

# ***ANNUAL TECHNICAL REPORT (2020-21)***



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## INTRODUCTION

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The ominous threat of damaging diseases/insects and changing environmental patterns coupled with continuous demand of farmers for high yielding and high oil content oilseed varieties, always keep oilseed breeders engaged in their research pursuits. The job is tedious and cumbersome because of the complex nature of divergent mode of pollination of oilseed crops. However, oilseed breeders, within limited resources, are trying hard to meet the challenges posed by various stresses, marketing trends and farmers' demands.

Annual Progress Report (Year, 2020-21) encompasses study of germplasm, filial generations, yield trials and study of emerging diseases & insects for better control in Rapeseed Mustard, Safflower, Sunflower, Linseed, Soybean and Sesame crops. The experiments included in the Report were designed aiming at genetic improvement of the said crops as per objectives of the Oilseeds Research Institute. The results of experiments included in this Annual Report have added new impetus to oilseed crop improvement endeavor. A number of promising lines/hybrids of aforementioned crops are in advance stages of testing.

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## 1. RAPESEED AND MUSTARD

### A. ZAID KHARIF BRASSICA

#### Project 1. DEVELOPMENT OF FRESH CROSSES

Sixteen 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 yield related traits.

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

#### S. No.Crosses

1. ZBJ-207001 x ZBJ-08051
2. ZBJ-207002 x ZBJ-08051
3. ZBJ-08047(1) x ZBJ-08051
4. ZBJ-08018(2) x ZBJ-08051
5. ZBJ-08025(2) x ZBJ-08051
6. ZBJ-08033(2) x ZBJ-08051
7. ZBJ-08031(1) x ZBJ-08051
8. ZBJ-08048(1) x ZBJ-08051
9. ZBJ-207001 x AARI Canola
10. ZBJ-207002 x AARI Canola
11. ZBJ-08047(1) x AARI Canola
12. ZBJ-08018(2) x AARI Canola
13. ZBJ-08025(2) x AARI Canola
14. ZBJ-08033(2) x AARI Canola
15. ZBJ-08031(1) x AARI Canola
16. ZBJ-08048(1) x AARI Canola

#### 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>6</sub> Summer Mustard generations during 2020-21 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>	14	-	-	-
F <sub>2</sub>	20	Whole material	131	-
F <sub>3</sub>	09	101	116	-
F <sub>4</sub>	18	126	72	-
F <sub>5</sub>	13	78	17	-
F <sub>6</sub>	06	16	-	07

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 20 F<sub>2</sub> crosses, 131 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>, 15 lines were selected for seed yield evaluation in preliminary yield trial.

**Project 3. PRELIMINARY YIELD TRIAL (*B. juncea*)**

Seventeen *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 17 entries of *B. juncea* in Preliminary Yield Trial at Oilseeds Research**

**Institute, Faisalabad during Zaid Kharif 2020-21.**

Rank	Entry Name	DF	DM	Plant height (cm)	Branches/ plant	Silique length (cm)	Seeds/ silique	1000 seed weight (g)	Oil content (%)	Seed yield (kg/ha)
1	ZBJ-20014-K	50	138	214	6	3.9	14	3.57	40	3096
2	ZBJ-20007	43	139	216	7	4.3	14	3.80	39	3000
3	ZBJ-20016	57	146	214	7	3.9	14	4.02	37	3000
4	ZBJ-20002-K	52	143	231	6	3.9	14	3.41	38	2959
5	ZBJ-20018-K	49	138	215	7	4.2	14	3.43	39	2941
6	ZBJ-20011-K	52	142	227	9	4.4	17	3.24	40	2904
7	ZBJ-20020	49	137	221	6	4.4	17	3.34	38	2867
8	ZBJ-20008	50	138	224	6	4.1	16	4.06	38	2830
9	AARI-Canola	50	143	218	8	3.9	15	2.99	37	2815
10	ZBJ-20006-K	50	144	193	7	3.8	16	3.17	40	2778
11	ZBJ-20022	44	138	220	7	4.1	14	4.03	39	2719
12	ZBJ-20003	52	143	221	8	4.4	14	3.99	39	2667
13	ZBJ-20013	49	137	203	6	4.1	16	4.05	39	2667
14	ZBJ-20005	49	141	201	6	4.4	15	3.82	38	2630
15	ZBJ-20009	44	138	232	6	4.2	15	3.83	38	2570
16	ZBJ-20015	52	142	211	7	3.9	13	3.75	37	2407
17	ZBJ-20014	43	140	208	7	4.0	14	3.72	38	2222
<b>LSD 5%</b>										235

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	22.09.2020

The perusal of table 1.2 indicates that ZBJ-20014-K gave highest yield i.e, 3096 kg/ha followed by ZBJ-20007 i.e, 3000 kg/ha. Days to flowering ranged from 43-57 and days to maturity 137 - 146. Plant height ranges from 193-232cm. Number of branches ranged from 6-8. Maximum silique length and seeds per silique were observed by ZBJ-20020 and ZBJ-20011K. 1000 grain

weight ranged from 2.99-4.06. Oil content% ranged from 40.21 to 36.90. Max oil content % were found in ZBJ-2006-K.

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

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

**Table 1.3**

**Performance of 07 entries of advanced seed yield trial, 2020-21 at Oilseeds Research**

**Institute, Faisalabad.**

<b>Rank</b>	<b>Entry Name</b>	<b>DF</b>	<b>DM</b>	<b>Plant height (cm)</b>	<b>Branches/ plant</b>	<b>1000 seed weight (g)</b>	<b>Oil content (%)</b>	<b>Seed yield (kg/ha)</b>
<b>1</b>	<b>ZBJ-19008</b>	50	141	216	7	2.95	39	3104
<b>2</b>	<b>AARI Canola (C )</b>	49	141	235	7	2.89	38	3043
<b>3</b>	<b>ZBJ-19003</b>	55	140	231	7	2.58	36	2761
<b>4</b>	<b>ZBJ-17003</b>	52	143	221	6	2.65	35	2680
<b>5</b>	<b>ZBJ-17017</b>	50	138	211	7	2.94	38	2587
<b>6</b>	<b>ZBJ-19015</b>	50	140	220	8	2.67	41	2580
<b>7</b>	<b>ZBJ-19038</b>	55	143	232	6	2.19	38	2093
<b>LSD 5%</b>								<b>257</b>

Design R.C.B  
 Plot size 5 x 1.35 m  
 Row spacing 45 cm  
 Fertilizer 80: 60:60 NPK kg/ha  
 Sowing date 22.09.2020

The perusal of Table 1.3 indicates that ZBJ-19008 gave highest yield i.e. 3104 kg/ha. Days to flowering ranged from 49 to 55. Days to maturity ranged from 138 to 143. ZBJ-19038 was last in maturity (143 days). Number of branches ranged from 6-8 and plant height 211-235cm. 1000 grain weight ranged from 2.19-2.95. Maximum oil contents (41%) were observed by ZBJ-19015.

#### **Project 5. MICRO SEED YIELD TRIALS (*B. juncea*)**

Yield performance of five 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 five *B. juncea* strains at different locations in the Punjab during  
Zaid Kharif 2020-21**

<b>Rank</b>	<b>Entry Name</b>	<b>Faisalabad</b>	<b>Karor</b>	<b>Khanpur</b>	<b>Bahawalpur</b>	<b>Piplan</b>	<b>Average</b>
<b>1</b>	<b>ZBJ-18008</b>	3122	3540	1597	2556	2147	2592
<b>2</b>	<b>ZBJ-17019</b>	2800	3256	1908	2306	1944	2443
<b>3</b>	<b>AARI Canola (C)</b>	2215	3386	1972	2356	2167	2419
<b>4</b>	<b>ZBJ-17008</b>	2733	3600	1431	1972	1806	2308
<b>5</b>	<b>ZBJ-17014</b>	2548	3339	1375	2167	2014	2288
	<b>LSD 5%</b>	373	362	281	189	101	

Perusal of the table 1.4 (a) indicated that ZBJ-18008 surpassed all the entries included in the trial by giving average seed yield of 2592 kg/ha followed by AARI Canola (2559 kg/ha) While lowest yield was obtained by ZBJ-17014 with yield performance of 2288 kg/ha.

**Table 1.4 (b)**

**Other parameters of advanced lines of Micro seed yield trial, 2020-21 recorded at  
Oilseed Research Institute, Faisalabad.**

<b>Ra nk</b>	<b>Entry Name</b>	<b>DOF</b>	<b>DOM</b>	<b>Plant height (cm)</b>	<b>Branches/ plant</b>	<b>1000 seed weight (g)</b>	<b>Oil content (%)</b>	<b>Seed yield (kg/ha)</b>
<b>1</b>	<b>ZBJ-18008</b>	55	141	217	9	3.01	41	3122
<b>2</b>	<b>ZBJ-17019</b>	50	140	208	7	2.95	41	2800
<b>3</b>	<b>ZBJ-17008</b>	52	142	210	7	2.98	41	2733
<b>4</b>	<b>ZBJ-17014</b>	52	142	214	7	2.96	40	2548
<b>5</b>	<b>AARI Canola</b>	52	139	212	7	2.50	38	2215
<b>LSD 5%</b>								<b>373</b>

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	22.09.2020

Perusal of the table 1.4 (b) indicated that all four lines surpassed the standard variety AARI Canola in seed yield. Days to flowering ranged from 50-55 days and days to maturity

139–142. Minimum days to maturity were taken by AARI Canola. Number of branches per plant ranged from 7-9. 1000 grain weight ranged from 2.50-2.98. Oil content ranged from 38-41%.

## **B. WINTER RAPESEED– FAISALABAD**

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

135 entries of *B. napus* were studied.

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

Following crosses were made keeping Sandal Canola 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.

#### **Sr. No. Crosses**

1. RBN-14017 x Sandal Canola
2. RBN-17014 x Sandal Canola
3. RBN-18001 x Sandal Canola
4. RBN-18006 x Sandal Canola
5. RBN-18007 x Sandal Canola
6. RBN-18008 x Sandal Canola
7. RBN-18009 x Sandal Canola
8. RBN-18010 x Sandal Canola
9. RBN- 18011 x Sandal Canola
10. RBN- 18013 x Sandal Canola
11. RBN- 18021 x Sandal Canola
12. RBN-19038 x Sandal Canola

### **Project 3. 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>	11	-	<b>Whole material</b>	-
<b>F<sub>2</sub></b>	12	Whole material	93	-
<b>F<sub>3</sub></b>	13	45	106	-
<b>F<sub>4</sub></b>	13	59	71	-
<b>F<sub>5</sub></b>	09	35	48	-
<b>F<sub>6</sub></b>	09	30	73	-
<b>F<sub>7</sub></b>	21	42	-	12 Lines



Each  $F_1$  cross was harvested separately to advance the generation. Selection in  $F_2$  to  $F_7$  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.

93 plants were selected from 12 crosses of  $F_2$  generation to raise  $F_3$  generation. In  $F_3$  generation, 106 plants were selected to raise  $F_4$  in the next year. In  $F_4$  generation, 71 plants were selected to raise  $F_5$  generation. In  $F_5$  generation 48 plants from 35 progenies derived from 09 crosses were selected. In  $F_6$  generation 73 plants from 30 progenies derived from 09 crosses were selected. In  $F_7$  generation, 12 lines were selected for PYT out of 42 progenies of 21 crosses.

#### **Project 4. PRELIMINARY SEED YIELD TRIAL (*B. napus*)**

Ten *B. napus* lines were tested along with the standard variety “Sandal Canola”. The data collected on seed yield and other agronomic traits are given in table 1.6.

**Table 1.6**

**Performance of 10 entries of *Brassica napus* in Preliminary Yield Trial at Oilseeds  
Research Institute, Faisalabad during Rabi 2020-21.**

Rank	Entry Name	DF	DM	Oil Content (%)	Plant height (cm)	No. of Branches	Salique Length (cm)	Seed/Salique	1000 grain weight (g)	Seed Yield (kg/ha)
1	RBN-20046	107	157	40	185	8	6.5	22	2.6	1815
2	Sandal Canola ©	71	156	41	176	7	8.0	24	3.7	1719
3	RBN-20072	108	155	44	188	7	8.1	23	3.6	1511
4	RBN-20033	70	155	37	165	9	7.2	22	3.2	1422
5	RBN-20034	67	155	38	173	10	7.6	24	3.7	1415
6	RBN-20056	69	157	42	169	7	6.6	19	3.8	1319
7	RBN-20060	74	158	41	161	7	7.2	19	3.7	1222
8	RBN-20057	70	157	43	184	8	6.3	18	3.9	1181
9	RBN-20051	71	158	40	179	8	7.5	22	2.9	1037
10	RBN-20058	73	156	41	176	8	7.1	23	3.8	993
LSD 5%									162.9	

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	07.10.2020

The perusal of table 1.6 indicates that RBN-20046 gave highest yield i.e, 1815 kg/ha followed by Sandal Canola i.e, 1719 kg/ha. Days to flowering ranged from 67-108 and days to maturity 155 - 158. Plant height ranges from 161-188cm. Number of branches ranged from 07-10. Maximum seeds per silique were observed by Sandal Canola and RBN-20034. 1000 grain weight ranged from 2.6-3.9. Oil content% ranged from 37.07 to 42.56. Max oil content % are found in RBN-20057.

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

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

**Table 1.7 Performance of 10 entries of *Brassica napus* for advanced seed yield trial, 2020-21 at Oilseeds Research Institute, Faisalabad.**

Rank	Entry Name	DF	DM	Oil Content (%)	Plant height (cm)	No. of branches	Silique length (cm)	Seeds/silique	1000 seed weight (g)	Seed yield (kg/ha)
1	RBN-18009	72	157	42	160	6	7.21	20.40	3.48	2074
2	Sandal Canola	67	157	40	160	5	7.24	16.07	4.58	2054
3	RBN-18008	64	155	37	152	6	7.88	20.67	3.50	2015
4	RBN-13012	78	159	40	170	6	7.55	21.93	3.54	2005
5	RBN-18013	67	158	41	158	5	7.53	23.53	4.03	1951
6	RBN-18001	70	158	39	165	6	7.85	22.73	3.92	1941
7	RBN-18010	64	157	43	163	6	7.49	23.93	4.08	1941
8	RBN-17003	71	159	39	169	8	8.41	23.13	3.39	1891
9	RBN-19038	71	159	40	179	7	7.09	18.20	3.42	1812
10	RBN-18011	66	158	40	171	6	7.73	22.27	4.37	1642
<b>LSD 5%</b>										285

The perusal of table 1.7 indicates that RBN-18009 gave highest yield i.e. 2074 kg/ha followed by Sandal Canola (2054 kg/ha). Days to flowering ranged from 64-78. RBN-18010 and RBN-18008 took minimum days to flower. Days to maturity ranged from 157-159. 1000 grain weight ranged from 3.39-4.58.

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	07.10.2020

[illegible]

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	07.10.2020

The perusal of table 1.8(b) indicates that 18CBN008 gave highest yield at ORI , Faisalabad i.e. 2160 kg/ha. Days to flowering ranged from 64-81, days to maturity from 155-160, Highest 1000 grain weight (4.41) 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 Punjab locations during Rabi 2020-21

**Rapeseed National 2020-21 (Punjab Locations)**

Sr. No.	Entry Name	BARI Chakwal	ORS, Khanpur	PARC ISL	AARI. Fsd	RARI Bwp	AZRI Bhakr	PPSL Sahiwal	Mean
1	Super Canola	1790	2056	1062	2141	1466	590	2287	1627
2	KN-279	1769	1370	1747	1648	1283	1097	2011	1561
3	KN-309	2021	1378	1204	1463	1333	1161	1731	1470
4	KN-338	1836	1352	1121	1267	1427	1441	1828	1467
5	Hop-9	2020	1519	1603	1722	1194	550	1658	1467
6	RBN-18021	1667	1252	1713	1600	1350	535	2110	1461
7	Hoyola-401	1832	1037	886	2348	1419	1072	1029	1375
8	HS-22	1529	1363	1267	1674	1491	517	1710	1364
9	HC025D	1998	1148	1267	1867	966	1021	1210	1354
10	KN-339	1704	970	1553	1889	1450	563	1339	1353
11	CHS-30	1591	1278	1528	1852	1275	663	1162	1336
12	KN-331	1704	1204	1914	1581	1205	476	1215	1328
13	16CBN002	1532	1522	1291	1319	1400	1060	988	1302
14	Sandil	1563	1221	981	1689	1161	435	1908	1280
15	17CBN007	1909	1352	905	1492	1277	729	1075	1248
16	RBN-16001	1564	889	1336	1159	1333	810	1611	1243

17	24884	1646	1259	1487	1341	1264	851	839	1241
18	Sitara-602	1589	1244	799	1359	1099	882	1680	1236
19	RM-1-2	509	1613	1394	1091	1466	900	1664	1234
20	Hoyola-VX-444	1300	1337	1151	1545	1300	612	1392	1234
21	I6CBN007	1342	1222	969	1500	1325	1289	966	1230
22	MUN-2	679	1800	1730	1119	1333	872	1042	1225
23	Kingola	1366	1370	682	1396	1419	833	1420	1212
24	CHS-33	1333	1393	1129	1530	1138	812	1148	1212
25	24182	1747	1389	1093	1455	1044	550	1027	1186
26	FLC-111	1868	1203	1264	1530	741	476	1222	1186
27	FBS-101	2012	1259	750	1278	938	576	1233	1149
28	RM-106-1	424	1382	1717	1350	1014	932	1129	1135
29	BNS-1	1621	1137	548	1611	1058	861	1086	1132
30	CHS-61	1660	1300	722	1259	1127	549	1195	1116
31	MUN-1	243	1818	1121	1500	1352	410	1259	1100
32	RM 1-9	206	1426	1404	1298	1153	556	1504	1078
33	MUN-3	309	1543	727	1456	1314	943	1240	1076
34	Sitara-601	1852	1445	498	1063	777	779	890	1043
35	RR-8-2	658	1445	566	1300	1240	773	762	963
36	FLC110	1556	1066	786	1026	786	563	948	962
37	MUN-4	358	1404	767	1063	1063	766	1266	955

A perusal of table 1.9 shows that the differences of means due to varieties are highly significant. Super Canola (check) gave the highest seed yield of 1627 kg/ha. RBN-18021 was at 6<sup>th</sup> number in Punjab province with seed yield of 1461 kg/ha which is above than other two checks Hoyola-401 and Sandal Canola.

### C. WINTER MUSTARD, FAISALABAD (2020-21)

#### Project 1. MAINTENANCE OF GENE POOL

128 entries of *B. juncea* were studied.

#### Project 2. DEVELOPMENT OF FRESH CROSSES

Sixteen 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 yield related traits.

Enough seed of each cross was saved for growing F<sub>1</sub> generation.

1.	RBJ-20003	x	ZBJ-08051
2.	RBJ-20006	x	ZBJ-08051
3.	RBJ-20009	x	ZBJ-08051
4.	RBJ-20010	x	ZBJ-08051
5.	RBJ-20011	x	ZBJ-08051
6.	RBJ-20012	x	ZBJ-08051
7.	RBJ-20013	x	ZBJ-08051
8.	RBJ-20014	x	ZBJ-08051
9.	RBJ-20018	x	ZBJ-08051
10.	RBJ-20019	x	ZBJ-08051
11.	RBJ-20003	x	AARI Canola
12.	RBJ-20006	x	AARI Canola
13.	RBJ-20009	x	AARI Canola
14.	RBJ-20010	x	AARI Canola
15.	RBJ-20011	x	AARI Canola
16.	RBJ-20012	x	AARI Canola
17.	RBJ-20013	x	AARI Canola
18.	RBJ-20014	x	AARI Canola
19.	RBJ-20018	x	AARI Canola
20.	RBJ-20019	x	AARI Canola

### Project 3. 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**

<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>	20	Whole material	103	-
<b>F<sub>3</sub></b>	12	95	74	-
<b>F<sub>4</sub></b>	12	80	41	-
<b>F<sub>5</sub></b>	09	63	38	-
<b>F<sub>6</sub></b>	07	42	31	-
<b>F<sub>7</sub></b>	07	17	-	06

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.

103 plants were selected from 20 crosses of F<sub>2</sub> generation to raise F<sub>3</sub> generation. In F<sub>3</sub> generation, 74 plants were selected to raise F<sub>4</sub> in the next year. In F<sub>4</sub> generation, 41 plants were selected to raise F<sub>5</sub> generation. In F<sub>5</sub> generation 38 plants from 63 progenies derived from 09 crosses were selected. In F<sub>6</sub> generation 31 plants from 42 progenies derived from 07 crosses were selected. In F<sub>7</sub> generation, 6 lines were selected for PYT out of 17 progenies of 07 crosses.

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

Seventeen *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 17 entries of *Brassica juncea* in Preliminary Yield Trial at Oilseeds Research Institute, Faisalabad during Rabi 2020-21.**

Rank	Entry Name	DOF	DOM	Plant height (cm)	Branches/plant	Silique length	No. of seeds per silique	1000 seed weight (g)	Oil content (%)	Seed yield (kg/ha)
1	RBJ-20009	61	156	230	7	3.4	12	2.8	37	2207
2	RBJ-20022	71	156	229	8	3.8	12	3.9	35	2133
3	RBJ-202052	59	152	189	5	4.3	16	5.0	38	2081
4	RBJ-202051	61	153	196	7	3.6	13	4.3	38	1963
5	RBJ-20202	58	155	199	6	3.8	14	4.1	37	1919
6	RBJ-18002	60	152	206	7	3.6	14	3.2	35	1889
7	RBJ-20023	75	154	234	8	3.7	12	3.0	34	1830
8	RBJ-20203	60	155	199	7	4.2	15	3.8	37	1793
9	RBJ-20005	74	156	238	8	3.6	12	2.8	34	1785
10	RBJ-20007	60	157	211	6	3.6	13	3.4	36	1756
11	Super raya ©	60	155	199	6	3.3	11	3.4	35	1741
12	RBJ-20001	64	154	216	6	3.6	14	3.5	37	1741
13	RBJ-20004	68	155	231	7	3.3	11	2.7	33	1704
14	RBJ-20020	70	157	214	7	3.3	11	3.0	34	1696
15	RBJ-20002	67	155	218	7	3.5	12	2.9	24	1630
16	RBJ-19002	73	153	244	9	3.7	11	2.7	36	1459
17	RBJ-20008	71	157	228	7	3.4	10	2.7	34	1259
<b>LSD5%</b>										<b>180</b>

Design	R.C.B.
Plot size	5 x 0.90 m
Row spacing	45 cm
Fertilizer	90: 85:60 kg NPK/ha
Sowing date	07.10.2020

The perusal of table 1.11 indicates that RBJ-20009 gave highest yield i.e., 2207 kg/ha followed by RBJ-20022 i.e., 2133 kg/ha. Days to flowering ranged from 58-75 and days to maturity 152-157.

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

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

**Table 1.12**

**Performance of 06 entries of *Brassica juncea* for advanced seed yield trial, 2020-21 at Oilseeds Research Institute, Faisalabad**

Rank	Entry Name	DF	DM	Plant height (cm)	Branches /plant	Silique length	No. of seeds per silique	1000 seed weight (g)	Oil content (%)	Seed yield (kg/ha)
1	RBJ-16012	58	153	202	5	3.6	10	4.1	37	2026
2	Super raya (C)	60	159	211	7	3.6	11	3.1	37	1741
3	RBJ-19003	62	160	223	8	3.4	11	2.8	35	1693
4	RBJ-18008	61	159	216	6	3.5	12	3.7	36	1556
5	RBJ-19022	61	154	211	7	3.6	12	3.3	35	1537
6	RBJ-18003	59	159	239	7	3.6	11	3.4	36	1474
<b>LSD 5%</b>										148

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	90: 85:60 NPK kg/ha
Sowing date	08.10.2020

The perusal of table 1.12 indicates that RBJ-16012 gave highest yield i.e. 2026 kg/ha. Days to flowering ranged from 58-62 and days to maturity from 153-160.

**Project 6. 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 8 locations in Punjab, 2020-21**

Rank	Entry name	Fsd	Karor	K/pur	Piplan	Chkwl	F/jang	RARI B/pur	ORS, B/pur	Average
1	<b>RBJ-15013</b>	1407	2778	1713	2000	2367	1233	1756	1963	1902
2	<b>RBJ-15017</b>	1519	2037	2148	1937	2314	944	1985	1926	1851
3	<b>RBJ-16007</b>	1752	2519	1778	2167	2133	924	1637	1593	1813
4	<b>KJ-284</b>	1481	2778	1944	2307	2144	451	1624	1704	1804
5	<b>BRJ-1775</b>	1663	2259	2074	1915	2278	733	1694	1778	1799
6	<b>BRJ-1778</b>	1548	2444	2111	1863	2033	712	1661	1481	1732
7	<b>RBJ-17003</b>	1304	2074	1926	2204	2011	906	1743	1593	1720
8	<b>Super raya ©</b>	1185	1963	1898	2444	2200	299	1822	1667	1685
9	<b>RBJ-17005</b>	1267	2593	1815	1804	1789	733	1567	1815	1673
10	<b>KJ-294</b>	1507	2296	1833	2074	2044	361	1320	1815	1656
11	<b>18CBJ001</b>	1537	2407	1704	1259	2344	608	1596	1667	1640
12	<b>18CBJ005</b>	1622	1667	2204	1826	2111	569	1333	1407	1593
	<b>LSD 5%</b>	215	380	342	108	359	100	124	243	234

Perusal of the table 1.13(a) indicated RBJ-15013 surpassed all the entries included in the trial by giving seed yield of 1902 kg/ha.

**Table 1.13 (b)**  
**Other parameters of advance lines of micro seed yield trial recorded at the Oilseeds Research Institute, Faisalabad during 2020-2021**

Rank	Entry Name	DF	DM	Plant height (cm)	Branches/ plant	Silique length (cm)	No. of seeds /silique	1000 seed weight (g)	Oil content (%)	Seed yield (kg/ha)
1	<b>RBJ-16007</b>	60	159	221	7	5	12	3.6	36	1752
2	<b>BRJ-1775</b>	59	158	197	7	4	12	4.4	37	1663
3	<b>18CBJ005</b>	59	157	221	8	3	10	3.5	39	1622
4	<b>BRJ-1778</b>	59	158	199	7	4	11	3.9	35	1548
5	<b>18CBJ001</b>	58	153	215	7	3	11	3.6	40	1537
6	<b>RBJ-15017</b>	62	161	228	6	3	14	3.7	36	1519
7	<b>KJ-294</b>	57	156	202	7	4	13	4.7	41	1507
8	<b>KJ-284</b>	57	156	216	8	4	12	4.6	39	1481
9	<b>RBJ-15013</b>	62	160	219	7	4	11	3.6	35	1407
10	<b>RBJ-17003</b>	63	155	224	7	4	11	2.5	34	1304
11	<b>RBJ-17005</b>	65	156	235	8	3	13	2.4	33	1267
12	<b>Super Raya (C)</b>	62	157	215	9	3	12	3.7	39	1185
								<b>LSD5%</b>		215

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	90: 85:60 NPK kg/ha
Sowing date	08.10.2020

The perusal of table 1.13(b) indicates that RBJ-16007 gave highest yield i.e. 1752 kg/ha followed by BRJ-1775i.e. 1663 kg/ha. Days to flowering ranged from 57-65and days to maturity 153-160. Minimum days to flowering were taken by RBJ-17003. Maximum 1000 grain weight (4.7) was observed inKJ-294.

### **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 Punjab locations during Rabi 2020-

21

<i>Sr. No.</i>	<b>Entry Name</b>	<b>BARI Chkwal</b>	<b>ORS K/pur</b>	<b>PARC Isl.</b>	<b>ORI Fsd.</b>	<b>RARI B/pur</b>	<b>AZRI Bhakr</b>	<b>Pioneer Sahiwal</b>	<b>Mean</b>
<i>1</i>	<b>M-11</b>	1864	1784	5514	2428	2141	948	2518	2457
<i>2</i>	<b>AS-207</b>	1815	1784	2682	2067	2358	1079	2769	2079
<i>3</i>	<b>VX-111</b>	1932	2389	2443	2161	2108	865	2374	2039
<i>4</i>	<b>NX-888</b>	1445	1933	1199	2278	2137	1823	2176	1856
<i>5</i>	<b>SD-40S50</b>	1802	2195	1239	1678	2583	859	2519	1839
<i>6</i>	<b>KJ-288</b>	1383	1295	1263	1762	2225	1834	2626	1770
<i>7</i>	<b>Coral 432</b>	2161	1483	649	1900	2346	896	2862	1757
<i>8</i>	<b>IS-381</b>	1210	1956	1454	1917	2525	1224	1990	1754
<i>9</i>	<b>BRJ-1304</b>	1260	1900	706	2178	2821	1376	1988	1747
<i>10</i>	<b>55E77</b>	901	1950	1325	1861	2191	1715	2227	1739
<i>11</i>	<b>T5522</b>	1803	1678	1650	1956	2250	1045	1765	1735
<i>12</i>	<b>KJ-282</b>	1297	1761	862	1695	2300	1671	2553	1734
<i>13</i>	<b>KJ-290</b>	1420	1822	1722	1861	2183	766	2177	1707
<i>14</i>	<b>MS-699</b>	1062	1956	1423	2289	1672	1537	1979	1703
<i>15</i>	<b>KJ-238</b>	2198	1162	3041	1750	1838	734	1192	1702
<i>16</i>	<b>MS-555</b>	1284	1567	1019	2139	2492	1136	2272	1701
<i>17</i>	<b>86M45</b>	1383	1917	2043	1445	2300	803	2005	1699

18	<b>BK-3036</b>	1556	1900	1725	1739	2013	990	1939	1695
19	<b>MMVEGEOILA</b>	1928	1400	1460	2028	1917	813	2212	1680
20	<b>T5533</b>	1210	1906	1179	1584	2471	1396	1974	1674
21	<b>KJ-289</b>	1877	1522	1415	1778	2121	956	1951	1660
22	<b>ES-4050</b>	1889	1567	1007	2111	1817	913	2223	1647
23	<b>22S66</b>	1198	1583	1281	1806	2650	1240	1677	1634
24	<b>M-444</b>	1938	1300	1640	1706	1767	969	2055	1625
25	<b>BRJ-1458</b>	1568	1822	1065	1817	2100	1042	1951	1624
26	<b>Sahara Mustard</b>	1667	1717	1302	1889	1858	948	1957	1620
27	<b>17CBJ007</b>	1389	2028	1241	1867	2367	438	2006	1619
28	<b>Sona Super</b>	864	1721	1141	1872	2187	1226	2306	1617
29	<b>AS-333</b>	877	1872	1451	2028	1742	909	2371	1607
30	<b>Rachna 3051</b>	1068	1584	992	1861	2696	1369	1657	1604
31	<b>TCH-01</b>	2383	2056	996	2106	1666	417	1571	1599
32	<b>TS-3435</b>	1865	1922	1204	1772	1829	702	1862	1594
33	<b>FBS-711</b>	1630	1561	505	2011	2092	1027	2174	1571
34	<b>ZS-4445</b>	1370	1134	1084	2084	1962	855	2496	1569
35	<b>Sarson-313</b>	1667	1695	1088	1650	2079	844	1936	1566
36	<b>R86</b>	972	1839	1159	1573	2362	1051	1790	1535
37	<b>MS-57</b>	1272	1750	1069	1734	1890	678	2301	1528
38	<b>MMDMOILA</b>	1819	1978	588	1806	2079	740	1657	1524
39	<b>MS-60</b>	1445	1345	892	1300	2221	757	2528	1498
40	<b>SD-3024</b>	1062	1956	895	1639	2096	1032	1752	1490
41	<b>Super Raya</b>	1309	1428	1219	1417	2404	644	1959	1483
42	<b>MS-7860</b>	1704	1194	1117	1889	2125	678	1645	1479
43	<b>GS-787</b>	1494	1445	1064	1528	2466	875	1455	1475
44	<b>15015</b>	1642	1233	623	2350	1542	544	2348	1469
45	<b>1694</b>	1655	1647	1624	1472	1504	730	1606	1463
46	<b>THB-65</b>	1080	1806	1178	1678	1846	795	1799	1455
47	<b>R00125/12</b>	2136	1622	747	2000	1000	698	1821	1432
48	<b>YG-Solo Super</b>	1519	1495	157	1723	2233	1115	1705	1421
49	<b>AS-8293</b>	1148	1822	660	1972	2150	948	1209	1416
50	<b>HS-11</b>	1371	1756	735	1512	2104	758	1607	1406
51	<b>THB-121</b>	1062	1467	868	1417	2008	852	2134	1401
52	<b>LG-96</b>	951	1550	670	1667	2033	719	2162	1393
53	<b>28103</b>	1210	1167	845	1539	1979	761	2100	1372
54	<b>THB-18</b>	1235	1500	486	1417	1754	741	2197	1333
55	<b>Mingora-1</b>	1704	1100	654	45	2183	526	1674	1127

Varietal behaviors were statistically highly significant. Table 1.14 further shows that M-11 produced the maximum seed yield of 2457 kg/ha, followed by AS-207 with seed yield 2079 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 97012 R	FHC-174
2	786-013 x 97012 R	FHC-175
3	786-015 x 97012 R	FHC-176
4	786-016 x 97012 R	FHC-177
5	786-010 x 97012 R	FHC-178
6	786-003 x 97012 R	FHC-179
7	786-012 x 96039 R	FHC-180
8	786-013 x 96039 R	FHC-181
9	786-015 x 96039 R	FHC-182
10	786-016 x 96039 R	FHC-183
11	786-010 x 96039 R	FHC-184
12	786-003 x 96039 R	FHC-185

**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-162</b>	1650	1520	1550	1573	3496
<b>2</b>	<b>FHC-166</b>	1300	1300	1700	1433	3185
<b>3</b>	<b>FHC-172</b>	1450	1250	1500	1400	3111
<b>4</b>	<b>FHC-168</b>	1000	1300	1600	1300	2889
<b>5</b>	<b>FHC-167</b>	1400	1020	1400	1273	2830
<b>6</b>	<b>FHC-173</b>	1420	1130	1250	1267	2815
<b>7</b>	<b>FHC-165</b>	950	1250	1550	1250	2778
<b>8</b>	<b>FHC-170</b>	1350	1130	1150	1210	2689
<b>9</b>	<b>FHC-163</b>	950	1120	1380	1150	2556
<b>10</b>	<b>FHC-169</b>	850	1320	1250	1140	2533
<b>11</b>	<b>FHC-164</b>	1250	1110	980	1113	2474
<b>12</b>	<b>FHC-171</b>	950	1130	1250	1110	2467
<b>13</b>	<b>Hyola-401 ©</b>	980	800	930	903	2007

Perusal of the table 1.15 indicated that FHC-162 surpassed all the entries included in the trial by giving seed yield of 3496 kg/ha. The standard canola hybrid “Hyola-401” gave 2007 kg seed yield per hectare.

## 2. OILSEEDS RESEARCH STATION, KHANPUR

### PLANT BREEDING & GENETIC

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

##### **TITLE 1: MAINTENANCE AND EVALUATION OF GERMPLASM (*Brassica juncea*)**

One hundred and forty eight (148) 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.

##### **TITLE 2: GENETIC IMPROVEMENT IN *Brassica juncea* THROUGH HYBRIDIZATION**

Ten crosses were made keeping KJ-238 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>
KJ-284	×	KJ-282
KJ-286	×	KJ-282
KJ-291	×	KJ-282
KJ-292	×	KJ-282
<b>High Yielder</b>		<b>Low Erucic acid</b>
KJ-284	×	AARI Canola
KJ-286	×	AARI Canola
KJ-291	×	AARI Canola
KJ-292	×	AARI Canola

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

##### **TITLE 3: 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 2020-21 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>	8	Whole material	-	-
F <sub>2</sub>	10	-do	99	-
F <sub>3</sub>	11	-do-	98	-
F <sub>4</sub>	5	68	75	-
F <sub>5</sub>	5	48	52	-
F <sub>6</sub>	4	39	19	-
F <sub>7</sub>	3	29	-	14

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 10 F<sub>2</sub> crosses, 99 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>, 14 progenies were selected for seed yield evaluation in preliminary yield trial.

**TITLE 4: PRELIMINARY YIELD TRIAL (*B. juncea*)**

Sixteen *B. juncea* lines were tested along with the standard varieties “AARI Canola” and “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 (PYT) at Oilseeds Research Station, Khanpur during 2020-21.**

Rank No.	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KJ-339	48	69	110	197	2011
2	KJ-340	48	72	107	206	1981
3	KJ-335	50	67	109	197	1933
4	KJ-333	53	74	113	179	1919
5	KJ-337	49	74	108	197	1889
6	KJ-336	50	72	109	195	1848
7	KJ-334	52	69	112	210	1822
8	Super Raya (C)	50	70	117	176	1815
9	KJ-342	48	65	113	218	1789
10	KJ-332	53	73	110	181	1778
11	KJ-338	49	72	110	209	1770
12	KJ-331	51	68	108	152	1722
13	KJ-341	49	65	104	211	1722
14	AARI Canola (C)	47	70	107	209	1715
15	KJ-343	52	64	114	195	1607
16	KJ-330	49	66	106	160	1444
LSD %						217

Design	R.C.B
Plot size	5 × 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	09.10.2020

The perusal of table 2 indicates that KJ-339 gave highest yield i.e., 2011 kg/ha followed by KJ-340 i.e., 1981 kg/ha. Days to flowering (50%) ranged from 47-53 while days to flowering (100%) 65-74 and days to maturity 104-117. The maximum plant height (218 cm) was observed by KJ-342 and minimum (152 cm) by KJ-331.

**TITLE 5: ADVANCED SEED YIELD TRIAL (*B. juncea*)**

Seventeen (17) *Brassica juncea* lines were evaluated along with two check varieties i.e., “Super Raya” and AARI Canola. The results are presented in table 3.

**Table 3: Performance of 17 entries of Advanced Yield Trial (AYT), 2020-21at Oilseeds Research Station, Khanpur.**

Rank No.	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KJ-326	54	73	103	206	2178
2	KJ-286	53	70	103	163	2111
3	KJ-315	53	72	104	197	2074
4	KJ-288	51	69	106	176	2056
5	KJ-321	54	70	100	198	2000
6	KJ-287	51	67	105	178	1963
7	KJ-327	53	74	102	207	1944
8	KJ-290	54	69	104	224	1889
9	KJ-316	51	66	104	212	1889
10	Super Raya (C)	56	68	102	217	1870
11	AARI Canola (C)	53	70	101	204	1870
12	KJ-325	53	73	102	199	1870
13	KJ-319	49	72	104	190	1833
14	KJ-320	47	68	102	195	1796
15	KJ-292	54	71	104	218	1741
16	KJ-322	51	71	101	214	1611
17	KJ-324	52	73	101	221	1426
LSD %						222

Design	R.C.B
Plot size	5 × 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	09.10.2020

The perusal of Table 3 indicates that KJ-326 gave highest yield i.e. 2178 kg/ha. Days to flowering 50% and 100% was ranged from 47-56 and 67-74 respectively. Days to maturity ranged from 101 to 106. The maximum plant height (224 cm) was observed by KJ-290 and minimum (163 cm) by KJ-286.

#### **TITLE 6: MICRO SEED YIELD TRIALS (*B. juncea*)**



Yield performance of twelve lines of *B. juncea* was tested under different agro- climatic conditions of the province. The results obtained from eight 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 8 locations in Punjab, 2020-2021**

Sr. No	Entry name	BARI chakwal	ORS, Kpur	AZRC, DI	PRTS, BZU	NIA, Tendoja	NIFA, Peshaw	ORI, FSD	RARI, BWP	ORI, Peshawar	AZRI, Bhakkar	NARC, ISD	Pioneer	ARI, Tendoja	ARI, Swat	I 5	I 6	Avg
Rank	Entry Name	FSD	Karor	K/pur	Piplan	Chkwl	F/Jhang	RARI B/pur	ORS B/pur	Average								
1	RBJ-15013	1407	2778	1713	2000	2367	1233	1756	1963	1902								
2	RBJ-15017	1519	2037	2148	1937	2314	944	1985	1926	1851								
3	RBJ-16007	1752	2519	1778	2167	2133	924	1637	1593	1813								
4	RBJ-17003	1304	2074	1926	2204	2011	906	1743	1593	1720								
5	RBJ-17005	1267	2593	1815	1804	1789	733	1567	1815	1673								
6	BRJ-1775	1663	2259	2074	1915	2278	733	1694	1778	1799								
7	BRJ-1778	1548	2444	2111	1863	2033	712	1661	1481	1732								
8	18CBJ001	1537	2407	1704	1259	2344	608	1596	1667	1640								
9	18CBJ005	1622	1667	2204	1826	2111	569	1333	1407	1593								
10	KJ-284	1481	2778	1944	2307	2144	451	1624	1704	1804								
11	KJ-294	1507	2296	1833	2074	2044	361	1320	1815	1656								
12	Super Raya (C)	1185	1963	1898	2444	2200	299	1822	1667	1685								
LSD 5%		215	380	342	108	359	100	124	243	234								

Perusal of the table 4 (a) indicate the entry RBJ-15013 with seed yield of 1902 kg/ha followed by RBJ-15017 (1851 kg/ha) out of all the entries included in the trial. The local entry KJ-284 showed seed yield of (1804 kg/ha).

**Table 4 (b): Performance of *B. juncea* strains at different locations in the Punjab during Zaid Kharif 2020-21**

Rank	Entry Name	Faisalabad	Karor	Khanpur	Bahawalpur	Piplan	Average
1	ZBJ-17008	2733	3600	1431	1972	1806	2308
2	ZBJ-17014	2548	3339	1375	2167	2014	2288
3	ZBJ-17019	2800	3256	1908	2306	1944	2443
4	ZBJ-18008	3122	3540	1597	2556	2147	2592
5	AARI Canola (C)	2215	3386	1972	2356	2167	2419
LSD 5%		373	362	281	189	101	219

## TITLE 7: NATIONAL UNIFORM MUSTARD SEED YIELD TRIAL (NUMYT)

1	Coral 432	2161	1483	2423	649	397	1945	1900	2346	541	896	1685	2862	1410	2245			1783
2	FBS-711	1630	1561	2167	505	492	2000	2011	2092	377	1027	3314	2174	1509	2250			1798
3	17CBJ007	1389	2028	2359	1241	319	2333	1867	2367	716	438	2182	2006	1275	2425			1772
4	AS-207	1815	1784	1954	2682	410	2333	2067	2358	530	1079	1745	2769	3084	2292			1928
5	LG-96	951	1550	1757	670	428	1778	1667	2033	345	719	2335	2162	1750	1979			1561
6	THB-65	1080	1806	1244	1178	451	2222	1678	1846	731	795	2986	1799	1208	1986			1586
7	MS-699	1062	1956	1810	1423	464	1945	2289	1672	754	1537	1637	1979	1804	2139			1626
8	AS-333	877	1872	1991	1451	338	2111	2028	1742	565	909	2147	2371	1745	1995			1649
9	BRJ-1458	1568	1822	1646	1065	209	2667	1817	2100	861	1042	2370	1951	1709	2146			1739
10	KJ-282	1297	1761	1584	862	322	2222	1695	2300	799	1671	2413	2553	1777	2158			1740
11	86M45	1383	1917	1822	2043	347	1667	1445	2300	458	803	2584	2005	2269	2017			1685
12	MS-57	1272	1750	2046	1069	429	2056	1734	1890	819	678	2330	2301	1297	2245			1681
13	28103	1210	1167	2064	845	337	2667	1539	1979	896	761	2770	2100	1205	2235			1681
14	T5533	1210	1906	2083	1179	287	2444	1584	2471	502	1396	1518	1974	990	2397			1614
15	ZS-4445	1370	1134	1674	1084	415	1333	2084	1962	485	855	1859	2496	1475	2417			1559
16	MS-60	1445	1345	1819	892	350	2333	1300	2221	976	757	2217	2528	1811	2199			1712
17	Sahara Mustard	1667	1717	1678	1302	408	2056	1889	1858	425	948	1950	1957	1180	1986			1564
18	YG-Solo Super	1519	1495	1724	157	419	1278	1723	2233	663	1115	1895	1705	1932	1880			1539
19	AS-8293	1148	1822	1631	660	466	1889	1972	2150	551	948	2017	1209	1949	2017			1568
20	THB-18	1235	1500	1925	486	406	1889	1417	1754	856	741	2512	2197	939	2030			1555
21	MS-7860	1704	1194	1958	1117	429	2000	1889	2125	569	678	1602	1645	1620	2134			1572
22	GS-787	1494	1445	1170	1064	395	2222	1528	2466	547	875	2270	1455	1609	2241			1570
23	Sarson-313	1667	1695	2100	1088	449	2000	1650	2079	531	844	2045	1936	1669	2052			1656
24	Mingora-1	1704	1100	1282	654	348	1889	45	2183	261	526	1167	1674	1539	1993			1265
25	NX-888	1445	1933	1657	1199	407	2611	2278	2137	733	1823	2055	2176	1917	1924			1773
26	THB-121	1062	1467	1510	868	285	2556	1417	2008	644	852	2309	2134	1360	2099			1571
27	Sona Super	864	1721	2010	1141	540	2444	1872	2187	717	1226	2268	2306	1852	2256			1753
28	MS-555	1284	1567	1609	1019	446	2278	2139	2492	641	1136	1981	2272	2030	2084			1735
29	BK-3036	1556	1900	1453	1725	365	2222	1739	2013	767	990	2439	1939	1789	2084			1689
30	R86	972	1839	1833	1159	476	1778	1573	2362	453	1051	1584	1790	2272	2439			1614
31	M-11	1864	1784	1785	5514	397	2111	2428	2141	609	948	1583	2518	1487	2071			1732
32	KJ-238	2198	1162	1845	3041	462	1834	1750	1838	526	734	2117	1192	1625	2200			1562
33	KJ-289	1877	1522	2080	1415	361	2056	1778	2121	658	956	2253	1951	1417	2360			1703
34	Rachna 3051	1068	1584	1424	992	323	2222	1861	2696	640	1369	2224	1657	2282	2038			1668
35	SD-40S50	1802	2195	1823	1239	422	2333	1678	2583	971	859	3347	2519	1858	2097			1969
36		1655	1647	1807	1624	449	2278	1472	1504	517	730	2493	1606	1075	2313			1568
37	KJ-288	1383	1295	1451	1263	385	2167	1762	2225	638	1834	1584	2626	1583	2292			1616
38	5.50E+78	901	1950	1612	1325	367	2222	1861	2191	562	1715	2244	2227	2625	1986			1729
39	TS-3435	1865	1922	2051	1204	410	2000	1772	1829	573	702	1719	1862	1420	2059			1624
40	ES-4050	1889	1567	1350	1007	331	1778	2111	1817	494	913	1572	2223	1542	2007			1557
41	IS-381	1210	1956	1840	1454	326	2389	1917	2525	828	1224	1941	1990	2183	2132			1770
42	Super Raya	1309	1428	1759	1219	326	2333	1417	2404	567	644	1834	1959	1882	2493			1643
43	KJ-290	1420	1822	1788	1722	396	2056	1861	2183	713	766	2364	2177	1207	2175			1680
44	M-444	1938	1300	1658	1640	256	1834	1706	1767	836	969	1949	2055	1792	2165			1605
45	SD-3024	1062	1956	2196	895	350	2111	1639	2096	523	1032	1642	1752	1542	1731			1550
46	BRJ-1304	1260	1900	1401	706	471	2444	2178	2821	828	1376	2550	1988	2469	2367			1890
47	T5522	1803	1678	1749	1650	504	1722	1956	2250	474	1045	2068	1765	1870	1995			1653
48	VX-111	1932	2389	1500	2443	391	1889	2161	2108	495	865	2683	2374	1542	2328			1816
49	MMDMOILA	1819	1978	1823	588	383	1834	1806	2079	521	740	1624	1657	1792	1833			1596
50	22S66	1198	1583	1513	1281	319	1667	1806	2650	545	1240	1615	1677	1369	2079			1502
51	MMVEGEOILA	1928	1400	2014	1460	353	2000	2028	1917	593	813	1935	2212	1704	2228			1693
52	HS-11	1371	1756	2137	735	479	1834	1512	2104	915	758	1566	1607	1459	2030			1564
53	TCH-01	2383	2056	2349	996	175	1125	2106	1666	432	417	1975	1571	2344	1977	3 1 3		1680
54	15015	1642	1233	2385	623	198	1999	2350	1542	666	544	2563	2348	2059	1856	3 3 3		1737
55	R00125/12	2136	1622	2015	747	245	1583	2000	1000	463	698	1459	1821	1525	1970	6 4		1487

Did not receive data for Mustard NUYT  
NUYT destroyed due to severe weather conditions

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

Varietal behaviors were statistically highly significant. Table 5 further shows that SD-40S50 produced the maximum seed yield of 1969 kg/ha, followed by AS-207 with seed yield 1928 kg/ha. Our local variety KJ-282 gave grain yield of 1740 kg/ha indicating significantly better yield than the check variety Super Raya (1643 kg/ha).

## B. RAPESEED

### **TITLE 1: MAINTENANCE AND EVALUATION OF GERMPLASM *Brassica napus***

One hundred and eighteen (118) 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.

### **TITLE 2: GENETIC IMPROVEMENT IN *Brassica napus* THROUGH HYBRIDIZATION**

Eight (08) crosses were made keeping KN-338 and Super 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.

#### ***Brassica napus***

<b>High Yielder</b>		<b>High Yielder</b>	
1. KN-327	×	KN-338	
2. KN-328	×	KN-338	
3. KN-330	×	KN-338	
4. KN-336	×	KN-338	
<b>High Yielder</b>		<b>Low Erucic acid</b>	
5. KN-327	×	Super Canola	
6. KN-328	×	Super Canola	
7. KN-330	×	Super Canola	
8. KN-336	×	Super Canola	

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

### **TITLE 3: 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 2020-21 at Oilseeds Research Station, Khanpur.**

<b>Generation</b>	<b>No. of crosses</b>	<b>No. of progenies</b>	<b>No. of plants selected</b>	<b>No. of lines selected for PYT</b>
F <sub>1</sub>	8	Whole material	-	
F <sub>2</sub>	10	-do-	93	-
F <sub>3</sub>	9	-do-	95	-
F <sub>4</sub>	4	56	68	-
F <sub>5</sub>	4	45	45	-
F <sub>6</sub>	3	37	15	-
F <sub>7</sub>	3	30	-	12

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 10 F<sub>2</sub> crosses, 93 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>, 12 progenies were selected for seed yield evaluation in preliminary yield trial.

**TITLE 4: PRELIMINARY YIELD TRIAL (*B. napus*)**

Sixteen (16) *B. napus* lines were tested along with the standard varieties “Rohi Sarsoon and Sandal Canola”. 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 (PYT) at Oilseeds Research Station, Khanpur during 2020-21.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KN-356	67	85	158	193	2012
2	KN-366	72	93	163	203	1901
3	Sandal Canola (C)	72	97	161	187	1894
4	Rohi Sarson (C)	71	85	160	196	1772
5	KN-360	63	90	163	199	1769
6	KN-368	74	97	167	192	1748
7	KN-359	73	93	158	200	1662
8	KN-357	66	85	158	202	1605
9	KN-367	75	97	167	195	1574
10	KN-355	70	85	160	203	1533
11	KN-362	66	88	152	198	1400
12	KN-363	69	96	154	193	1358
13	KN-358	72	85	155	189	1333
14	KN-361	71	89	148	197	1309
15	KN-365	72	88	158	187	1212
16	KN-364	67	96	157	193	1090
<b>LSD %</b>						231

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	17.10.2020

The perusal of table 7 indicates that KN-356 gave highest yield i.e., 2012 kg/ha followed by KN-366 i.e., 1901 kg/ha. Days to flowering (50%) were 63-75 while days to flowering (100%) was 85-97 and days to maturity ranged from 148-167. The maximum plant height (203 cm) was observed by KN-355 & KN-366 and minimum (187 cm) by KN-365 and Sandal Canola (check variety).

**TITLE 5: ADVANCED SEED YIELD TRIAL (*B. napus*)**

Sixteen (16) *B. napus* lines were evaluated along with check varieties “Rohi Sarsoon and Sandal Canola”. The results are presented in table 8.

**Table 8: Performance of 16 entries of Advanced Yield Trial (AYT), 2020-21 at Oilseeds Research Station, Khanpur.**

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	KN-319	72	84	166	192	1778
2	KN-347	73	84	167	183	1733
3	KN-342	70	86	161	167	1689
4	KN-346	72	84	167	177	1685
5	KN-353	72	84	168	197	1685
6	KN-328	73	86	156	206	1685
7	KN-339	73	87	154	219	1648
8	KJ-354	72	85	166	208	1644
9	KN-324	72	86	154	208	1630
10	Sandal Canola (C)	72	84	168	211	1563
11	KN-352	72	85	166	197	1556
12	Rohi Sarsoon (C)	73	85	151	181	1481
13	KN-329	74	86	154	210	1463
14	KN-341	72	83	157	188	1352
15	KN-340	72	83	164	182	1333
16	KN-343	72	84	165	175	1315
LSD %						215

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	17.10.2020

The perusal of Table 8 indicates that KN-319 gave highest yield i.e. 1778 kg/ha followed by KN-347 (1733 kg/ha). Days to flowering (50%) ranged from 70 to 74 and days to flowering (100 %) was 83-87. Days to maturity ranged from 154 to 168. The maximum plant height (219 cm) was observed by KN-339 and minimum (167 cm) by KN-342.

**TITLE 6: MICRO SEED YIELD TRIALS (*B. napus*)**

Twelve (12) *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 twelve (12) entries of *B. napus* in Micro Yield Trial conducted over 8 locations in Punjab, 2020-2021**

Rank	Entry Name	FSD	K/pur	Karor	ORS B/pur	RARI B/pur	F/jang	Chkwl	Piplan	Average
1	RBN-18006	2006	1981	2037	3296	1200	1489	2848	1907	2096
2	RBN-17014	1969	1630	2037	2704	1106	527	3370	1463	1851
3	KN-327	1654	1444	2593	2630	1177	979	1963	2026	1808
4	RBN-16014	1765	1389	1667	2889	1462	604	2648	2026	1806
5	Sandal Canola (C)	1898	1222	1852	2667	1295	777	2648	1915	1784
6	KN-312	2031	1315	2037	2778	1105	503	2444	2011	1778
7	KN-330	1759	1407	1852	2778	1066	1118	2241	1815	1754
8	18CBN008	2160	1574	1852	2778	1106	628	2019	1863	1747
9	KN-336	1864	1537	1481	2889	1177	899	2333	1167	1668
10	RBN-14017	1809	1074	1481	2667	1433	1149	2185	1483	1660
11	18CBN001	1549	1463	1667	2815	1058	482	2519	1678	1654
12	RBN-18007	1426	1778	1889	2296	1044	774	1778	1463	1556
LSD (%)		273	299	316	449	181	73	455	367	

Perusal of the table 9 indicated that RBN-18006 surpassed all the entries included in the trial by giving seed yield of 2096 kg/ha followed by RBN-17014 (1851 kg/ha). Local variety (KN-327) ranked 3<sup>rd</sup> with grain yield of 1808 kg/ha indicating better yield than check variety Sandal Canola (1784 kg/ha).

#### **TITLE 7: NATIONAL UNIFORM RAPESEED YIELD TRIAL (NURYT)**

The objective of this trial was to test the performance of rapeseed varieties under different 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 16 locations during Rabi 2020-21**

Rapeseed National 2020-21 (Punjab Locations)									
Sr. No.	Entry Name	BARI Chakwal	ORS, Khanpur	PARC ISL	AARI. Fsd	RARI Bwp	AZRI Bhakr	PPSL Sahiwal	Mean
1	Super Canola	1790	2056	1062	2141	1466	590	2287	1627
2	KN-279	1769	1370	1747	1648	1283	1097	2011	1561
3	KN-309	2021	1378	1204	1463	1333	1161	1731	1470
4	KN-338	1836	1352	1121	1267	1427	1441	1828	1467
5	Hop-9	2020	1519	1603	1722	1194	550	1658	1467
6	RBN-18021	1667	1252	1713	1600	1350	535	2110	1461
7	Hoyola-401	1832	1037	886	2348	1419	1072	1029	1375
8	HS-22	1529	1363	1267	1674	1491	517	1710	1364
9	HC025D	1998	1148	1267	1867	966	1021	1210	1354
10	KN-339	1704	970	1553	1889	1450	563	1339	1353
11	CHS-30	1591	1278	1528	1852	1275	663	1162	1336

12	KN-331	1704	1204	1914	1581	1205	476	1215	1328
13	16CBN002	1532	1522	1291	1319	1400	1060	988	1302
14	Sandil	1563	1221	981	1689	1161	435	1908	1280
15	17CBN007	1909	1352	905	1492	1277	729	1075	1248
16	RBN-16001	1564	889	1336	1159	1333	810	1611	1243
17	24884	1646	1259	1487	1341	1264	851	839	1241
18	Sitara-602	1589	1244	799	1359	1099	882	1680	1236
19	RM-1-2	509	1613	1394	1091	1466	900	1664	1234
20	Hoyola-VX-444	1300	1337	1151	1545	1300	612	1392	1234
21	I6CBN007	1342	1222	969	1500	1325	1289	966	1230
22	MUN-2	679	1800	1730	1119	1333	872	1042	1225
23	Kingola	1366	1370	682	1396	1419	833	1420	1212
24	CHS-33	1333	1393	1129	1530	1138	812	1148	1212
25	24182	1747	1389	1093	1455	1044	550	1027	1186
26	FLC-111	1868	1203	1264	1530	741	476	1222	1186
27	FBS-101	2012	1259	750	1278	938	576	1233	1149
28	RM-106-1	424	1382	1717	1350	1014	932	1129	1135
29	BNS-1	1621	1137	548	1611	1058	861	1086	1132
30	CHS-61	1660	1300	722	1259	1127	549	1195	1116
31	MUN-1	243	1818	1121	1500	1352	410	1259	1100
32	RM 1-9	206	1426	1404	1298	1153	556	1504	1078
33	MUN-3	309	1543	727	1456	1314	943	1240	1076
34	Sitara-601	1852	1445	498	1063	777	779	890	1043
35	RR-8-2	658	1445	566	1300	1240	773	762	963
36	FLC110	1556	1066	786	1026	786	563	948	962
37	MUN-4	358	1404	767	1063	1063	766	1266	955

A perusal of table 10 shows that the differences of means due to varieties are highly significant. Super Canola gave the yield of 1754 kg/ha. KN-338 (1597 kg/ha) and KN-339 (1473 kg/ha) local varieties showed better yield than the 2<sup>nd</sup> check variety Hyola-401 (1404 kg/ha).

## **PLANT PATHOLOGY**

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

Twelve (17) advance lines of *B. Juncea* and 16 of *B.napus* were sown on 1<sup>st</sup> week of October, 2020 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 *Alternariabrassicae* 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)	KJ-326	1
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KJ-290, Super Raya, KJ-292, KJ-326, KJ-319, KJ-320, AAR canola, KJ-322, KJ-324, KJ-325 and KJ-327	11
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)	KJ-286, KJ-287, KJ-288, KJ-315, KJ-321, KJ-159,	6
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)	KJ-267	1
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)	-	-

**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)	KN-328	1
2	A few scattered plants blighted with 5-10 spots/plant.	Highly Resistant (HR)	KN-319, KN-324, KN-329, Rohi Sarsoon, KN-346, KN-347	6
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KN-340, KN-341, KN-342, KN-343, KN-353 and KN-354	6
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)	-	-

## **TITLE 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: *Brassica juncea***

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

<i>Brassica juncea</i>				
Sr.No	Lines Tested	Downy mildew (Category)	Powdery mildew (Category)	White Rust (%)
1	KJ-286	MR	-	-
2	KJ-287	MR	-	-

3	KJ-288	MR	-	2
4	KJ-290	R	-	-
5	Super Raya	R	-	2
6	KJ-292	R	-	-
7	KJ-315	MR	-	-
8	KJ-316	R	-	-
9	KJ-319	R	-	-
10	KJ-320	R	-	2
11	KJ-321	MR	-	-
12	AARI Canola	R	-	-
13	KJ-322	R	-	-
14	KJ-324	R	-	1
15	KJ-325	R	-	-
16	KJ-326	HR	-	1
17	KJ-327	R	-	2
18	KJ-159 (S <sup>1</sup> )	MR	-	2
19	KJ-267 (S <sup>2</sup> )	MS	-	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 while rust (*Albugo candida*) incidence in almost all the lines remained up to Resistant (R) category.

**Set-B:**

<i>Brassica napus</i>				
Sr.No	Lines Tested	Downy mildew (Category)	Powdery mildew (Category)	White Rust (%)
1	KN-319	R/MR	-	VHR
2	KN-324	HR	-	R
3	KN-328	VHR	-	VHR
4	KN-329	HR	-	R
5	KN-339	R/MR	-	R
6	Rohi Sarsoon	HR	-	R
7	KN-340	R	-	R
8	KN-341	R	-	MR
9	KN-342	R	-	R
10	KN-343	R	-	R
11	KN-346	HR	-	R
12	KN-347	HR	-	R
13	Sandal Canola	MR	-	R
14	KN-352	MR	-	R
15	KJ-353	R	-	R
16	KJ-354	R	-	VHR
17	KJ-159 (S <sup>1</sup> )	MR	-	MR
18	KJ-267 (S <sup>2</sup> )	MR	-	MR

Amongst 16 promising advanced lines of *Brassica*, all the entries showed response in varying categories against the diseases under natural environmental conditions. Reaction of all lines remained in between resistant and moderately resistant categories. No lines showed susceptible response.

### 3.OILSEEDS RESEARCH STATION, BAHAWALPUR

#### RAPESEED AND MUSTARD:

##### A. WINTER MUSTARD AND RAPESEED

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

150 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-250 x AARI canola
2. OBJ-245 x AARI canola
3. OBJ-248 x AARI canola
4. OBJ-220 x AARI canola
5. OBJ-250 x Super raya
6. OBJ-245 x Super raya
7. OBJ-248 x Super raya
8. OBJ-220 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	25	-
F <sub>6</sub>	-	24	-	-
F <sub>7</sub>		20		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>7</sub>, 5 progenies were selected for seed yield evaluation in preliminary yield trial.

###### Project 4. YIELD TRIALS

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

12 *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 12 entries for seed yield in Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2020-21.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	OBJ-268	1955
2	OBJ-269	1922
3	OBJ-272	1810
4	OBJ-278	1810

5	OBJ-273	1777
6	OBJ-277	1700
7	Super Raya (C)	1666
8	OBJ-275	1665
9	OBJ-270	1588
10	OBJ-271	1588
11	OBJ-274	1477
12	OBJ-276	1400
<b>LSD 5%</b>		<b>275</b>

Design	R.C.B.
Plot size	5m x 1.8 m
Row spacing	45 cm
Fertilizer	75: 75 kg NP/ha
Sowing date	13.10.2020

The perusal of table 1.2 indicates that OBJ-268 gave highest yield i.e., 1955 kg/ha followed by OBJ-268 i.e., 1922 kg/ha.

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

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

**Table 1.3: Performance of 10 entries of advanced seed yield trial, 2020-21 at Oilseeds Research Station, Bahawalpur.**

<b>Rank</b>	<b>Line/Variety</b>	<b>Yield (kg/ha)</b>
1	OBJ-160	2810
2	OBJ-165	2775
3	OBJ-167	2477
4	OBJ-168	2477
5	OBJ-166	2442
6	OBJ-153	2399
7	OBJ-151	2288
8	OBJ-169	2288
9	OBJ-163	2255
10	Super Raya (C)	2110
<b>LSD 5%</b>		<b>225</b>

Design	R.C.B
Plot size	6 x 1.35 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha
Sowing date	20.10.2020

The perusal of table 1.3 indicates that OBJ-160 gave highest yield i.e. 2810 kg/ha followed by OBJ-165 that gave the yield 2775 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.

8 different varieties of rapeseed and mustard were tested and 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 2020-21.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	Super Canola	1800
2	SohniDharti	1750
3	Rustam Canola	1500
4	Super Raya	1460
5	Faisal Canola	1380
6	AARI Canola	1265
7	Khanpur Raya	1185
8	RohiSarsoon	900
<b>LSD 5%</b>		<b>580</b>

Fertilizer 75: 75 kg NP/ha

Sowing date 20.10.2020

The perusal of table 1.5 indicates that Super Canola gave highest yield i.e., 1800 kg/ha followed by SohniDharti hybrid i.e., 1750 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**

18 safflower lines were tested along with the standard variety “Thori-78” in A1 and 10 entries were tested in A2 trial along with standard variety. 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 top 5 entries for seed yield in A1 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2020-21.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-310	1288
2	SAF-344	1177
3	SAF-333	1177
4	SAF-324	1165
5	SAF-342	1110
<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	08.11.2020

The perusal of table 1.6 indicates that SAF-310 gave highest yield i.e., 1288 kg/ha followed by SAF-344 i.e., 1177 kg/ha.

**Table 1.7: Performance of 10 entries for seed yield in A2 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2020-21.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-145	2333
2	SAF-148	1955
3	SAF-165	1588
4	SAF-187	1477
5	SAF-177	1366
6	SAF-135	1288
7	SAF-141	1255
8	SAF-184	1177
9	SAF-168	1110
10	Thori-78©	1110
<b>LSD 5%</b>		<b>650</b>

Design	R.C.B.
Plot size	5m x 1.8 m
Row spacing	45 cm
Fertilizer	75: 75 kg NP/ha
Sowing date	08.11.2020

The perusal of table 1.7 indicates that SAF-145 gave highest yield i.e., 2333 kg/ha followed by SAF-148 i.e., 1955 kg/ha.

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

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

**Table 1.8: Performance of 9 entries of advanced seed yield trial, 2020-21 at Oilseeds Research Station, Bahawalpur.**

Rank	Line/Variety	Yield (kg/ha)
1	SAF-202	2775
2	SAF-111	2410
3	SAF-220	2400
4	SAF-214	2400
5	Thori-78©	2033
6	SAF-209	2220
7	SAF-208	2220
8	SAF-205	1844
9	SAF-200	1844
<b>LSD 5%</b>		<b>670</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              08.11.2020

The perusal of table 1.8 indicates that SAF-202 gave highest yield i.e. 2775 kg/ha followed by stand SAF-111 that gave the yield 2410 kg/ha.

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

Eight 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 2020-21.**

S.No.	Line	BWP	K/Pur	Khanewal	D.G khan	Avg.
1.	SAF-111	2775	1990	2350	1850	2241
2.	SAF-55	2588	2450	2037	1760	2208
3.	Thori-78©	2588	1940	1750	1325	1900
4.	SAF-115	2220	1800	1759	1765	1886
5.	SAF-96	1844	1666	2037	1755	1825
6.	SAF-70	1477	1314	1667	1173	1407
7.	SAF-79	1110	1514	1700	1075	1349
8.	SAF-50	777	1400	1305	1253	1183
<b>LSD 5%</b>		<b>890</b>	<b>730</b>	<b>650</b>	<b>570</b>	

Perusal of the table 1.9 indicated that SAF-111 surpassed all the entries included in the trial by giving seed yield of 2241 kg/ha while lowest yield was taken by SAF-50 (1183 kg/ha).

Design                      R.C.B



Plot size	5 m x 1.8 m
Row spacing	45 cm
Fertilizer	75:75 NP kg/ha
Sowing date	08.11.2020

**Project 5: Performance of Promising Safflower Strain Sown at Different Dates –2020-21**

LAY OUT									
LINE	1(SAF-65)								
PLOT SIZE	5 Marla								
NO OF SOWING DATES	3								
IRRIGATIONS	3								
DATE OF SOWING	3								
	<table> <tr> <th>SR. #</th><th>Sowing Date</th></tr> <tr> <td>1</td><td>10-11-2020</td></tr> <tr> <td>2</td><td>25-11-2020</td></tr> <tr> <td>3</td><td>10-12-2020</td></tr> </table>	SR. #	Sowing Date	1	10-11-2020	2	25-11-2020	3	10-12-2020
SR. #	Sowing Date								
1	10-11-2020								
2	25-11-2020								
3	10-12-2020								

**Table-1.10: Performance of Safflower Line Sown at Different Dates –Rabi 2020-21**

Line	SEED YIELD(kg/plot)		
SAF-65	SOWING DATES		
	1	2	3
	17	10	5

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 2020-21 at Oilseeds Research Station, Bahawalpur.**

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

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 2020.**

Sr. No.	Line	Seed Yield (kg/ha)
1.	Sesame-10	600
2.	Sesame-5	850
3.	Sesame-15	550
4.	Sesame-16	850
5.	Sesame-24	925
6.	Sesame-22	550
7.	Sesame-29	870
8.	Sesame-33	600
9.	Sesame-38	530
10.	TH-6 (C)	515

Design R.C.B.  
 Plot size 5m x 1.8 m  
 Row spacing 45 cm  
 Fertilizer 75: 75 kg NP/ha  
 Sowing date 03.07.2020

The perusal of table 1.12 indicates that Sesame-24 gave highest yield i.e., 925 kg/ha followed by Sesame-29 i.e., 870 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 2020-21.**

Rank	Line/Variety	Seed Yield (kg/ha)
1	FS-2000	1380
2	S-4	1265
3	S-15	1255
4	KR-20	1255
5	DS-30 ©	1245
6	FS-90	1150
7	KR-30	1145
8	S-29	1050
<b>LSD 5%</b>		<b>450</b>

Design R.C.B.

Plot size	5m x 4 m
Row spacing	1 m
Sowing date	20.07.2020

The perusal of table 1.13 indicates that FS-2000 gave highest yield i.e., 1380 kg/ha fallowed by S-4 i.e., 1265 kg/ha.

## 4. SUNFLOWER

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

94 A & B lines and 76 restorer lines are maintained during 2021. “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 was 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 2021**

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**

Twenty new hybrid combinations were developed by crossing A and R Lines having good yield and oil quality parameters during 2021. Twenty two sunflower hybrids produced during Spring-2020 were evaluated in Station Yield Trial during Spring-2021 against standard check Hysun-33, AGSUN-5264, Aguara-4, US-666 and NKS-Armoni. Data was recorded for Plant height (cm), Head diameter (cm), Stem thickness (mm), 100 seed weight (g), Seed yield (kg/ha) and Oil contents (%).

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 2021**

<b>Sr. No.</b>	<b>Hybrids</b>	<b>Seed Yield (kg/ha)</b>
1	FH-885	2877.7
2	FH-893	2626.2
3	FH-896	2596.6
4	Hysun-33 (c)	2591.5
5	US-666	2477.9
6	FH-888	2450.6
7	ARMONI	2429.4
8	FH-894	2380.5
9	FH-883	2371.1
10	FH-891	2369.0
11	FH-889	2317.6
12	AGUARA-4	2274.3
13	FH-897	2272.1
14	FH-882	2262.0
15	FH-898	2249.0
16	FH-884	2223.7
17	FH-887	2171.7
18	AGSUN-5264	2171.7
19	FH-895	2088.5
20	FH-890	2020.6
21	FH-892	2017.0
22	FH-903	1926.7
23	FH-902	1905.0
24	FH-886	1885.5
25	FH-899	1852.2
26	FH-900	1817.5
27	FH-901	1662.2

Three sunflower hybrids showed higher yield than the check hybrid Hysun-33. Highest yield was showed by FH-885 (2877 kg/ha) followed FH-893 (2626 kg/ha) and 896 (2596 kg/ha).

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

Seed of sunflower 07 promising hybrids were increased for further testing in Micro Yield, Demonstration and National Uniform Yield Trials during 2021.

**Table No.3.Seed produced of elite sunflower hybrids during 2021**

Sr.No.	Hybrids	Seed (kg)
1	FH-701	114
2	FH-741	44
3	FH-648	38
4	FH-675	14
5	FH-751	40
6	FH-825	0.66
7	FH-732	1.65

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

Seed of 7 A & B and 6 restorer lines were increased for further utilization in hybrid development program

**Table No. 4. Seed increase of elite parental lines during 2021.**

Sr.No.	CMS line	A (kg)	B (kg)	Sr.No.	Restorer line	Seed Produced (kg)
1	ORI-1	11.75	8.20	1	RL-67	15
2	ORI-42	15.5	21	2	RL-96	12
3	ORI-43	0.35	0.25	3	RL-86	13
4	ORI-90	17	4.5	4	RL-72	02
5	ORI-92	12	6.5	5	RL-58	0.5
6	ORI-106	01	01	6	RL-114	01
7	ORI-73	0.9	0.8			

**Project No. 5. Micro Yield Trial of sunflower hybrids2021**

10 sunflower hybrids were evaluated against check hybrid Hysun-33 under different agroecological 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 2021

**Table No. 5. Micro Yield Trial of Sunflower hybrids during 2021**

Sr.No.	HYBRIDS	Faisalabad	Karror	Bahawalpur	Multan	Average kg/ha
1	FH-829	3009.6	2584.5	-	3673.5	3089.2
2	FH-825	2026.4	2526.9	-	3898.4	2817.2
3	Aguara-4	2598.8	3915.6	1448.6	3173.6	2784.1

4	Armoni	2672.5	2881.8	1619.0	3763.6	2734.2
5	AGSUN-5264	2715.1	3395.9	1079.3	3652.6	2710.7
6	US-666	2928.3	3159.4	1420.2	3262.5	2692.6
7	Hysun-33	2363.9	3884.0	1050.9	3452.6	2687.8
8	FH-841	2305.4	3728.9	1249.8	3322.3	2651.6
9	FH-847	2673.9	3240.3	1590.6	2878.4	2595.8
10	FH-862	1966.4	3287.5	1420.2	3453	2531.8
11	H2	2387.7	2426.0	1789.5	3233.5	2459.2
12	H1	1929.6	3614.3	1619.0	2360.5	2380.8
13	FH-849	2114.6	3155.0	1590.6	2396	2314.0
14	H3	2186.8	2861.1	1136.2	2652.4	2209.1
15	H4	1806.7	-	1193.0	2434.6	1811.4

Six sunflower hybrids perform better than the check hybrid Hysun-33. FH-829 gave highest yield of 3089 kg/ha followed by the hybrid FH-825 with the yield of 2817 kg/ha.

#### **Project No.6. Demonstration trial of sunflower hybrids 2021**

The performance of 13 promising sunflower hybrids were evaluated on different locations at farmer's field.

Plot size                                      1 Kanal (each hybrid)  
 Row to Row spacing                      75cm  
 Plant to Plant spacing                    23cm  
 Sowing dates                                1st Jan to 15th Feb 2021

**Table No.6. Demonstration plots of sunflower hybrids during 2021**

SR.#	Hybrids	FSD	A.pur	Karror	Lalazar	Multan	BWP	RYK	Avg. (kg/ha)
1	<b>FH-701</b>	3057.8	3045.0	3365.8	2334.1	3294.9	2824.4	2983.7	2986.5
2	<b>Hysun-33</b>	2451.9	2795.0	2636.4	3272.7	3010.9	2730.5	-	2816.2
3	<b>Armoni</b>	1657.2	2613.2	2629.1	2954.1	3067.7	3181.3	3178.8	2754.5
4	<b>FH-675</b>	2304.8	2834.5	2939.3	2032.8	2499.6	2954.1	3569.1	2733.4
5	<b>FH-555</b>	2635.1	2811.8	2806.6	2655.2	2465.0	2865.2	2857.7	2728.1
6	<b>US-666</b>	2280.0	2386.0	2303.6	2726.8	2954.1	3294.9	3047.9	2713.3
7	<b>US-444</b>	1814.6	2726.8	2254.2	2852.8	3238.1	2442.8	2731.8	2580.2
8	<b>FH-516</b>	2039.4	1545.2	1955.9	2581.1	3010.9	3067.7	3502.4	2528.9
9	<b>Aguara-4</b>	2036.6	1522.5	3116.4	-	2726.8	3124.5	2282.28	2468.2
10	<b>T-40318</b>	2195.4	1840.6	3048.9	-	2897.3	2272.4	2519.4	2462.3
11	<b>FH-331</b>	2185.3	2681.4	1608.3	2440.3	2897.3	1931.5	3206.06	2421.4
12	<b>AGSUN5264</b>	2884.2	1795.1	3174.5	2531.7	1249.8	3039.3	1793.2	2352.5
13	<b>FH-648</b>	1750.4	-	2220.2	-	2726.8	1420.2	2297.1	2082.9

The sunflower hybrid FH-701 showed higher yield of 2986kg/ha followed by the check hybrid Hysun-33 with the average yield of 2816kg/ha.

**Project No. 7. National Uniform Sunflower Yield Trial 2020**

Results of NUSYT 2020 at Punjab locations are as under:

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

<b>Sr.No.</b>	<b>Hybrid</b>	<b>ORI-Faisalabad</b>	<b>Rajapur</b>	<b>ICI-Multan</b>	<b>RARI-Bahawalpur</b>	<b>Mean (kg/ha)</b>
<b>1</b>	<b>FH-751</b>	2957	2863	4368	2679	3216
<b>2</b>	<b>FH-675</b>	3321	2873	4018	2650	3215
<b>3</b>	<b>FH-741</b>	3300	3283	3447	2809	3209
<b>4</b>	<b>FH-555</b>	2901	3161	4375	2041	3119
<b>5</b>	<b>FH-701</b>	3074	3159	3147	2779	3039
<b>6</b>	<b>GIF-3060-TOB-3045</b>	3336	2672	3886	2011	2976
<b>7</b>	<b>SMH-0927</b>	2945	3050	3129	2742	2966
<b>8</b>	<b>Sun-7</b>	3030	2902	3395	2479	2951
<b>9</b>	<b>Diamond 2033</b>	3218	2833	3305	1981	2834
<b>10</b>	<b>FH-732</b>	2517	2139	4187	2010	2713
<b>11</b>	<b>FH-331 (c)</b>	2260	2640	3886	2010	2699
<b>12</b>	<b>Gul Bahar 436</b>	2852	2831	2548	2259	2622
<b>13</b>	<b>Tahaffuz 4033</b>	2734	2573	2870	1980	2539
<b>14</b>	<b>PARSUN-3</b>	2836	2289	2539	2275	2484
<b>15</b>	<b>Hysun-33 (c)</b>	2197	3003	2880	1597	2419
<b>16</b>	<b>OLIMP</b>	1987	2701	2754	2011	2363
<b>17</b>	<b>GS-999</b>	2242	2800	2140	2052	2308
<b>18</b>	<b>NS-12</b>	1849	2872	1164	1979	1966

Six sunflower hybrids FH-751 (3216 kg/ha), FH-675 (3215 kg/ha), FH-741 (3209 kg/ha) and FH-555 (3119 kg/ha), FH-701 (3039 kg/ha) and FH-732 (2713 kg/ha) show higher yield than check hybrids in NUSYT 2020 at Punjab locations.



## 5. SOYBEAN

### Project 1. DEVELOPMENT OF FRESH CROSSES

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

1.	HM-8468	X	Faisal Soybean
2.	R-315	X	Faisal Soybean
3.	HM-8468	X	AARI Soybean
4.	AARI Soybean	X	Faisal Soybean
5.	CN-5	X	Faisal Soybean
6.	Faisal Soybean	X	AARI Soybean

Seed of 3 successful crosses 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>5</sub> generations in 2020 at Oilseeds Research Institute, Faisalabad.**

<u>Generations</u>	<u>Crosses studied</u>	<u>Progenies studied</u>	<u>Plants selected</u>
F1	3	Whole material was be studied.	-
F2	2	-do-	35
F3	4	50	25
F4	4	30	12
F5	4	10	08

All F<sub>1</sub> crosses were harvested to raise F<sub>2</sub> generation. From 02 F<sub>2</sub> crosses, 35 desirable plants were selected. In F<sub>3</sub>, F<sub>4</sub> and F<sub>5</sub> generations, the best progenies were selected and from each of those, one desirable plant was selected to raise next generation.

### Project 3. PRELIMINARY YIELD TRIAL

Eleven 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 11 entries of soybean in Preliminary Yield Trial at Oilseeds Research**  
**Institute, Faisalabad in Kharif 2020.**

Rank	Entry Name	Plant height (cm)	Branches /plant	Seeds /pod	Pods/plant	Seed yield (kg/ha)
1	Prover	39	3.0	2.1	66.4	2444
2	Columbus	59	2.7	2.4	63.1	2387
3	Adams	38	2.8	2.0	77.5	2121
4	E-1097	34	2.9	2.0	60.1	1989
5	<b>Faisal Soybean (C)</b>	48	2.7	2.0	61.1	1929
6	Semmes	41	2.1	1.9	72.4	1775
7	E-418	53	2.5	2.0	78.5	1522
8	E-402	32	2.1	2.0	49.4	1421
9	TN-81-77	26	1.9	1.9	42.6	1324
10	S-39-40	40	3.1	2.1	78.5	1273
11	<b>Ajmeri (C)</b>	24	1.5	1.9	40.9	495
<b>LSD at 5%</b>						334

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	30 cm
Fertilizer	60: 100:60 NPK kg/ha
Sowing date	03.08.2020

The perusal of table 1.2 indicates that Prover gave highest yield i.e, 2444 kg/ha followed by Columbus i.e, 2387 kg/ha. The maximum plant height (59 cm) was observed for Columbus. Number of branches ranged from 1.5-3.1. Maximum No. of pods per plant i.e. 78.5 was observed for E-418 and S-39-40.

**Project 4.     ADVANCED SEED YIELD TRIAL**

Eight 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, 2020 at Oilseeds Research Institute, Faisalabad.**

<b>Rank</b>	<b>Entry Name</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>	Lafe-40	44	3.0	2.1	85.8	2211
<b>2</b>	FS-10	40	1.9	1.9	75.9	2139
<b>3</b>	SH-1274	45	2.5	2.0	70.0	1964
<b>4</b>	CN-5	59	3.6	2.1	101.8	1940
<b>5</b>	<b>Faisal Soybean (C)</b>	44	3.0	2.2	76.6	1924
<b>6</b>	HS-17	56	2.4	2.1	95.8	1322
<b>7</b>	TN-81-27-32	29	2.1	2.0	57.2	965
<b>8</b>	<b>Ajmeri (C)</b>	26	2.3	2.0	57.6	529
<b>LSD at 5%</b>						313

Design	R.C.B
Plot size	5 x 1.2 m
Row spacing	30 cm
Fertilizer	60: 100: 60 NPK kg/ha
Sowing date	03.08.2020

The perusal of Table 1.3 indicates that Lafe-40 gave highest yield i.e. 2211 kg/ha. The maximum plant height (59 cm) was observed for CN-5. Number of branches ranged from 1.9-3.6. Maximum No. of pods per plant i.e. 101.8 was observed for CN-5.

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

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

**Table 1.4**  
**Performance of soybean strains at different locations in the Punjab in Kharif 2020**

<b>(Seed Yield in Kg/ha)</b>							
<b>RANK</b>	<b>Lines/Variety</b>	<b>FSD</b>	<b>MBD</b>	<b>Piplan</b>	<b>Khanpur</b>	<b>BWP</b>	<b>Average</b>
1	HM-8437	1993	2973	833	1415	1564	1756
2	HM-8468	1943	2367	958	1382	1638	1658
3	<b>Faisal Soybean (C)</b>	1734	1400	1278	1595	1610	1523
4	E-1092	1456	2167	861	1272	1443	1440

5	BSR-301	1156	2242	1111	970	1216	1339
6	SPK-16	1245	1667	764	1295	1157	1226
7	<b>Ajmeri (C)</b>	546	1100	625	472	510	651
<b>LSD 5%</b>		282	290	73	275	188	

Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	30 cm
Fertilizer	60:100:60 N:P:K kg/ha
Sowing date	03.08.2020

Perusal of the table 1.4 indicated that HM-8437 surpassed all the entries included in the trial by giving average seed yield of 1756 kg/ha.

## 6. SESAME

### Project 1. MAINTENANCE OF GERMPLASM

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

### Project 2. DEVELOPMENT OF FRESH CROSSES

Sixteen crosses were made keeping parental lines having good traits.

<u>Sr.No.</u>	<u>Crosses</u>	<u>Sr.No.</u>	<u>Crosses</u>
1.	L-7 x 17002	2.	17002 x L-7
3.	L-7 x 16005	4.	16005 x L-7
5.	17002 x 16005	6.	16005 x 17002
7.	17002 x 18002	8.	18002 x 17002
9.	19003 x 50007	10.	50007 x 19003
11.	No.56 x 18003	12.	18003 x No.56
13.	L-100 x 19003	14.	19003 x L-100
15.	18001 x 15001	16.	15001 x 18001

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> sesame generations during 2020 at Oilseeds Research Institute, Faisalabad.**

<b>Generation</b>	<b>No. of crosses/progenies studied</b>
F <sub>1</sub>	14 crosses
F <sub>2</sub>	13 crosses
F <sub>3</sub>	08 progenies
F <sub>4</sub>	07 progenies
F <sub>5</sub>	08 progenies
F <sub>6</sub>	107 progenies
F <sub>7</sub>	26 Lines

All F<sub>1</sub> crosses were harvested to raise 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> was selected to raise next generation. In F<sub>7</sub>, 26 lines were selected for seed yield evaluation.

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

Twelve 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 2020.**

Rank	Line/Variety	Days to 50% Flowering	No. of pods/plant	Branches/ Plant	Plant height (cm)	Seed yield (kg/ha)
1	<b>20001</b>	48	52	1	188	637
2	<b>20002</b>	47	60	1	181	465
3	<b>20003</b>	46	51	1	196	456
4	<b>20004</b>	50	90	1	196	450
5	<b>19001</b>	51	61	1	196	536
6	<b>18005</b>	50	63	1	208	562
7	<b>17004</b>	51	50	1	195	585
8	<b>16003</b>	52	61	1	210	646
9	<b>19004</b>	48	90	1	185	529
10	<b>19002</b>	49	63	1	192	649
11	<b>TH-6</b>	53	48	1	194	577
12	<b>TIL-18</b>	70	30	4	213	409
<b>LSD 5%</b>						68.262

Design                      R.C.B.  
 Plot size                    5 x 1.35m  
 Row spacing                45 cm  
 Fertilizer                    60:60:60 NPK kg/ha  
 Sowing date                June, 2020

The perusal of table 1.2 indicates that 19002 gave highest yield i.e, 649 kg/ha followed by 16003 i.e, 646 kg/ha. Days to 50% flowering ranged from 47-70. The maximum plant height (213cm) was observed by TIL-18 and minimum (181cm) by 20002. Number of pod/plant ranged from 30-90. 20004 and 19004 showed maximum number of pod/plant 90.

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

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

**Table 1.3 Performance of 10 entries of Advanced Sesame Yield Trial, 2020 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	17002	65	42	4	212	375
2	16005	64	42	4	229	322
3	18002	51	74	1	213	500
4	19003	50	72	1	202	605
5	17005	50	57	1	209	512
6	18001	50	64	1	202	589
7	Small Pod	45	88	1	208	510
8	87005	63	51	1	219	416
9	TH-6	53	73	1	194	421
10	TIL-18	70	38	4	207	403
					<b>LSD 5%</b>	8.552

Design R.C.B  
 Plot size 5 x 1.8 m  
 Row spacing 45 cm  
 Fertilizer 60:60:60 NPK kg/ha  
 Sowing date June, 2020

The perusal of table 1.3 indicates that 19003 gave highest yield i.e. 605 kg/ha followed by 18001 i.e. 589 kg/ha. Days to 50% flowering ranged from 45 to 70. Number of branches ranged from 1-4 and plant height 194-229. Maximum plant height was observed by 16005.

#### **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 2020**

Rank	Line/ Variety	Karore	F/Abad	Piplan	BWP	KHAN PUR	Average
1	50007	54	413	343	370	1252	487
2	18003	369	321	296	333	956	455
3	70004	81	359	481	333	1100	471
4	87006	54	296	565	407	1037	472
5	15002	171	341	389	333	1137	474
6	77011	154	339	533	241	986	450
7	86001	137	443	694	296	1119	538
8	Til-18	98	421	361	222	1163	453
9	NIAB Pearl©	57	289	324	315	986	394
10	NIAB Sesame 2016 ©	65	361	528	278	997	446
	LSD 5%	50.273	13.775	37.404	123.58	198.25	

Perusal of the table 1.4 (a) indicated that 86001 and 50007 surpassed all the entries included in the trial by giving average seed yield of 538 kg/ha and 487 kg/ha while lowest yield was taken by NIAB Pearl (394 kg/ha), whereas Til-18, the standard Variety, produced the seed yield of 453 kg/ha.

**Table 1.4 (b) Others parameters of advanced lines of Micro seed yield trial, 2020 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	50007	66	62	6	195	413
2	18003	50	46	4	210	321
3	70004	64	25	6	214	359
4	87006	64	30	1	219	296
5	15002	59	48	1	211	341
6	77011	61	46	6	225	339
7	86001	65	45	6	216	443
8	Til-18	65	22	4	216	421
9	NIAB Pearl©	70	33	4	207	289
10	NIAB Sesame 2016 ©	66	15	5	214	361
					LSD 5%	13.78



Design	R.C.B.
Plot size	5 x 1.8 m
Row spacing	45 cm
Fertilizer	60:60:60 N:P:K kg/ha
Sowing date	June, 2020

Perusal of the table 1.4 (b) Days to 50% flowering ranged from 50-70 days. Number of branches per plant ranged from 1-6 and Plant height from 195-225cm.

### **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. The data recorded are given in table 1.5.

**Table 1.5 Results of National Uniform Sesame Yield Trial conducted during 2020**

Sr No.	De-Coded Entry	Location Yield ( kg/ha)								
		ARI Quetta	ARI Tendojam	BARI Chakwal	ORI-FSD	NIAB FSD	AZRC DI Khan	AZRI BWP	NARC ISB	Mean
1	NS-260-SP-5	434	939	0	344	725	669	328	532	515
2	SG-21	413	1436	0	268	167	220	352	904	675
3	NS-103-1	403	1087	83	419	277	368	319	782	602
4	15001	355	836	24	522	656	660	358	214	457
5	SG-174	449	791	196	282	153	341	292	806	524
6	NS260SP1-2	385	806	111	439	942	809	362	494	497
7	PAPA TiL01	243	675	0	602	161	175	286	131	387
8	17003	383	946	47	613	594	436	344	149	487
9	17006	327	1177	169	640	742	824	274	176	519
10	DM-14	371	877	241	672	970	414	312	215	489
11	CMS101	292	1011	11	670	213	364	298	231	500
12	TS-5 (C)	475	1041	102	424	488	412	312	716	594
13	SG-99	437	898	0	331	136	185	319	1329	663
14	CMS-202	356	1229	41	576	717	686	298	209	534
Mean		380	982	73	486	496	469	318	492	
LSD		18	30	159	28	36	40	12	28	

Perusal of the table 1.5 indicated that entry SG-21 surpassed all the entries included in the trial by giving average seed yield of 675 kg/ha while lowest yield was taken by PAPA TiL01 (387 kg/ha), whereas TS-5, the standard Variety, produced the seed yield of 594 kg/ha.

## 7. OILSEEDS ENTOMOLOGY

### Project 1: SCREENING OF PROMISING LINES OF SESAME FOR RESISTANCE/ SUSCEPTIBILITY AGAINST INSECT PEST COMPLEX

Ten promising strains of Sesame were sown to test their behavior against mirid bug, whitefly and leaf webber/pod borer under natural conditions. The mirid bug population were recorded by randomly selecting 5 plants from each plot in three replications. The population of whitefly were recorded from 3 leaves from each of five plants per plot in three replications. Percent infestation were recorded in case of leaf webber/pod borer.

It was revealed that minimum population of mirid bug were recorded on Niab Pearl (3.49) while maximum was recorded at line 50007 (6.40). Mean population of mirid bug remained below ETL in case of other tested strains. Minimum population of whitefly was found on Til-18 (1.01) and maximum was found on line 18003 (2.01). Mean population of whitefly also remained below ETL. Maximum percent infestation of pod borer was observed on line 50007 (10.03) while minimum infestation was recorded on Niab Pearl (3.83).

Sr. No.	Variety	Whitefly/Leaf	Mirid Bug/Plant	Pod Borer (% Infestation)
1	50007	1.92	6.4	10.03
2	18003	2.01	5.73	6.68
3	70004	1.24	3.88	8.23
4	87006	1.70	4.24	6.28
5	15002	1.21	4.79	5.50
6	77011	1.32	3.68	6.86
7	86001	1.07	5.96	6.60
8	Til-18	1.01	4.36	6.99
9	Niab Sesame-2016	1.30	3.84	4.90
10	Niab Pearl	1.03	3.49	3.83
LSD @ 5%		0.30	1.02	2.61

### Project 2: SCREENING OF ELITE LINES OF *Brassica juncea* AGAINST MUSTARD APHID

Twenty four 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 17 CBJ 007 (14.76) followed by RBJ-17005 (14.02) and 17 CBJ 001 (13.36) respectively. Whereas, minimum population of mustard aphid was found on KJ-284 (10.16). 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	RBJ-16007	10.47	13	RBJ-15013	11.44
2	RBJ-17005	11.67	14	RBJ-15017	12.40
3	RBJ-17013	11.38	15	RBJ-16007	13.00
4	RBJ-17015	11.62	16	RBJ-17003	11.38
5	17 CBJ 002	12.87	17	RBJ-17005	14.02
6	17 CBJ 001	13.36	18	BRJ-1775	10.78
7	BRJ-1501	11.89	19	BRJ-1778	12.27
8	BRJ-1519	11.13	20	18 CBJ 001	11.76
9	KJ-274	12.24	21	18 CBJ 005	12.47
10	KJ-282	11.62	22	KJ-284	10.16
11	17 CBJ 007	14.76	23	KJ-294	11.47
12	Super Raya	12.78	24	Super Raya	12.07
		LSD @ 5%	3.41		

**Project.3: SCREENING OF ELITE LINES OF *Brassica napus* AGAINST MUSTARD APHID**

Twenty three 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-14017 (14.56), while minimum mustard aphid population was observed on KN-336 (8.20). 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/10 cm central shoot	Sr. #	Strain/Variety	Avg. aphid population/10 cm central shoot
1	RBN-14017	9.00	13	RBN-16014	10.98
2	RBN-16001	9.49	14	RBN-17014	11.98
3	RBN-17014	12.64	15	RBN-18006	12.22
4	RBN-18007	12.67	16	RBN-18007	13.53
5	RBN-18021	11.44	17	18 CBN 001	13.47
6	17 CBN 004	12.22	18	18 CBN 008	13.71
7	17 CBN 007	10.04	19	KN-312	11.89
8	KN-331	12.38	20	KN-327	11.58
9	KN-338	10.24	21	KN-330	12.82

10	Super Canola	14.49	22	KN-336	8.20
11	Chakwal Sarsoon	10.87	23	Sandal Canola	9.60
12	RBN-14017	14.56	-		
LSD @ 5%			3.57		

**Project 4: IDENTIFICATION OF GENETIC RESISTANCE IN *Brassica juncea* AGAINST MUSTARD APHID**

The source population was sown in the field under natural conditions. Twelve 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 5: EVALUATION OF VARIOUS PLANT EXTRACTS AS BIOPESTICIDES AGAINST MUSTARD APHID**

Three biopesticides made from Taramera, Super Canola and Super Raya were tested against mustard aphid. These biopesticides were applied @ 500 ml/acre. Biopesticide made from Super Canola gave the highest mortality (58.68%) followed by Taramera (57.51%) and Super Raya (54.46%) respectively.

Sr. No.	Insecticides	B.T	8 HAT	24 HAT
1	Taramera	925	685 (25.94 %)	393 (57.51 %)
2	Super Canola	864	510 (40.97 %)	357 (58.68 %)
3	Super Raya	795	499 (37.23 %)	362 (54.46 %)
4	Control	547	605 (-10.60 %)	665 (-21.57 %)
LSD @ 5%			209.16	118.72

**Project 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 (95.07%) followed by Lesenta (92.92%) and Acetamiprid (44.93%) after 72 hours of application.

Sr. #	Insecticides	B.T	24 HAT	48 HAT	72 HAT
1	Major	710	357 (49.72 %)	167 (76.48 %)	35 (95.07 %)
2	Lesenta	777	422 (45.69 %)	193 (75.16 %)	55 (92.92 %)
3	Acetamiprid	779	609 (21.82 %)	527 (32.35 %)	429 (44.93 %)

4	Control	788	876 (-11.17 %)	920 (-16.75 %)	989 (-25.50 %)
	LSD @ 5%		43.90	21.55	32.94

**Project 7: SCREENING OF SUNFLOWER HYBRIDS FOR THEIR RESISTANCE/SUSCEPTIBILITY AGAINST INSECT PESTS**

Twelve 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 (1.15) was found on hybrid AGSUN-5264 while maximum population (1.65) was observed on hybrid Hysun-33. The minimum population of jassid (0.87) was observed on hybrid AGSUN-5264 while maximum population was observed on hybrids FH-555 and Hysun-33 (1.28). In case of Head moth larvae, the population remained below ETL level on all tested hybrids. Minimum head moth population (0.03) per plant was observed on hybrids viz; FH-516, Hysun-33 and AGSUN-5264. Whereas, maximum population (0.10) per plant was observed in hybrids viz; FH-701, FH-555, Aguara-4, N.K. Armoni and US-666.

Sr.#	Hybrid	Whitefly/Leaf	Jassid/Leaf	Head Moth/Plant
1	FH-701	1.27	0.88	0.10
2	FH-648	1.39	1.19	0.07
3	FH-516	1.34	1.05	0.03
4	FH-675	1.51	0.99	0.07
5	FH-331	1.60	1.10	0.07
6	FH-555	1.37	1.28	0.10
7	Aguara-4	1.38	0.90	0.10
8	N.K Armoni	1.46	1.16	0.10
9	Hysun-33	1.65	1.28	0.03
10	AGSUN-5264	1.15	0.87	0.03
11	US-444	1.53	1.09	0.07
12	US-666	1.63	1.08	0.10
	LSD @ 5%	0.32	0.33	0.11

**Project 8: SCREENING OF SUNFLOWER INBRED LINES FOR THEIR RESISTANCE/SUSCEPTIBILITY AGAINST INSECT PESTS**

Twelve newly developed promising Inbred lines 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 Inbred lines, but lowest population (1.38) was found on ORI-106B while maximum population (2.01) was

observed on ORI-90B. The minimum population of jassid (0.91) was observed on ORI-90B while maximum population was observed on RL-67 (1.81). In case of Head moth larvae, the population remained below ETL level on all tested inbred lines. Minimum head moth population (0.03) per plant was observed on RL-82. Whereas, maximum population (0.17) per plant was observed in RL-86.

Sr.#	Inbred Line	Whitefly/Leaf	Jassid/Leaf	Head Moth/Plant
1	ORI-90B	2.01	0.91	0.13
2	ORI-41B	1.64	1.36	0.10
3	ORI-1B	1.47	1.34	0.10
4	ORI-92B	1.84	1.41	0.13
5	ORI-106B	1.38	1.48	0.10
6	ORI-20B	1.61	0.98	0.10
7	ORI-42B	1.78	1.48	0.13
8	RL-86	1.67	1.51	0.17
9	RL-82	1.66	1.59	0.03
10	RL-67	1.58	1.81	0.10
11	RL-114	1.48	1.49	0.07
12	V-214	1.74	1.18	0.13
LSD @ 5%		0.39	0.49	0.12

**Project 9: 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. Six undamaged plants, free from head moth larvae attack were selected for further testing during next cropping season.

**Project 10: EVALUATION OF DIFFERENT INSECTICIDES AGAINST JASSID ON**  
**SUNFLOWER**

Four insecticides; Imidacloprid, Nitenpyram, Carbosulfan and Bifenthrin were tested against Jassid. These insecticides were applied @ 250 ml/acre, 100 g/acre, 500 ml/acre and 100 ml/acre respectively. Bifenthrin gave the highest mortality (97.40%) followed by Nitenpyram (96.58%), Imidacloprid (94.69%) and Carbosulfan (82.35%) after 7 days of application.

			<b>Mortality (%)</b>			
<b>Sr. #</b>	<b>Insecticides</b>	<b>B.T</b>	<b>24 HAT</b>	<b>48 HAT</b>	<b>72 HAT</b>	<b>7 DAT</b>
1	Imidacloprid	113	79.65	84.07	87.61	94.69
2	Nitenpyram	117	49.57	65.81	89.74	96.58
3	Carbosulfan	85	60.00	72.94	88.24	82.35
4	Bifenthrin	77	88.31	96.10	83.12	97.40
5	Control	66	-6.06	-16.67	-28.79	-37.88
	LSD @ 5%		13.36	11.32	4.25	2.78

## 8. OILSEEDS PATHOLOGY

### RAPESEED AND MUSTARD

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

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

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. Phytopathology. Technical bulletin-2. Special bulletin-3, P. Marathwada Agri. University, P. Marathwada, 431402, 196-97.



**Table -2:- During 2020-21, 12 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	20	3	R	-	-
2	RBN-16014	27	4	MR	-	-
3	RBN-17014	22	3	R	-	-
4	RBN-18006	26	4	MR	-	-
5	RBN-18007	21	3	R	-	-
6	18CBN001	28	4	MR	-	-
7	18CBN008	24	3	R	-	-
8	KN-312	26	5	R	-	-
9	KN-327	28	5	MR	-	-
10	KN-330	26	4	MR		
11	KN-336	21	3	R		
12	Sandal Canola	24	3	R		

Downy mildew and powdery mildew diseases did not appear during 2020-21.

**Table -3:- During 2020-21, 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-15013	25	3	R	-	-
2	RBJ-15017	29	4	MR	-	-
3	RBJ-16007	31	5	MR	-	-
4	RBJ-17003	28	4	MR	-	-
5	RBJ-17005	48	5	MS	-	-
6	BRJ-17075	43	4	MR	-	-
7	BRJ-17078	47	5	MR	-	-
8	18CBJ001	46	5	MS	-	-
9	18CBJ005	50	5	MS	-	-
10	KJ-284	58	5	MS	-	-
11	KJ-294	55	6	S	-	-
12	Super raya	44	4	MR	-	-

Whit rust, downy mildew and powdery mildew diseases did not appear during 2020-21.

**Project 2: EVALUATION OF VARIOUS BACTERIOCIDES 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. PREVIOUS YEAR'S RESULTS (in vivo)**

<b>Treatments</b>	<b>Disease %</b>	<b>% disease decrease</b>
T1 = Kasumin (Kasugamycin) @ 2.5ml/liter of water	04	96
T2 = Casper (Kasugamycin+ Copper Oxychloride) @ 1ml/liter of water	10	90
T3 = Cobox (Copper Oxychloride) @ 2.5g/liter of water	16	84
T4 = Control	100	0

**Project 3: SCREENING OF SUNFLOWER NUSYT MATERIAL FOR ITS BEHAVIOUR AGAINST DISEASES DURING 2021.**

During spring 2021, 26 entries NUSYT inbred lines/hybrids were tested against their behavior to diseases like 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 as under

**Score                  Condition**

- 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 will be done by tooth pick method at flowering initiation stage on stem.

Data will be 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, 2021 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)	0	0
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	NUYT-1, NUYT-2, NUYT-3, NUYT-4, NUYT-5, NUYT-6, NUYT-8, NUYT-9, NUYT-11, NUYT-12, NUYT-13, NUYT-14, NUYT-15, NUYT-18, NUYT-19, NUYT-20, NUYT-21, NUYT-22, NUYT-23, NUYT-24, NUYT-25, NUYT-26,	22
D	infection covered the stem length 31cm or above	Susceptible (S)	NUYT-7, NUYT-10, NUYT-16, NUYT-17,	04
			<b>Total</b>	26

Out of 26 entries of NUSYT, 22 were moderately resistant and 04 were susceptible.

No hybrid showed highly resistant & 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 bullatin-2. Special bullatin-3, Puld. Marathwada Agri. University, Porbhari- 431402, 196-97.

**Table-7:-Behavior of Sunflower hybrids against Head Rot Disease at ORI, Faisalabad during spring, 2021 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	NUYT-1, NUYT-2, NUYT-3, NUYT-4, NUYT-5, NUYT-6, NUYT-7, NUYT-8, NUYT-9, NUYT-10, NUYT-11, NUYT-12, NUYT-13, NUYT-14, NUYT-15, NUYT-16, NUYT-17, NUYT-18, NUYT-19, NUYT-20, NUYT-21, NUYT-22, NUYT-23, NUYT-24, NUYT-25, NUYT-26,	26
			<b>Total</b>	26

Out of 26 NUYST entries, no hybrid was found highly resistant, resistant and moderately susceptible. All 26 were highly susceptible.

**Project 4: SCREENING OF SUNFLOWER LOCAL MATERIAL FOR ITS BEHAVIOUR AGAINST DISEASES DURING 2021**

During spring 2021, 12 entries local inbred lines/hybrids were tested against their behavior to diseases like 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, 2021.**

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-331, FH-675, Hysun-33,	03
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	FH-516, FH-555, FH-648, FH-701, Agri. Sun-5269, Agvara-4, NK-Armoni	07
D	infection covered the stem length 31cm or above	Susceptible (S)	VS-444, VS-666,	02
			Total	12

Out of 12 hybrids, 03 were Resistant, 07 were moderately resistant and 02 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 2021.**

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	FH-331, FH-516, FH-555, FH-648, FH-675, FH-701, Hysun-33, VS-444, VS-666, Agri. Sun-5269, Agvara-4, NK-Armoni	12
			Total	12

Out of 12 entries, no hybrid was found highly resistant, resistant and moderately susceptible and susceptible. All 12 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, 2021.**

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-41B, ORI-106B, RL-67, RL-114,	04
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	ORI-1B ORI-20B, ORI-42B, ORI-90B, ORI-92B, RL-72, RL-86, V-214,	08
D	infection covered the stem length 31cm or above	Susceptible (S)	0	0
			<b>Total</b>	12

Out of 12 entries, 04 inbred lines were resistant, 08 were moderately resistant and no inbred line was found susceptible.

**PROJECT 6: BEHAVIOR OF SESAME GERMPLASM AGAINST CHARCOAL ROT DISEASE DURING 2020 AT FAISALABAD IN SICK FIELD**

The sesame germplasm was sown at Faisalabad (sick field) to note their behavior to 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.

**Table-12:-Behavior of sesame germplasm against charcoal rot disease during 2020 at Faisalabad in sick field.**

Score	Conditions	Remarks	Varieties/lines	No. of varieties/lines
0	No	Immune	0	0

	symptoms on plants			
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)	18003, 70004, 87006, 15002, 77011, 86011, Til-18, NIAB Sesame 2016, NIAB Peal	09
7	26-50% mortality	Susceptible (S)	50007	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 7: BEHAVIOR OF SESAME GERMPLASM AGAINST CHARCOAL ROT DISEASE DURING 2020 AT Bhakkar & M. B. Din**

The sesame germplasm was sown at Bhakkar & M. B. Din to note their behavior to charcoal rot disease caused by *Macrophomina phaseolina*. 10 lines/varieties were sown. 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 13.

**Table-13:-Behavior of sesame germplasm against charcoal rot disease during 2020 at Bhakkar and M.B. Din in sick field.**

Sr. No.	Line/ Variety	Bhakkar		M.B.Din	
		Dis. %	Remarks	Dis. %	Remarks
1.	50007	24.56	MR	23.69	MR
2.	18003	23.86	MR	21.30	MR
3.	70004	26.12	S	21.05	MR
4.	87006	22.18	MR	20.08	MR
5.	15002	23.12	MR	27.29	S
6.	77011	18.19	MR	19.24	MR
7.	86001	16.21	MR	19.29	MR

8.	Til-18	26.39	S	23.37	MR
9.	NIAB Sesame 2016	22.54	MR	22.81	MR
10.	NIAB Pearl	19.74	MR	21.60	MR

**PROJECT 8: BEHAVIOR OF SESAME GERMPLASM AGAINST PHYLLODY DISEASE DURING 2020.**

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-14:-Behavior of sesame germplasm against phyllody disease during 2020.**

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)	77011, 86001, NIAB Sesame 2016, NIAB Pearl,	04
5	11-20% plants infected	Moderately resistant (MR)	50007, 18003, 70004, 87006, 15002, Til-18,	06
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. 04 were resistant & 06 was moderately resistant. No line/variety was found susceptible.



## 9. AGRONOMY

### Project 1: EFFECT OF DIFFERENT SOWING DATES ON THE YIELD OF CAMELINA

Sowing Date	Yield (Kg/ha)
1) 15 September, 2020	676
2) 30 September, 2020	703
3) 15 October, 2020	1106
4) 30 October, 2020	1089

LSD (5%): 135

Design	R.C.B
Replications	3
Plot size	9 m x 5.4 m
Row to Row spacing	30 cm
Candidate Variety	Camelina Naheel

As the table shows that 15 October sowing gave the maximum yield of 1106 Kg/ha followed by the 30 October sowing which produced yield of 1089 Kg/ha whereas 15 September sowing produced the minimum yield of 676 kg/ha.

### Project 2: EFFECT OF VARIOUS DOSES OF FERTILIZER ON ELITE SUNFLOWER HYBRIDS

Seed Yield (kg/ha)			
Fertilizer (N-P-K Kg/ha)	FH-701	FH-675	Mean
1) 119-85-62	2479	2194	2337
2) 147-85-62	2753	2452	2603
3) 124-99-62	2578	2283	2431
4) 153-99-62	2861	2551	2706
Mean	2668	2370	

LSD (5%) for Hybrids: 234

LSD (5%) for fertilizer: 238

Interaction: NS

Design	Split plot
Replications	3
/Plot size	9 m x 3 m
Row to Row spacing	75 cm

As the table shows that the treatment (153-99-62 NPK Kg/ha) gave the maximum yield of 2706 Kg/ha followed by the treatment (147-85-62 NPK Kg/ha) which produced yield of 2603

Kg/ha. Among hybrids FH-701 gave the higher yield (2668 Kg/ha) as compared to the FH-675 (2370 Kg/ha). However, interaction between fertilizer doses and hybrids was found non-significant.

## 10.OIL TECHNOLOGY

### Experiment 1:- Determination of Oil Contents of Sunflower Hybrids

**Table-1 Oil Content Results of Local Hybrids Set I**

Sr. No.	Sample ID	Oil %	Oleic Acid %	Linoleic Acid %
1	FH-856 R2	32	64	5
2	FH-851 R1	33	43	32
3	FH-857 R3	32	66	5
4	FH-860 R1	34	49	38
5	FH-849 R1	34	38	39
6	FH-851 R3	33	52	28
7	FH-858 R3	32	42	30
8	FH-852 R1	32	46	24
9	FH-859 R3	31	50	33
10	FH-859 R2	35	44	42
11	FH-849 R2	34	52	38
12	FH-857 R2	37	75	5
13	FH-852 R2	34	52	21
14	FH-850 R3	31	60	20
15	FH-849 R3	32	59	32
16	FH-856 R3	34	66	12
17	FH-858 R1	35	44	36
18	FH-848 R1	33	47	34
19	FH-858 R2	36	57	30
20	FH-847 R2	35	54	41
21	FH-851 R2	31	44	31
22	FH-852 R3	31	40	21
23	HYSUN-33 R3	33	54	46
24	HYSUN-33 R2	33	49	61
25	FH-857 R1	34	72	16
26	FH-847 R1	35	46	43
27	FH-856 R1	33	47	17
28	FH-847 R3	34	54	39
29	FH-846 R1	38	60	29
30	HYSUN-33 R1	34	65	27

31	FH-841 R1	36	20	59
32	FH-844 R3	37	29	38
33	FH-831 R2	34	64	41
34	FH-833 R3	37	27	51
35	FH-844 R3	37	36	39
36	FH-829 R2	36	45	43
37	HYSUN-33 R2	33	47	25

Thirty seven samples of locally developed sunflower hybrids set I were tested for their oil contents and fatty acid profile. Maximum oil contents 38% were observed in FH-846 R1 followed by FH-844 R3, FH-833 R3, FH-844 R3 and FH-857 R2 having oil content 37%. Minimum oil contents were estimated in FH-859 R, FH-850 R3, FH-851 R2 and FH-852 R3 (31%).

**Table-2 Oil Content Results of Local Hybrids Set II**

Sr. No.	Sample ID	Oil %	Oleic Acid %	Linoleic Acid %
1	FH-847 R3	30	55	36
2	FH-847 R1	33	57	38
3	FH-847 R2	31	63	39
4	FH-852 R1	30	52	21
5	FH-852 R2	31	67	19
6	FH-852 R3	32	55	24
7	FH-851 R1	29	44	35
8	FH-851 R3	31	58	28
9	FH-851 R2	30	47	31
10	HYSUN-33 R2	30	67	53
11	HYSUN-33 R1	31	68	30
12	HYSUN-33 R3	31	72	39
13	FH-857 R1	31	81	9
14	FH-857 R2	33	65	12
15	FH-857 R3	31	87	9
16	FH-856 R1	30	68	16
17	FH-856 R2	31	81	12
18	FH-856 R3	30	73	14
19	FH-859 R2	32	57	43

20	FH-859 R3	30	59	37
21	FH-858 R2	34	58	32
22	FH-858 R1	32	57	31
23	FH-858 R3	33	69	32
24	FH-849 R1	32	54	43
25	FH-849 R2	31	63	40
26	FH-849 R3	32	62	38
27	FH-829 R2	34	61	38
28	FH-833 R3	35	64	22
29	FH-844 R1	36	62	17
30	FH-850 R3	29	62	18
31	FH-860 R1	33	64	39
32	FH-848 R1	31	52	33
33	FH-331 R2	32	55	29

Thirty three samples of locally developed sunflower hybrids set II were tested for their oil contents and fatty acid profile. Maximum oil contents 36% were observed in FH-844 R1 followed by FH-833 R3 having oil content 35%. Minimum oil contents were estimated in FH-850 R3 and FH-851 R1 (29%).

**Experiment 2:- Determination of Oil Contents of National Uniform Sunflower Yield Trial**  
**Table-3 Oil Content Results of National Uniform Sunflower Yield Trial**

Sr. No.	Sample ID	Oil %	Oleic Acid %	Linoleic Acid %
1	R1 E1	41.85	36.59	17.00
2	R1 E15	42.05	49.30	27.37
3	R1 E13	40.14	38.13	54.67
4	R1 E6	43.85	34.92	19.05
5	R1 E5	39.56	58.47	26.59
6	R1 E4	44.72	27.13	39.20
7	R1 E7	39.41	15.66	45.89
8	R1 E19	40.66	19.63	35.13
9	R1 E2	38.19	12.51	62.30
10	R1 E9	40.83	57.27	7.30
11	R1 E11	38.27	49.20	41.06
12	R1 E20	40.08	38.72	14.26

13	R1 E12	42.06	34.88	44.13
14	R1 E10	42.08	50.19	5.46
15	R1 E3	41.25	13.62	57.33
16	R1 E26	43.43	40.01	24.39
17	R1 E22	40	53.90	7.84
18	R1 E16	42.68	36.34	35.13
19	R1 E23	38.75	32.63	41.24
20	R1 E17	42.11	23.81	32.21
21	R1 E18	41.70	23.72	27.40
22	R1 E21	36.54	23.93	68.52
23	R1 E8	41.13	28.67	17.78
24	R1 E25	42.82	35.07	34.21
25	R1 E24	46.43	25.98	43.90
26	R1 E14	42.28	35.60	44.65
27	R2 E5	43.98	41.26	21.49
28	R2 E17	37.94	44.98	51.91
29	R2 E2	38.93	36.47	48.43
30	R2 E7	41.28	55.73	13.68
31	R2 E10	40.25	50.32	11.92
32	R2 E8	41.77	35.21	9.70
33	R2 E1	40.84	13.39	13.60
34	R2 E15	37.31	71.08	12.08
35	R2 E26	37.24	26.19	36.25
36	R2 E25	41.75	12.55	65.73
37	R2 E21	39.73	30.67	63.64
38	R2 E20	36.16	37.53	26.44
39	R2 E6	40.41	22.14	24.84
40	R2 E13	35.07	36.23	43.99
41	R2 E18	39.98	38.91	19.97
42	R2 E19	35.63	45.01	36.70
43	R2 E11	36.86	30.54	35.98
44	R2 E16	41.02	27.25	46.05
45	R2 E4	43.61	38.26	30.14
46	R2 E22	39.95	19.68	40.20

47	R2 E3	38.13	21.68	46.64
48	R2 E24	42.43	21.23	44.95
49	R2 E14	40.91	40.76	42.88
50	R2 E23	35.98	37.01	49.76
51	R2 E9	38.46	49.91	24.54
52	R2 E12	38.73	31.96	58.21
53	R3 E1	39.96	17.40	44.94
54	R3 E24	40.31	17.91	66.86
55	R3 E19	36.13	28.38	67.45
56	R3 E2	38.74	15.78	76.76
57	R3 E9	39.95	35.76	39.51
58	R3 E26	39.17	37.30	12.19
59	R3 E17	36.82	46.67	55.89
60	R3 E15	40.44	33.11	19.61
61	R3 E21	39.66	26.70	46.09
62	R3 E6	41.44	45.35	25.55
63	R3 E23	38.05	25.33	49.38
64	R3 E20	36.77	32.13	42.39
65	R3 E22	37.67	25.78	56.34
66	R3 E14	39.27	37.73	52.38
67	R3 E16	39.42	37.69	55.91
68	R3 E4	42.12	40.31	30.37
69	R3 E12	38.65	44.62	15.63
70	R3 E18	41.60	20.67	52.17
71	R3 E11	36.82	39.99	60.80
72	R3 E7	42.37	23.80	54
73	R3 E8	41.93	30.98	33.50
74	R3 E5	38.84	25.98	43.78
75	R3 E10	38.98	43.40	26.71
76	R3 E13	37.45	38.92	55.57

Seventy six samples of sunflower National Uniform Seed Yield Trial hybrids were tested for their oil contents and fatty acid profile. Maximum oil contents 46.43% were observed in R1 E24 followed by R1 E4 having oil content 44.72%. Minimum oil contents were estimated in R2 E13 (35.07%).

**Experiment 3:- Determination of Oil Contents of Sunflower Inbred lines****Table-4 Oil Content Results of Sunflower Inbred Lines**

<b>Sr. No.</b>	<b>Sample ID</b>	<b>Oil %</b>	<b>Oleic Acid %</b>	<b>Linoleic Acid %</b>
1	ORI96B P2	34.61	57.22	43.82
2	ORI96A P2	39.61	46.9	54.36
3	ORI97A P1	44.52	50.01	44.59
4	ORI97B P1	40.46	34.52	35.16
5	ORI99A P5	41.42	60.5	35.18
6	ORI99B P5	41.39	55.22	15.79
7	ORI98B P2	40.4	34.08	46.51
8	ORI98A P2	38.96	43.24	58.19
9	ORI100A P4	37.62	41.12	41.48
10	ORI100B P4	36.70	47.94	35.35
11	ORI95A P5	32.98	42.95	39.47
12	ORI91A	37.82	41.63	48.00
13	ORI91B	36.94	32.97	26.28
14	ORI94A	39.21	56.24	27.91
15	ORI94B	37.15	55.28	40.46
16	ORI93A	36.39	47.04	50.61
17	ORI93B	34.89	46.17	44.90
18	ORI92B	39.24	64.61	35.55
19	ORI92A	32.79	64.74	16.99
20	ORI1A	40.04	37.89	20.04
21	ORI1B	39.30	46.65	21.63
22	ORI2B	31.85	51.40	47.91
23	ORI2A	33.03	56.92	43.10
24	ORI4B	34.40	36.22	58.10
25	ORI4A	36.37	36.36	57.72
26	ORI6A	37.37	56.74	36.13
27	ORI6B	37.63	49.33	42.07
28	ORI8A	33.79	65.19	28.95
29	ORI8B	34.81	24.72	23.92
30	ORI7B	40.63	24.20	75.09
31	ORI7A	39.96	33.43	67.77



32	ORI10A	38.86	39.48	27.66
33	ORI10B	40.78	25.92	68.97
34	ORI11B	40.51	18.94	51.81
35	ORI11B	41.45	24.45	68.65
36	ORI12B	36.08	42.37	26.68
37	ORI12A	35.25	40.17	37.23
38	ORI16A	39.10	68.56	7.55
39	ORI16B	38.08	45.86	10.50
40	ORI18B	37.81	19.26	66.49
41	RL-6	37.89	47.15	17.64
42	RL-7	38.77	35.67	31.15
43	RL-8	33.49	35.39	41.18
44	RL-9	38.07	24.22	30.65
45	RL-10	38.73	46.91	15.21
6	RL-14	38.43	72.30	9.70
47	RL-15	31.84	69.04	13.13
48	RL-16	34.15	32.07	52.42
49	RL-17	36.67	48.32	37.70
50	RL-20	34.51	56.45	36.33
51	RL-25	34.20	26.82	7.89
52	RL-26	35.17	55.61	24.25
53	RL-35	36.14	67.54	16.61
54	RL-36	35.66	65.56	29.62
55	RL-41	37.32	63.43	25.23
56	RL-42	30.12	50.06	44.22
57	RL-44	37.30	59.63	38.05
58	RL-45	44.44	31.41	55.91
59	RL-46	33.15	50.76	20.22
60	RL-47	37.97	44.39	14.54

Sixty samples of sunflower inbred lines were tested for their oil contents and fatty acid profile. Maximum oil contents 44.52% were observed in ORI97A P1 followed by RL-45 having oil content 44.44%. Minimum oil contents were estimated in RL-42 (30.12%).

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

**Table-5 Oil Content Results of Rapeseed (*Brassica napus*) Lines**

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	MYT E1	40.87	17	PYT E5	41.62
2	MYT E2	40.70	18	PYT E6	42.56
3	MYT E3	39.84	19	PYT E7	41.39
4	MYT E4	39.57	20	PYT E8	40.72
5	MYT E5	38.81	21	PYT E9	43.84
6	MYT E6	40.02	22	AYT E1	38.58
7	MYT E7	39.97	23	AYT E2	38.62
8	MYT E8	40.66	24	AYT E3	36.79
9	MYT E9	41.08	25	AYT E4	39.61
10	MYT E10	41.33	26	AYT E5	43.08
11	MYT E11	42.08	27	AYT E6	39.62
12	MYT E12	40.74	28	AYT E7	40.47
13	PYT E1	37.07	29	AYT E8	40.64
14	PYT E2	38.41	30	AYT E9	40.46
15	PYT E3	40.37	31	AYT E10	42.10
16	PYT E4	40.12			

Thirty one samples of Rapeseed (*Brassica napus*) lines were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 43.84% were observed in PYT E9 followed by RBN AYT E5 having oil content 43.08%. Minimum oil contents were seen in RBN PYT E1 (37.07%).

**Table-6 Oil Content Results of Mustard (*Brassica juncea*) Lines**

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	PYT E1	34.87	19	AYT E2	35.69
2	PYT E2	35.28	20	AYT E3	35.56
3	PYT E3	36.80	21	AYT E4	35.49
4	PYT E4	24.08	22	AYT E5	35.78
5	PYT E5	32.86	23	AYT E6	36.92
6	PYT E6	33.59	24	MYT E1	35.02
7	PYT E7	36.18	25	MYT E2	36.02
8	PYT E8	34.21	26	MYT E3	36.44
9	PYT E9	36.52	27	MYT E4	33.64
10	PYT E10	34.14	28	MYT E5	33.23
11	PYT E11	35.42	29	MYT E6	36.57
12	PYT E12	33.71	30	MYT E7	35.49
13	PYT E13	36.78	31	MYT E8	40.35
14	PYT E14	36.51	32	MYT E9	39.15
15	PYT E15	37.55	33	MYT E10	39.49
16	PYT E16	38.27	34	MYT E11	40.74
17	PYT E17	34.62	35	MYT E12	38.87
18	AYT E1	37.02			

Thirty five samples of Mustard (*Brassica juncea*) were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 40.74% were observed in MYT E11 followed by MYT E8 having oil content 40.35%. Minimum oil contents were determined in PYT E4 (24.08%).

**Experiment 5:- DETERMINATION OF QUALITY TRAITS OF PROMISING LINES/VARIETIES OF RAPESEED AND MUSTARD (RABI GROUP)**

**Table-7 Quality Traits of Rapeseed (*Brassica napus*) Lines**

Sr. No.	Sample ID	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Glucosinolates
1	MYT E1	50.04	14.14	6.32	1.89	157.84
2	MYT E2	50.13	15.23	7.40	2.27	170.88
3	MYT E3	64.51	17.64	6.74	3.60	162.92
4	MYT E4	51.38	15.51	6.90	2.44	155.87

5	MYT E5	59.36	17.78	7.02	2.83	165.47
6	MYT E6	36.57	12.11	5.86	1.54	187.27
7	MYT E7	39.57	12.65	5.65	1.36	176.77
8	MYT E8	55.21	15.73	6.70	2.69	148.55
9	MYT E9	34.03	10.56	5.86	1.28	175.24
10	MYT E10	59.33	15.23	6.09	3.00	159.42
11	MYT E11	55.24	14.69	6.32	2.63	143.47
12	MYT E12	50.23	14.75	6.45	1.74	139.49
13	PYT E1	65.17	20.95	7.83	3.11	156.03
14	PYT E2	66.54	20.98	7.79	3.03	159.96
15	PYT E3	41.88	14.78	6.41	1.06	192.05
16	PYT E4	43.60	13.92	6.17	1.50	171.95
17	PYT E5	40.13	11.83	5.35	1.26	151.11
18	PYT E6	41.14	11.64	5.20	1.15	149.23
19	PYT E7	41.81	11.48	5.09	1.44	154.22
20	PYT E8	39.07	12.74	5.91	1.30	162.88
21	PYT E9	45.78	14.75	7.82	1.08	173.05
22	AYT E1	63.75	18.47	7.08	3.51	156.09
23	AYT E2	57.84	17.397	6.88	2.55	141.21
24	AYT E3	61.69	18.49	6.99	3.19	156.27
25	AYT E4	63.40	17.92	6.98	3.25	152.27
26	AYT E5	51.56	15.38	7.78	2.05	148.79
27	AYT E6	51.18	16.15	7.35	2.48	158.56
28	AYT E7	60.06	17.11	7.01	2.87	13458
29	AYT E8	55.18	15.86	7.21	2.95	150.39
30	AYT E9	64.01	17.35	7.23	3.19	155.45
31	AYT E10	61.28	16.73	7.17	2.88	131.29

Thirty one samples of Rapeseed (*Brassica napus*) lines were tested for their fatty acid profile through NIR. Maximum Erucic acid was observed 3.60% in MYT E3 and minimum Erucic acid 1.06% was observed in PYT E3. Erucic acid of 12 lines/entries was observed less than 2%.

**Table-8 Quality Traits of Mustard (*Brassica juncea*) Lines**

Sr. No.	Sample ID	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Glucosinolates
1	PYT E1	43.09	20.50	8.17	0.61	182.46
2	PYT E2	29.89	17.93	7.63	23.25	172.20
3	PYT E3	32.29	17.58	8.44	0.10	172.87
4	PYT E4	33.48	19.23	7.41	0.03	180.79
5	PYT E5	33.38	18.55	7.42	0.39	184
6	PYT E6	39.74	21.27	8.07	0.44	199.69
7	PYT E7	35.58	19.48	8.95	0.67	197.98
8	PYT E8	45.57	22.95	8.71	1.27	204.49
9	PYT E9	44.46	20.62	9.21	1.43	207.78
10	PYT E10	34.95	19.86	8.87	0.48	214.84
11	PYT E11	30.10	17.28	8.05	22.73	202.44
12	PYT E12	23.08	16.13	6.92	0.04	212.70
13	PYT E13	25.31	15.33	8.23	28.97	215.99
14	PYT E14	29.14	15.92	8.55	24.74	201.36
15	PYT E15	28.85	16.79	9.07	24.14	197.60
16	PYT E16	28.36	15.46	8.81	25.21	213.19
17	PYT E17	28.86	17.13	7.70	25.36	198.11
18	AYT E1	31.96	16.61	8.02	23.86	188.84
19	AYT E2	33.15	18.31	8.68	0.55	205.15
20	AYT E3	31.03	17.46	8.51	0.72	203.80
21	AYT E4	27.94	16.14	7.95	0.99	200.54
22	AYT E5	33.49	19.07	9.14	1.02	194.70
23	AYT E6	22.06	15.28	8.43	33	196.82
24	MYT E1	28.68	18.52	8.41	0.07	196.21
25	MYT E2	25.20	16.98	8.49	28.17	189.32
26	MYT E3	27.67	16.81	8.55	0.16	198.44
27	MYT E4	35.25	18.79	7.79	1.10	206.25
28	MYT E5	33.25	18.94	8.28	1.25	213.47
29	MYT E6	31.04	16.91	8.65	0.64	217.60
30	MYT E7	28.72	16.83	8.37	0.74	210.65
31	MYT E8	32.65	15.93	8.33	0.94	200.28
32	MYT E9	29.26	16.05	8.53	0.74	207.18
33	MYT E10	31.37	15.20	7.98	0.69	217.66
34	MYT E11	31.67	14.76	8.05	0.37	207.00
35	MYT E12	29.37	15.14	8.47	0.40	202.88

Thirty five samples of Mustard (*Brassica juncea*) lines were tested for their fatty acid profile through NIR. Maximum Erucic acid was observed 33% in AYT E6 and minimum Erucic acid 0.03% was observed in PYT E4. Erucic acid of 25 lines/entries was observed less than 2%.

**Experiment 6:- DETERMINATION OF OIL CONTENT OF PROMISING LINES OF SUMMER MUSTARD**

**Table-9 Oil Content Results of Summer Mustard (Zaid Kharif Brassica) Lines**

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	ZKB PYT E1	38.84	16	ZKB PYT E16	39.13
2	ZKB PYT E2	37.82	17	ZKB PYT E17	37.18
3	ZKB PYT E3	38.61	18	ZKB AYT E1	35.40
4	ZKB PYT E4	38.43	19	ZKB AYT E2	38.14
5	ZKB PYT E5	37.98	20	ZKB AYT E3	36.36
6	ZKB PYT E6	38.91	21	ZKB AYT E4	38.20
7	ZKB PYT E7	37.72	22	ZKB AYT E5	40.55
8	ZKB PYT E8	37.33	23	ZKB AYT E6	37.64
9	ZKB PYT E9	36.90	24	ZKB AYT E7	39.24
10	ZKB PYT E10	38.49	25	ZKB MYT E1	40.91
11	ZKB PYT E11	39.37	26	ZKB MYT E2	39.61
12	ZKB PYT E12	37.99	27	ZKB MYT E3	41.09
13	ZKB PYT E13	40.21	28	ZKB MYT E4	41.18
14	ZKB PYT E14	39.71	29	ZKB MYT E5	37.65
15	ZKB PYT E15	39.51			

Twenty nine samples of Zaid Kharif Brassica were tested for their oil contents. Maximum oil contents 41.18% were observed in ZKB MYT E4 followed by ZKB MYT E3 having oil content 41.09%. Minimum oil contents were determined in ZKB AYT E1 (35.40%).

**Experiment 7:- DETERMINATION OF QUALITY TRAITS OF PROMISING LINES OF SUMMER MUSTARD**

**Table-10 Quality Traits of Summer Mustard (Zaid Kharif Brassica) Lines**

Sr. No.	Sample ID	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Glucosinolates
1	ZKB PYT E1	24.81	17.50	10.82	26.52	166.75
2	ZKB PYT E2	24.97	17.83	10.56	26.18	180.12
3	ZKB PYT E3	19.98	16.21	11	31.10	190.33
4	ZKB PYT E4	25.52	17.64	10.92	25.40	188.18
5	ZKB PYT E5	29.29	19.00	11.04	21.13	179.43
6	ZKB PYT E6	25.90	17.36	10.62	0.33	190.09
7	ZKB PYT E7	24.84	16.98	10.35	0.44	194.36
8	ZKB PYT E8	23.91	16.90	10.30	0.07	183.09
9	ZKB PYT E9	24.44	17.40	10.21	0.35	206.40
10	ZKB PYT E10	25.13	17.37	10.96	0.53	198.93
11	ZKB PYT E11	28.34	17.53	11.41	0.62	199.78

12	ZKB PYT E12	26.94	17.24	10.44	0.56	178.71
13	ZKB PYT E13	20.93	14.60	9.53	33.37	141.60
14	ZKB PYT E14	23.93	16.94	10.40	28.53	172.61
15	ZKB PYT E15	32.58	19.82	11.86	0.38	169.39
16	ZKB PYT E16	22.03	16.08	10.44	30.14	180.39
17	ZKB PYT E17	24.53	17.62	10.48	0.20	181.14
18	ZKB AYT E1	27.29	18.80	9.64	0.27	187.38
19	ZKB AYT E2	23.31	16.31	10	0.11	184.45
20	ZKB AYT E3	24.56	18.29	10.51	0.24	165.26
21	ZKB AYT E4	19.44	16.64	10.17	32.27	175.88
22	ZKB AYT E5	23.81	15.82	9.74	29.99	162.36
23	ZKB AYT E6	26.43	17.40	9.51	26.65	158.35
24	ZKB AYT E7	30.31	18.73	11.08	20.57	159.41
25	ZKB MYT E1	19.30	15.63	10.35	32.60	161.14
26	ZKB MYT E2	18.72	15.62	10.26	33.53	162.61
27	ZKB MYT E3	21.68	15.84	10.62	30.58	163.11
28	ZKB MYT E4	22.03	15.38	9.53	31.93	155.23
29	ZKB MYT E5	30.95	18.87	9.94	0.26	176.85

Twenty nine samples of Summer Mustard lines were tested for their fatty acid profile through NIR. Maximum Erucic acid was observed 33.53% in MYT E2 and minimum Erucic acid 0.07% was observed in PYT E8. Erucic acid of 13 lines/entries was observed less than 2%.

#### **Experiment 8:-Determination of Oil Contents of Promising Lines of Soybean**

**Table-11 Oil Content Results of Soybean Lines**

<b>Sr. No.</b>	<b>Sample ID</b>	<b>Oil %</b>	<b>Sr. No.</b>	<b>Sample ID</b>	<b>Oil %</b>
1	CARLIL	18.50	14	SOYBEAN LAKOTA	21.33
2	FS 85	21.29	15	E418	20.89
3	BOSSIER	18.65	16	SEMMES	21.92
4	CRANFORDD	19.12	17	BSR301	21.39
5	P976	17.92	18	COLUMBUS	20.66
6	T418	20.27	19	ADAMS	20.28
7	KWOWGYO	20.94	20	LAFE40	20.36
8	HM8437	24.62	21	E1092	20.73
9	SPK16	20.77	22	FS60	19.26
10	PROVER	18.84	23	L16	19.43
11	DGS16	18.33	24	SS183	17.89
12	HM8468	21.38	25	MS4	19.84
13	952	17.98			

Twenty five samples of advance lines of Soybean were tested for their oil contents and fatty acid profile through NIR. Maximum oil contents 24.62% were observed in HM-8437 followed by SEMMES having oil content 21.92%. Minimum oil contents were estimated in SS183 (17.89%).