 2020 under NUSYT.**

Score	Conditions	Remarks	Hybrids	No. of hybrids
0	No disease	Immune	0	0
1	1% or less head rotten	Highly Resistant (HR)	0	0
3	1-10% head rotten	Resistant (R)	0	0

5	11-25% head rotten	Moderately susceptible (MS)	0	0
7	26-50% head rotten	Susceptible (S)	0	0
9	51% rotten and above	Highly Susceptible	SF-20001, SF-20005, SF-20007, SF-20009, SF-20010, SF-20011, SF-20013, SF-20017, SF-20020, SF-20023, SF-20025, SF-20027, SF-20033, SF-20034, SF-20037, SF-20039, SF-20040, SF-20044,	18
			Total	18

Out of 18 NUYST entries, no hybrid was found highly resistant, resistant and moderately susceptible. All 18 were highly susceptible.

**Project-4: SCREENING OF SUNFLOWER LOCAL MATERIAL FOR ITS BEHAVIOUR AGAINST DISEASES DURING 2020**

During spring 2020, 06 entries local inbred lines/hybrids were tested against their behavior to diseases; charcoal rot [by tooth pick method] and head rot [by injury method] under natural condition. Data for disease infection of head rot were recorded on the basis of diseased and healthy plants and data for charcoal rot were collected on the basis of A-D. Disease Rating Scale already mentioned.

**Table-8:-Behavior of advance Sunflower hybrids against Charcoal Rot Disease at ORI, Faisalabad during spring, 2020.**

Score	Conditions	Remarks	Hybrids	No. of hybrids
A	After inoculation with toothpick method, infection covered the stem length 1-10cm only	Highly Resistant (HR)	0	0
B	infection covered the stem length 11-20cm	Resistant (R)	FH-516, FH-701,	02
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	FH-555, FH-675, FH-751,	03

D	infection covered the stem length 31cm or above	Susceptible (S)	Hysun-33	01
			Total	06

Out of 06 hybrids, 02 were Resistant, 03 were moderately resistant and 01 were susceptible against charcoal rot disease. No hybrid observed highly resistant.

**Table No.09:- Behavior of Sunflower advance hybrids against Head rot disease at ORI, Faisalabad, during spring 2020.**

Score	Conditions	Remarks	Hybrids	No. of hybrids
0	No disease	Immune	0	0
1	1% or less head rotten	Highly Resistant (HR)	0	0
3	1-10% head rotten	Resistant (R)	0	0
5	11-25% head rotten	Moderately susceptible (MS)	0	0
7	26-50% head rotten	Susceptible (S)	0	0
9	51% rotten and above	Highly Susceptible		06
			Total	06

Out of 06 entries, no hybrid was found highly resistant, resistant and moderately susceptible and susceptible. All 06 were highly susceptible.

**PROJECT -5. EVALUATION OF INBRED LINES (B & R) OF NEWLY DEVELOPED SUNFLOWER HYBRIDS AGAINST CHARCOAL ROT DISEASE**

**Table-10:-Behavior of Sunflower inbred lines (B&R) against Charcoal Rot Disease at ORI, Faisalabad during spring, 2020.**

Score	Conditions	Remarks	Hybrids	No. of hybrids
A	After inoculation with toothpick method, infection covered the stem length 1-10cm only	Highly Resistant (HR)	0	0
B	infection covered the stem length 11-20cm	Resistant (R)	ORI-18, ORI-428, ORI-458, RL-39,	05

			RL-114,	
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	ORI-208, ORI-418, ORI-908, ORI-1068, RL-72, RL-86,	06
D	infection covered the stem length 31cm or above	Susceptible (S)	ORI-928, V-214	02
			Total	13

Out of 13 entries, 05 inbred lines were resistant, 06 were moderately resistant and 02 were susceptible.

### **PROJECT -6: EVALUATION OF VARIOUS FUNGICIDES AGAINST HEAD ROT**

#### **(*Rhizopus arrhizus*) DISEASE**

**Table-11:- RESULTS (in vivo)**

<b>Treatments</b>	<b>Disease %age</b>	<b>% disease decrease/ Inhibition</b>
Amistar Top 325 SC (Azoxystrobin Difenconazole) @ 1ml/liter of water	12	88
Score 250 EC (Difenconazole) @ 1ml/liter of water	16	84
Topsin – M (Thiophenate Methyl) @ 2.5 g/liter of water	24	76
Carbendazim 50wp @ 2gm/liter of water	35	65
Control	100	0

### **PROJECT -7: BEHAVIOR OF SESAME GERMPLASM AGAINST CHARCOAL ROT DISEASE DURING 2019.**

The sesame germplasm was sown at Faisalabad to note their behavior against charcoal rot disease caused by *Macrophomina phaseolina*. 10 lines/varieties were sown in a sick plot at ORI field. The disease infection was recorded on the basis of diseased/healthy plants in each entry. The entries were classified according to the intensity of infection and the data recorded is presented in table below.

**Table-12:-Behavior of sesame germplasm against charcoal rot disease during 2019 at ORI, Faisalabad in sick field.**

Score	Conditions	Remarks	Varieties/lines	No. of varieties/lines
0	No symptoms on plants	Immune	0	0
1	1% or less plants mortality	Highly Resistant (HR)	0	0
3	1-10% mortality	Resistant (R)	0	0
5	11-25% mortality	Moderately resistant (MR)	87006, 77011, 17006, 17003, 86001, 70002, TS-5 (c), Niab Pearl (c), Niab sesame 2016 (c)	09
7	26-50% mortality	Susceptible (S)	15002	01
9	51% or more mortality	Highly Susceptible (HS)	0	0
			Total	10

Out of 10 varieties/lines of sesame, there was no immune, highly resistant & resistant. 09 were moderately resistant and 01 was susceptible.

**PROJECT -8: BEHAVIOR OF SESAME GERMPLASM AGAINST PHYLLODY DISEASE DURING 2019.**

The sesame germplasm was sown at Faisalabad to note their behavior to phyllody disease. 10 lines/varieties were sown under natural conditions at ORI field. The disease infection was recorded on the basis of diseased/healthy plants in each entry. The entries were classified according to the intensity of infection and the data recorded are presented in table.

**Table-13:-Behavior of sesame germplasm against phyllody disease during 2019.**

Score	Conditions	Remarks	Varieties/lines	No. of varieties/lines
0	No symptoms on plants	Immune	-	-



1	1% or less plants infected	Highly Resistant (HR)	-	-
3	1-10% plants infected	Resistant (R)	87006, 77011, 15002, 17003, 86001, 70002, TS-5 (c), Niab Pearl (c), Niab Sesame 2016 (c)	09
5	11-20% plants infected	Moderately resistant (MR)	17006	01
7	21-50% plants infected	Susceptible (S)	-	-
9	51% or above plants infected	Highly Susceptible (HS)	-	-
			Total	10

Out of 10 varieties/lines of sesame, there was no immune and highly resistant. 09 were resistant & 01 was moderately resistant. No line/variety was found susceptible.

**10. OIL TECHNOLOGY****Experiment 1:- Determination of Oil Contents of Sunflower Hybrids****Local Hybrids Set I**

<b>Sr. No.</b>	<b>Sample ID</b>	<b>Moisture %</b>	<b>Oil %</b>	<b>Oleic Acid %</b>	<b>Linoleic Acid %</b>
1	FH-77 R1 S1, SP 19	4.85	44.04	36.02	21.09
2	FH-77 R2 S1, SP 19	4.24	45.74	29.77	23.95
3	FH-77 R3 S1, SP 19	4.91	43.42	25.04	22.94
4	FH-328 R1 S1, SP 19	4.85	43.29	14.10	19.71
5	FH-328 R2 S1, SP 19	4.89	41.62	15.79	24.37
6	FH-328 R3 S1, SP 19	4.72	43.57	17.84	30.32
7	FH-772 R1 S1, SP 19	4.53	42.1	2.66	42.59
8	FH-772 R2 S1, SP 19	4.35	44.33	6.52	48.66
9	FH-772 R3 S1, SP 19	4.26	45.51	2.62	47.96
10	FH-773 R1 S1, SP 19	4.34	46.22	6.19	30.15
11	FH-773 R2 S1, SP 19	4.22	48.53	8.93	30.24
12	FH-773 R3 S1, SP 19	4.30	46.78	6.56	30.20
13	FH-776 R1 S1, SP 19	4.67	38.82	16.14	44.76
14	FH-776 R1 S1, SP 19	4.48	38.36	16.15	44.34
15	FH-776 R3 S1, SP 19	4.84	39.68	16.11	45.1
16	FH-777 R1 S1, SP 19	5.19	44.55	0.18	47.51
17	FH-777 R2 S1, SP 19	4.36	46.11	4.31	42.25
18	FH-777 R3 S1, SP 19	4.45	45.85	1.42	43.98

19	FH-780 R1 S1, SP 19	4.27	41.94	13.48	49.49
20	FH-780 R2 S1, SP 19	4.09	43.61	5.75	54.01
21	FH-780 R3 S1, SP 19	4.92	40.58	14.61	49.89
22	FH-781 R1 S1, SP 19	4.38	46.1	4.76	39.80
23	FH-781 R2 S1, SP 19	4.44	43.90	20.40	34.49
24	FH-781 R3 S1, SP 19	4.37	44.63	13.95	36.22
25	FH-783 R1 S1, SP 19	4.25	47.6	6.24	41.12
26	FH-783 R2 S1, SP 19	4.68	43.47	19.35	43.89
27	FH-783 R3 S1, SP 19	4.76	40.32	19.28	47.32
28	FH-784 R1 S1, SP 19	4.69	43.78	7.62	31.85
29	FH-784 R2 S1, SP 19	4.63	42.78	0.73	41.02
30	FH-784 R3 S1, SP 19	4.38	46.17	4.5	38.28
31	FH-788 R1 S1, SP 19	4.54	42.9	26.86	18.51
32	FH-788 R2 S1, SP 19	5.01	40.0	15.62	26.72
33	FH-788 R3 S1, SP 19	4.37	45.48	3.56	34.74
34	HYSUN-33 (C) R1 S1	4.75	40.64	28.97	45.77
35	HYSUN-33 (C) R2 S1	4.28	42.96	17.44	44.17
36	HYSUN-33 (C) R3 S1	4.41	37.0	32.97	38.35

Thirty six samples of locally developed sunflower hybrids set I were tested for their oil contents and fatty acid profile. Maximum oil contents 48.53% were observed in FH-773 R2 S1, SP 19 followed by FH-783 R1 S1, SP 19 having oil content 47.60%. Minimum oil contents were estimated in HYSUN-33 (C) R3 S1 (37%).

**Local Hybrids Set II**

<b>Sr. No.</b>	<b>Sample ID</b>	<b>Moisture %</b>	<b>Oil %</b>	<b>Oleic Acid %</b>	<b>Linoleic Acid %</b>
1	FH-790 R1 S1, SP 19	4.69	41.66	13.92	38.39
2	FH-790 R2 S1, SP 19	4.74	38.91	18.76	38.17
3	FH-790 R3 S1, SP 19	4.58	41.77	16.98	41.2
4	FH- 793 R1 S1, SP 19	4.6	45.05	3.77	43.86
5	FH-793 R2 S1, SP 19	4.67	40.46	10.52	40.63
6	FH-793 R3 S1, SP 19	4.37	46.14	1.21	42.61
7	FH-797 R1 S1, SP 19	4.34	46.41	2.94	43.14
8	FH-797 R2 S1, SP 19	4.71	44.84	3.75	42.29
9	FH-797 R3 S1, SP 19	4.58	44.77	3.62	52.37
10	FH-800 R1 S1, SP 19	4.45	40.91	25.38	32.61
11	FH-800 R2 S1, SP 19	4.48	42.74	27.26	31.7
12	FH-800 R3 S1, SP 19	4.47	41.39	26.71	32.16
13	FH-801 R1 S1, SP 19	4.11	43.83	13.05	10.06
14	FH-801 R2 S1, SP 19	4.0	43.32	11.16	25.92
15	FH-801 R3 S1, SP 19	4.14	42.48	11.56	14.67
16	FH-803 R1 S1, SP 19	4.26	43.64	19.89	37.17
17	FH-803 R2 S1, SP 19	4.21	40.0	22.19	37.13
18	FH-803 R3 S1, SP 19	4.69	43.91	6.81	39.47
19	FH-804 R1 S1, SP 19	4.73	41.58	7.78	43.42
20	FH-804 R2 S1, SP 19	4.44	41.54	11.28	39.92

21	FH-804 R3 S1, SP 19	4.86	43.38	5.44	48.71
22	FH-808 R1 S1, SP 19	4.8	44.29	6.75	37.79
23	FH-808 R2 S1, SP 19	4.78	42.74	8.98	31.7
24	FH-808 R3 S1, SP 19	4.8	43.94	8.01	41.04
25	FH-809 R1 S1, SP 19	4.62	46.15	16.17	27.17
26	FH-809 R2 S1, SP 19	4.67	47.05	9.78	30.53
27	FH-809 R3 S1, SP 19	4.82	45.46	9.72	30.46
28	FH-811 R1 S1, SP 19	4.11	43.67	7.20	49.56
29	FH-811 R2 S1, SP 19	4.15	44.18	8.06	51.18
30	FH-811 R3 S1, SP 19	4.27	43.16	7.19	50.86
31	FH-812 R1 S1, SP 19	4.98	41.95	9.96	44.74
32	FH-812 R2 S1, SP 19	4.93	44.27	2.08	50.28
33	FH-812 R3 S1, SP 19	4.40	42.33	8.16	47.34
34	HYSUN-33 (C) R1 S1	4.39	41.87	26.07	46.25
35	HYSUN-33 (C) R2 S1	4.2	40.8	30.5	45.66
36	HYSUN-33 (C) R3 S1	4.54	40.62	12.89	57.58

Thirty six samples of locally developed sunflower hybrids set II were tested for their oil contents and fatty acid profile. Maximum oil contents 47.05% were observed in FH-809 R2 S1, SP 19 followed by FH-797 R1 S1, SP 19 having oil content 46.41%. Minimum oil contents were estimated in FH-790 R2 S1, SP 19 (38.91%).

**Experiment 2:- Determination of Oil Contents of Sunflower National Uniform Seed Yield Trial**

Sr. No.	Sample ID	Moisture %	Oil %	Oleic Acid %	Linoleic Acid %
1	E-1 R1,SP19	3.02	37.6	59.02	43.08
2	E-1 R2,SP19	2.99	43.82	25.19	8.58
3	E-2 R1,SP19	2.91	40.01	21.7	58.32
4	E-2 R2,SP19	3.16	39.47	51.92	15.52
5	E-2 R3,SP19	3.34	41.2	30.34	6.59
6	E-3 R1,SP19	3.52	40.46	13.82	20.66
7	E-3 R2,SP19	3.02	41.45	23.97	37.18
8	E-3 R3,SP19	4.17	44.44	18.53	31.94
9	E-4 R1,SP19	3.55	41.83	11.11	24.38
10	E-4 R2,SP19	3.5	45.73	26.19	20.49
11	E-4 R3,SP19	3.35	44.49	26.43	36.46
12	E-5 R1,SP19	2.84	42.56	6.04	20.76
13	E-5 R2,SP19	2.65	43.05	16.57	34.22
14	E-5 R3,SP19	3.81	39.64	33.8	54.17
15	E-6 R1,SP19	3.38	42.20	5.91	10.11
16	E-6 R2,SP19	3.08	42.84	9.82	13.43
17	E-6 R3,SP19	4.17	38.72	44.3	34.97
18	E-7 R1,SP19	3.17	46.06	11.07	43.01
19	E-7 R2,SP19	4.27	44.01	5.39	34.73
20	E-7 R3,SP19	3.8	41.98	26.19	22.26
21	E-8 R1,SP19	3.01	44.09	16.17	56.80

22	E-8 R2,SP19	3.08	41.35	1.11	50.94
23	E-8 R3,SP19	3.54	41.64	15.52	44.79
24	E-9 R2,SP19	3.13	42.16	27.61	61.16
25	E-9 R3,SP19	2.78	44.78	27.5	40.79
26	E-10 R1,SP19	3.73	40.11	19.03	15.74
27	E-10 R2,SP19	2.84	42.16	29.01	16.29
28	E-11 R1,SP19	3.02	42,10	72.79	11.91
29	E-11 R2,SP19	3.07	43.69	41.60	8.27
30	E-11 R3,SP19	3.02	41.45	23.97	37.18
31	E-12 R1,SP19	3.69	41.26	4.3	15.56
32	E-12 R2,SP19	3.21	39.82	12.19	47.06
33	E-13 R1,SP19	3.8	38.16	23.99	101.28
34	E-13 R2,SP19	2.74	41.65	18.74	52.04
35	E-13 R3,SP19	2.93	37.98	27.79	41.44
36	E-14 R1,SP19	3.76	40.69	35.49	34.49
37	E-14 R3,SP19	3.36	41.27	24.7	28.0
38	E-15 R1,SP19	3.32	40.21	35.41	34.55
39	E-15 R2,SP19	3.74	40.97	17.72	36.48
40	E-15 R3,SP19	3.3	40.9	43.9	27.61
41	E-16 R1,SP19	3.0	39.16	10.3	25.15
42	E-16 R2,SP19	2.93	39.06	9.42	20.06

Forty two samples of sunflower National Uniform Seed Yield Trial hybrids were tested for their oil contents and fatty acid profile. Maximum oil contents 46.06% were observed in E-7 R1, SP19

followed by E-4 R2, SP19 having oil content 45.73%. Minimum oil contents were estimated in E-1 R1, SP19 (37.60%).

**Experiment 3:- Determination of Oil Contents of Sunflower Inbred lines**

Sr. No.	Sample ID	Moisture %	Oil %	Oleic Acid %	Linoleic Acid %
1	T R-1,S-5,SP19	5.38	35.25	26.40	88.92
2	T R-2,S-5,SP19	5.29	39.77	52.22	37.18
3	T R-3,S-5,SP19	5.48	40.7	74.44	10.21
4	T R-4,S-5,SP19	5.07	40.96	20.83	99.51
5	T R-5,S-5,SP19	5.47	37.79	44.63	52.88
6	T R-6,S-5,SP19	5.14	44.77	48.06	18.05
7	T R-7,S-5,SP19	4.87	42.29	53.33	20.78
8	T R-9,S-5,SP19	5.42	41.87	39.2	21.07
9	T R-11,S-5,SP19	6.96	34.29	48.22	134.59
10	T R-12,S-5,SP19	5.39	38.35	45.33	49.43
11	T R-13,S-5,SP19	5.14	41.26	47.91	103.47
12	T R-14,S-5,SP19	5.7	41.2	35.31	33.59
13	T R-15,S-5,SP19	5.32	43.51	47.86	9.17
14	T R-16,S-5,SP19	5.29	41.86	40.45	58.08
15	T R-17,S-5,SP19	5.04	41.09	44.81	39.36
16	T R-18,S-5,SP19	6.71	32.7	68.30	112.62
17	T R-20,S-5,SP19	4.91	43.55	33.03	36.26
18	T R-21,S-5,SP19	4.89	45.98	46.67	40.45
19	T R-23,S-5,SP19	4.35	41.49	27.94	38.4



20	T R-24,S-5,SP19	5.31	43.28	39.79	46.36
21	T R-25,S-5,SP19	5.36	41.62	35.63	33.68
22	T R-26,S-5,SP19	4.86	40.35	45.69	20.55
23	T R-27,S-5,SP19	5.65	40.38	54.39	9.44
24	T R-28,S-5,SP19	4.56	40.99	46.41	16.83
25	T R-29,S-5,SP19	4.65	41.98	38.36	17.33
26	T R-30,S-5,SP19	4.75	43.37	66.62	4.32
27	T R-32,S-5,SP19	4.94	39.89	48.99	112.63
28	T R-33,S-5,SP19	5.61	42.14	49.31	21.87
29	T R-34,S-5,SP19	6.01	40.17	47.42	14.92
30	T R-35,S-5,SP19	5.92	44.39	55.44	37.03
31	T R-36,S-5,SP19	5.51	39.48	46.72	21.98
32	T R-37,S-5,SP19	4.87	47.41	43.6	8.6

Thirty two samples of sunflower inbred lines were tested for their oil contents and fatty acid profile. Maximum oil contents 47.41% were observed in T R-37, S-5, SP19 followed by T R-21, S-5, SP19 having oil content 45.98%. Minimum oil contents were estimated in T R-1, S-5, SP 19 (35.25%).

**Experiment 4:-Determination of Oil Content of Promising Lines/Varieties of Rapeseed and Mustard (Rabi Group)**

**Rabi Brassica napus PYT SET-1**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	RBN PYT-1 E1	37.26	59.75	20.60	7.96	1.53	6.27	83.47
2	RBN PYT-1 E2	38.23	62.80	19.78	7.53	2.32	6.27	99.13
3	RBN PYT-1 E3	37.22	64.51	20.42	7.60	2.65	6.26	104.87
4	RBN PYT-1 E4	37.45	50.14	17.77	7.97	1.76	5.98	112.45

5	RBN PYT-1 E5	36.75	61.99	19.93	7.07	2.73	6.36	84.84
6	RBN PYT-1 E6	36.74	61.57	19.52	6.97	2.75	6.30	81.80
7	RBN PYT-1 E7	41.75	46.52	13.78	6.33	1.06	5.71	89.35
8	RBN PYT-1 E8	38.80	63.55	19.45	8.47	1.79	5.95	137.72
9	RBN PYT-1 E9	36.81	64.29	20.60	8.12	1.51	6.01	111.70
10	RBN PYT-1 E10	35.70	59.29	20.77	8.04	2.21	6.19	71.03

**Rabi Brassica napus PYT SET-11 (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	RBN PYT-11 E1	39.08	65.42	19.23	8.21	2.18	5.97	130.93
2	RBN PYT-11 E2	38.80	65.53	19.38	8.45	2.1	5.96	131.69
3	RBN PYT-11 E3	36.22	65.67	21.83	8.00	2.31	6.38	104.28
4	RBN PYT-11 E4	38.89	62.93	19.26	8.38	1.72	5.94	138.63
5	RBN PYT-11 E5	38.37	64.07	19.84	8.37	2.01	6.00	130.14
6	RBN PYT-11 E6	36.18	71.10	22.60	8.60	2.94	6.33	100.17
7	RBN PYT-11 E7	36.68	70.05	21.89	8.26	2.75	6.24	109.93
8	RBN PYT-11 E8	37.42	56.59	18.88	7.87	1.33	5.90	103.74
9	RBN PYT-11 E9	37.70	62.92	21.56	8.90	1.34	6.12	101.36
10	RBN PYT-11 E10	35.19	62.05	22.09	8.45	2.13	6.22	69.03

**Rabi Brassica napus MYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	38.13	49.51	16.08	7.33	1.14	5.52	95.86
2	E2	36.41	46.73	16.47	7.32	1.18	5.50	101.59
3	E3	36.19	62.64	19.76	7.57	2.48	5.93	96.34
4	E4	37.76	56.31	19.58	8.71	1.65	5.80	97.34
5	E5	41.84	58.08	18.40	9.06	1.41	5.82	92.06

6	E6	35.94	35.93	15.01	7.29	0.63	5.32	112.57
7	E7	35.48	31.59	14.09	6.68	0.78	5.28	118.17
8	E8	40.07	52.0	16.59	7.59	1.37	5.72	91.47
9	E9	38.53	53.94	17.75	8.44	1.59	5.71	106.50
10	E10	39.40	49.89	16.51	7.87	1.25	5.62	95.80
11	E11	37.93	51.29	17.35	7.57	1.25	5.62	103.59

**Rabi Brassica napus AYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	39.04	61.57	19.02	8.29	2.47	6.14	84.95
2	E2	38.22	46.32	15.57	7.38	1.21	5.68	123.45
3	E3	36.96	60.76	20.10	8.34	2.42	6.15	103.58
4	E4	39.60	41.55	14.99	7.81	0.81	5.61	115.84
5	E5	37.80	59.99	19.82	8.18	2.44	6.17	106.38
6	E6	40.16	47.74	17.19	8.84	1.21	5.81	113.13
7	E7	40.66	45.07	15.78	8.20	1.27	5.74	109.17
8	E8	42.0	53.40	17.75	8.86	1.43	5.98	86.15
9	E9	35.90	51.13	18.49	7.57	1.86	5.96	84.49

Forty samples of Brassica napus lines were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 41.84% were observed in MYT E5 followed by RBN PYT-1 E7 having oil content 41.75%. Minimum oil contents were seen in RBN PYT-11 E10 (35.19%).

**Brassica juncea**

**Rabi Brassica juncea MYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	28.97	34.33	21.37	7.47	18.05	5.73	113.77

2	E2	32.34	34.92	20.81	8.16	17.26	5.74	128.11
3	E3	32.03	32.90	20.63	7.99	19.62	5.73	119.20
4	E4	30.31	36.25	21.87	7.25	16.1	5.94	117.81
5	E5	32.28	28.89	18.92	7.70	24.94	5.61	122.10
6	E6	29.52	33.40	20.51	6.75	19.89	5.82	122.25
7	E7	33.39	26.37	19.02	8.36	27.18	5.57	129.45
8	E8	32.38	29.13	19.26	7.64	25.19	5.67	127.91
9	E9	32.93	31.59	20.00	8.54	21.51	5.76	118.47
10	E10	34.37	26.75	17.45	7.92	28.13	5.55	127.60
11	E11	33.16	26.82	18.67	8.07	26.39	5.60	121.54
12	E12	32.87	26.17	18.25	7.81	28.74	5.54	129.25

**Rabi Brassica *juncea* AYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	30.47	33.18	20.29	7.32	19.94	5.85	134.30
2	E2	33.17	27.38	19.20	8.79	24.96	5.71	135.15
3	E3	31.19	26.64	19.48	7.36	26.19	5.74	131.40
4	E4	30.64	28.31	19.48	6.99	25.27	5.79	136.27
5	E5	33.38	30.80	19.38	8.29	21.16	5.79	133.03
6	E6	32.07	35.23	20.70	8.31	16.53	5.85	143.44
7	E7	31.58	31.25	19.87	7.84	21.21	5.79	138.78
8	E8	32.08	32.79	20.46	8.27	19.48	5.85	121.57
9	E9	31.97	29.41	19.25	7.84	24.31	5.66	134.62

**Rabi Brassica *juncea* PYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	31.61	31.33	21.06	8.3	17.48	5.85	125.20
2	E2	31.88	30.18	19.74	8.06	23.28	5.56	136.64

3	E3	39.03	30.29	19.76	7.44	22.91	5.79	137.90
4	E4	30.99	28.77	19.14	7.36	24.71	5.73	139.40
5	E5	30.92	32.49	20.36	7.65	20.62	5.81	130.38
6	E6	34.67	22.18	17.37	8.98	31.43	5.50	126.87
7	E7	33.53	23.72	16.79	7.78	31.48	5.48	128.58
8	E8	35.53	20.30	16.70	8.48	33.44	5.56	134.07
9	E9	33.31	27.81	19.13	8.03	25.03	5.73	137.81
10	E10	32.58	25.89	18.61	7.77	28.11	5.60	132.79
11	E11	34.15	23.76	17.61	8.61	29.58	5.47	134.90
12	E12	32.44	32.46	20.14	8.80	20.08	5.70	137.90
13	E13	31.15	34.71	21.72	8.54	16.76	5.88	137.94
14	E14	32.89	31.17	20.46	8.76	20.8	5.84	129.28
15	E15	30.62	29.27	18.78	7.21	26.07	5.66	138.57

Thirty six samples of *Brassica juncea* were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 39.03% were observed in PYT E3 followed by PYT E8 having oil content 35.53%. Minimum oil contents were determined in MYT E1 (28.97%).

**Experiment 5:-Determination of Oil Content of Promising Lines/Varieties of Zaid Kharif Brassica**

**Zaid Kharif Brassica MYT (2019-20)**

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Saturated Fatty Acids %	Glucosinolates
1	E1	38.82	23.25	16.47	10.31	29.64	5.24	139.35
2	E2	39.87	23.37	15.83	10.55	30.38	5.23	143.19
3	E3	38.55	29.87	17.95	8.95	24.01	5.44	136.14
4	E4	37.57	28.49	18.47	10.46	23.31	5.49	138.65
5	E5	34.38	31.90	21.07	10.50	17.44	5.73	137.23
6	E6	40.29	28.89	16.94	10.67	24.22	5.39	134.43
7	E7	38.68	23.65	16.54	10.49	29.59	5.22	142.56

8	E8	38.03	24.08	16.98	10.73	28.28	5.32	142.25
9	E9	38.19	23.52	18.63	11.29	26.76	5.43	146.49
10	E10	41.17	29.18	17.44	10.91	23.85	5.50	128.18

**Zaid Kharif Brassica PYT (2019-20)**

1	E1	37.89	31.66	18.52	10.92	21.15	5.44	136.45
2	E2	37.52	25.67	17.38	10.54	26.81	5.30	144.47
3	E3	38.04	24.91	17.28	10.64	27.81	5.31	146.10
4	E4	39.02	28.61	17.81	10.75	23.37	5.45	141.38
5	E5	35.49	32.0	19.73	10.33	19.79	5.68	128.35
6	E6	36.77	32.19	18.73	9.99	21.57	5.52	128.35
7	E7	36.15	30.47	18.91	10.57	21.53	5.43	134.76
8	E8	35.22	32.13	20.03	10.62	18.64	5.53	139.06
9	E9	34.20	30.96	18.82	9.98	21.99	5.36	136.56
10	E10	38.09	24.55	17.19	10.46	28.39	5.26	130.82
11	E11	40.01	26.21	16.85	10.73	28.11	5.38	127.21
12	E12	41.09	24.32	15.57	10.37	30.23	5.40	125.24
13	E13	37.91	28.46	18.30	10.95	23.48	5.44	143.90
14	E14	37.79	27.20	17.82	10.36	25.15	5.40	152.70
15	E15	37.14	29.27	18.39	10.67	22.95	5.47	147.45
16	E16	39.02	25.30	16.77	10.08	29.41	5.47	135.63
17	E17	39.65	28.40	17.63	10.78	25.32	5.47	140.26
18	E18	38.46	31.51	18.29	11.57	20.75	5.41	141.78

Twenty eight samples of Zaid Kharif Brassica were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 41.17% were observed in ZKB MYT E10 followed by ZKB PYT E12 having oil content 41.09%. Minimum oil contents were determined in ZKB MYT E9 (34.20%).

**Experiment 6:-Determination of Oil Content of Promising Lines of Linseed**

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	LS 14074	39.86	10	LS 18002	35.78
2	LS 15014	39.38	11	LS 18021	36.79
3	LS 15022	38.50	12	LS 18033	35.00
4	LS 16006	38.09	13	LS 18040	35.52
5	LS 16020	37.23	14	LS 18043	37.30
6	LS 17007	38.95	15	LS 18059	35.87
7	LS 17011	36.18	16	LS 18078	36.09
8	LS 17029	39.85	17	LS 18084	37.57
9	LS 17075	38.88	18	LS 18091	40.31

Eighteen samples of promising lines of linseed were tested for their oil contents. Maximum oil contents 40.31% were observed in LS 18091 followed by LS 14074 having oil content 39.86%. Minimum oil contents were estimated in LS 18033 (35.00%).

**Experiment 6:-Determination of Oil Content of Promising Lines of Sesame**

AYT					
Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	AYT-R-1 870006	52.14	6	AYT-R-1 17003	52.69
2	AYT-R-1 17001	52.00	7	AYT-R-1 Til-18	50.72
3	AYT-R-1 87005	50.53	8	AYT-R-1 TH-6	50.69
4	AYT-R-1 86003	50.69	9	AYT-R-1- 50007	50.32
5	AYT-R-1 17006	53.21			
MYT					
Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %

1	R-1 MYT N.PEARL (C)	49.66	6	R-1 MYT 70005	50.42
2	R-1 MYT N.SESAME (C)	49.56	7	R-1 MYT 8700	50.38
3	R-1 MYT TS-5 (C)	49.99	8	R-1 MYT 86001	45.76
4	R-1 MYT 77011	50.30	9	R-11 MYT 15001	48.13
5	R-1 MYT 70002	50.66	10	R-1 MYT 15002	49.87
<b>PYT</b>					
<b>Sr. No.</b>	<b>Sample ID</b>	<b>Oil %</b>	<b>Sr. No.</b>	<b>Sample ID</b>	<b>Oil %</b>
1	R-1 PYT Til-18	48.33	8	R-1 PYT 16003	58.79
2	R-1 PYT Snail Pod	47.61	9	R-1 PYT 18002	47.88
3	R-1 PYT 17005	50.20	10	R-1 PYT 18001	46.49
4	R-1 PYT 18006	50.82	11	R-1 PYT 18003	48.90
5	R-1 PYT 18005	55.53	12	R-1 PYT 16002	51.72
6	R-1 PYT 16005	49.50	13	R-1 PYT 17002	52.44
7	R-1 PYT 17004	51.77			

Thirty Two samples of promising lines of Sesame were tested for their oil contents. Maximum oil contents 58.79% were observed in R-1 PYT 16003 followed by R-1 PYT 18005 having oil content 55.53%. Minimum oil contents were estimated in R-1 MYT 86001 (45.76%).

**Experiment 7:-Determination of Oil Contents and Fatty acid profile of Promising Lines of Soybean**

<b>Sr No.</b>	<b>Sample ID</b>	<b>Oil %</b>	<b>Protein %</b>	<b>Omega 9 %</b>	<b>Omega 6 %</b>	<b>Omega 3 %</b>
1	SS-183	18.73	41.36	21.57	58.19	5.25
2	E-1092	21.94	39.24	20.82	58.23	4.92



3	MS-4	19.80	42.34	20.60	57.50	5.45
4	TN-81-27-32	20.53	41.38	19.90	59.17	5.62
5	CN-5	18.61	41.58	18.74	58.12	6.30
6	F.S-60	21.36	41.78	23.51	55.18	4.59
7	MCH-5	19.78	41.60	20.06	56.13	5.50
8	E-1092(2)	21.86	38.52	21.24	58.15	4.53
9	95-1	21.87	37.83	18.15	58.42	6.76
10	249-313-D	21.24	38.97	19.33	58.87	5.70
11	SPIC-16	20.06	38.38	22.26	56.27	5.73
12	F.Soybean	21.36	40.48	21.30	57.37	5.91
13	DGS-16	18.46	43.12	24.46	57.01	4.95
14	HM-8468	21.27	39.06	21.29	56.76	5.36
15	95-2	18.91	42.01	23.43	56.08	5.85
16	FS-10	21.53	39.88	18.22	58.83	6.88
17	HM-8437	22.11	40.40	21.91	57.34	5.12
18	HS-17	19.53	43.04	19.34	58.55	6.76
19	R-315	19.47	40.75	19.25	57.87	5.73
20	BSR-301	19.69	40.04	19.77	57.53	6.84

Twenty samples of advance lines of Soybean were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 22.11% were observed in HM-8437 followed by E-1092 having oil content 21.94%. Minimum oil contents were estimated in DGS-16 (18.46%).