ANNUAL TECHNICAL REPORT (2021-22)

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INTRODUCTION

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, 2021-22) 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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RAPESEED AND MUSTARD

A. MUSTARD

Project 1. DEVELOPMENT OF FRESH CROSSES

Twenty crosses were made keeping 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_1 generation.

Sr. No.	Crosses		
1.	ZBJ-08001	x	AARI Canola
2.	ZBJ-08003	x	AARI Canola
3.	ZBJ-08005	x	AARI Canola
4.	ZBJ-20016	x	AARI Canola
5.	ZBJ-20020	x	AARI Canola
6.	ZBJ-20014-k	x	AARI Canola
7.	RBJ-18002	x	AARI Canola
8.	RBJ-20005	x	AARI Canola
9.	RBJ-20007	x	AARI Canola
10.	RBJ-20009	x	AARI Canola
11.	RBJ-200023	x	AARI Canola
12.	RBJ-19003	x	AARI Canola
13.	BRJ-1775	x	AARI Canola
14.	BRJ-1778	x	AARI Canola
15.	KJ-284	x	AARI Canola
16.	KJ-294	x	AARI Canola
17.	RBJ -21009	x	AARI Canola
18.	RBJ -21010	x	AARI Canola
19.	ZBJ -21009	x	AARI Canola
20.	ZBJ -21016	x	AARI Canola

Project 2. STUDY OF FILIAL GENERATIONS

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

Table 1.1 (a)

Crosses/progenies studied and selections made in F_1 to F_6 Summer Mustard generations during 2021-22 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_1	30	Whole material	-	-
F_2	24	-do-	128	-
F_3	39	233	82	-
F_4	16	190	43	-
F_5	24	113	42	-
F_6	9	55	18	04
F_7	6	31	--	11

All F_1 crosses were harvested to raise F_2 generation. From 24 F_2 crosses, 128 desirable plants were selected. In F_3 to F_5 generations, the best progenies were selected and from each of those, one desirable plant was selected to raise next generation. In F_6, 04 lines and from F_7 ,11 lines were selected for seed yield evaluation in preliminary yield trial.

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

Thirteen lines of *B. juncea* were tested along with the standard variety "AARI Canola" and "Super Raya". The data collected on seed yield and other agronomic traits are given in Table 1.2.

Table 1.2

Performance of 15 entries of B. *juncea* in Preliminary Yield Trial at Oilseeds Research Institute, Faisalabad during Zaid Kharif 2021-22.

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-21008**	47	142	232	8	5.2	14	3.3	37	1963
2	**ZBJ-21007**	45	140	243	9	4.0	11	3.3	36	1926
3	**ZBJ-21001**	45	140	251	13	5.8	17	2.5	37	1852
4	**ZBJ-21013**	45	140	195	10	4.7	12	3.1	38	1830
5	**ZBJ-21012**	50	144	265	9	5.2	12	3.1	34	1770
6	**RBJ-21015**	54	144	284	13	6.1	10	3.3	37	1763
7	**RBJ-21017**	49	143	243	11	4.9	15	3.3	34	1630
8	**ZBJ-21009**	47	142	208	10	5.3	15	2.9	36	1615
9	**RBJ-21011**	60	150	267	11	5.2	11	2.5	35	1600
10	**RBJ-21004**	54	147	276	9	5.8	11	3.4	33	1526
11	**RBJ-21010**	54	147	265	9	5.2	10	2.7	30	1496
12	**ZBJ-21016**	44	138	222	8	5.0	12	3.2	34	1311
13	**Super Raya (C)**	54	148	254	9	7.9	14	3.2	33	1230
14	**AARI Canola (C)**	54	144	222	10	4.6	19	2.9	35	1170
15	**RBJ-21009**	57	149	279	12	5.2	15	3.3	31	926
LSD 5%										232

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	18-09-2021

The perusal of table 1.2 indicates that ZBJ-21008 gave highest yield i.e, 1963 kg/ha followed by ZBJ-21007 i.e, 1926 kg/ha. Days to flowering ranged from 44-60 and days to maturity 138-150. Plant height ranges from 195-284cm. Number of branches ranged from 8-13. Maximum silique

length was observed by Super raya (C). 1000 grain weight ranged from 2.5- 3.4g. Oil content (%) ranged from 30 to 38. Max oil content % were found in ZBJ-21013.

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

Twelve lines of *B. juncea* were evaluated along with "AARI Canola" and "Super Raya". The results are presented in table 1.3

Table 1.3
Performance of 14 entries of Advanced Seed Yield Trial, 2021-22 at Oilseeds Research Institute, Faisalabad.

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-20002-K**	45	141	247	8	4.8	13	3.1	37	2370
2	**ZBJ-20014-K**	46	142	252	8	4.5	14	3.0	35	2272
3	**ZBJ-20018-K**	48	143	233	8	5.1	14	3.0	36	2123
4	**ZBJ-20007**	57	146	257	8	4.7	15	3.6	38	2049
5	**Super Raya (C)**	55	149	223	7	5.4	14	4.1	36	2049
6	**RBJ-18002**	58	147	226	8	5.9	13	3.7	34	2035
7	**ZBJ-20020**	47	142	259	7	5.2	15	2.8	36	1990
8	**ZBJ-20016**	48	143	253	8	5.1	15	3.4	38	1956
9	**RBJ-20007**	48	143	220	8	5.3	14	3.7	36	1891
10	**RBJ-20022**	59	151	264	8	5.3	15	4.0	37	1605
11	**RBJ-20009**	49	144	240	8	4.6	11	3.4	34	1442
12	**RBJ-20005**	62	151	249	8	5.5	14	3.3	33	1407
13	**AARI Canola (C)**	46	141	208	6	4.8	16	3.4	35	1146
14	**RBJ-20023**	59	151	286	8	5.4	13	4.2	35	988
LSD 5%										**262**

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	18.09.2021

The perusal of Table 1.3 indicates that gave highest ZBJ-20002-K yield i.e. 2370 kg/ha. Days to flowering ranged from 45 to 62. Days to maturity ranged from 141 to 151. Number of branches ranged from 6-8 and plant height 208-286cm. 1000 seed weight ranged from 3.0–4.2. Maximum oil contents (38%) were observed by ZBJ-20016 and ZBJ-20007.

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

Yield performances of four lines of B. *juncea* were tested along with check AARI-Canola 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 2021-22

Rank	Entry Name	Faisalabad	Karor	Khanpur	ORS BWP	Piplan	Average kg/hac
1	**ZBJ-17019**	1353	2917	2522	833	1833	1892
2	**ZBJ-19008**	1494	1486	3161	1389	1924	1891
3	**ZBJ-17008**	1522	2222	3153	833	1583	1863
4	**ZBJ-18008**	1317	894	2461	1444	1777	1579
5	**AARI - Canola (C)**	800	1486	1933	1389	1944	1510
	LSD 5%	230	255	377	170	207	

Perusal of the table 1.4 (a) indicated that ZBJ-17019 surpassed all the entries included in the trial by giving average seed yield of 1892 kg/ha followed by ZBJ-19008 (1891 kg/ha) While lowest yield was obtained by AARI - Canola (C) with yield performance of 1510 kg/ha.

Table 1.4 (b)
Other parameters of advanced lines of Micro seed Yield Trial, 2021-22 recorded at Oilseed Research Institute, Faisalabad.

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-17008**	55	142	238	9	5.7	13	3.49	38	1522
2	**ZBJ-17019**	53	145	242	6	5.8	16	3.21	38	1353
3	**ZBJ-18008**	58	146	252	9	5.6	16	3.48	40	1317
4	**ZBJ-19008**	52	146	244	8	5.5	14	3.48	37	1494
5	**AARI-Canola (C)**	55	146	213	8	5.7	15	3.34	37	800
LSD 5 %										**232**

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	18.09.2021

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 52-58 days and days to maturity 142–146. Number of branches per plant ranged from 6-9. 1000 seed weight ranged from 3.21-3.49g. Oil content ranged from 37-40%.

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

Yield performances of nine lines of B. *juncea* were tested along with check Super raya under different agro-climatic conditions of the province. The results obtained from eight locations are given in table 1.5 (a) and 1.5 (b).

Table 1.5 (a)
Performance of ten *B. juncea* strains at different locations in the Punjab during Rabi 2021-22

Rank	Entry Name	FSD	Karor	K/pur	ORS, B/pur	Piplan	RARI B/pur	Chkwl	F/jang	Seed yield (kg/ha)
1	**RBJ-15017**	1722	1167	2052	622	1620	2130	2889	1276	1685
2	**KL326**	1485	1444	2378	733	1370	1593	3012	767	1598
3	**RBJ-16007**	1707	1667	1441	667	1583	1630	2519	1061	1534
4	**RBJ-17003**	1130	2278	1454	589	1713	1463	2617	919	1520
5	**RBJ-16012**	1259	1481	1456	622	1824	1796	2716	974	1516
6	**OBJ-160**	1307	1519	1530	778	1944	1685	2525	737	1503
7	**BRJ-1669**	1307	1741	1526	778	1806	1037	2957	799	1494
8	**KJ340**	1148	1259	1900	733	1500	1574	2901	785	1475
9	**Super Raya (C)**	1248	1370	1674	667	1824	1704	2642	540	1459
10	**19CBJ005**	944	1111	1685	889	1713	1315	2481	913	1381
	LSD 5%	209	103	300	209	188	259	297	89	209.25

Perusal of the table 1.5 (a) indicated that RBJ-15017surpassed all the entries included in the trial by giving average seed yield of 1685 kg/ha followed by KL326 (1598 kg/ha). While lowest yield was obtained by 19CBJ005 with yield performance of **1381**kg/ha.

Table 1.5 (b)
Other parameters of advanced lines of Micro seed Yield Trial, 2021-22 recorded at Oilseed Research Institute, Faisalabad.

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	**RBJ-15017**	44	152	248	8	4.4	15	4.44	36	1722
2	**RBJ-16007**	48	154	254	8	5.3	15	3.79	34	1707
3	**KJ-326**	51	157	238	10	4.6	16	4.88	37	1485
4	**BRJ-1669**	49	152	239	9	5.2	15	4.68	37	1307
5	**OBJ-160**	52	157	214	9	4.7	15	4.11	36	1307
6	**RBJ-16012**	46	156	231	10	4.6	15	3.24	36	1259
7	**Super Raya (C)**	50	156	216	8	4.5	14	3.75	36	1248
8	**KJ-340**	49	155	248	9	4.3	14	4.17	34	1148
9	**RBJ-17003**	50	157	237	8	4.1	11	3.58	33	1130
10	**19 CBJ 005**	50	157	214	10	4.4	15	3.43	34	944
LSD 5%										209

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	18.09.2021

Perusal of the table 1.5(b) indicated that RBJ-15017 surpassed all the entries included in the trial by giving average seed yield of 1722 kg/ha followed by RBJ-16007 (1707 kg/ha) While lowest yield was obtained by 19 CBJ 005 with yield performance of 944 kg/ha.

Project 7. 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 1.6.

Table 1.6 Seed Yield (kg/ha) in National Uniform Yield Trial (NUYT) of Mustard for 2021-22 Cropping Season

S.r No	Entry Name	Location wise Mean Yield															Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	ORI-FSD	Quettta	k.pur	
1	SD-40S50 (C)	2339	1517	1607	2528	525	2811	1509	2063	1931	1044	555	1543	1700	1069	1683	1776
2	S-4550	2089	1493	1420	2417	1120	2375	1508	1546	2156	747	650	1408	1710	896	1592	1654
3	T-5522	2042	1480	1867	2805	1225	2652	1150	1469	1864	595	719	1305	1823	740	1667	1690
4	S-3550	1611	1454	1550	2000	1570	2415	2000	1524	2122	1070	748	1528	1634	1049	1915	1668
5	RBJ-15013	1681	2112	2607	2528	1103	2256	1667	2134	2134	1075	530	673	1748	940	1542	1823
6	FBS-711	1961	1191	1680	2750	1140	2217	1817	1705	2200	1269	730	613	1880	638	1484	1688
7	45M47	1789	1410	1974	2028	1134	1861	2175	2179	1948	524	550	895	1587	845	1634	1665
8	T-5533	1839	1527	1827	2027	1384	2098	1492	1975	2049	555	607	836	1965	812	1875	1674
9	Sahara Mustard	1839	1257	2440	2500	1612	2138	1825	1587	1989	679	645	1554	1955	621	1900	1725
10	Pasban-1	1753	1734	1720	2472	828	2177	1425	1773	1942	420	710	907	1130	860	1834	1627
11	81A81	2406	1450	1500	2361	1185	2415	1763	1618	2432	435	705	1213	2031	739	1733	1763
12	HMU-1620A	2772	1200	1474	1694	972	1742	1800	2006	2156	321	680	1448	1445	914	1650	1628
13	TSA95-752	3434	1334	2254	1611	904	1425	1734	1353	2017	559	618	663	1719	1031	1742	1689
14	MK-666	2489	1230	2034	2139	1060	2415	1733	1718	2277	450	525	970	2144	914	1709	1777
15	RA-7242	2039	1708	1920	2639	788	2692	1634	1784	2096	488	622	1080	1681	794	2075	1807
16	16GR33	1911	1185	1647	2167	962	1465	1242	1684	2311	611	645	951	1606	948	1717	1544
17	RA-3051	2028	1479	1350	2122	1358	2178	1625	1839	2202	348	686	693	1615	867	1967	1663
18	MS-555	2064	1563	2167	2500	912	1901	1708	1829	2278	1153	527	788	1493	775	1575	1698
19	MS-7860	2606	1534	1900	2278	863	1821	1509	1978	2356	484	527	863	1719	961	1617	1734
20	M-11	1939	1425	1624	2472	917	2177	1517	1705	2245	290	597	948	1861	753	1850	1680
21	R-86	1786	1344	1694	2278	1125	2742	1634	1838	1843	349	600	662	1483	828	1375	1620
22	Mun-5	2392	474	1540	1333	825	951	1675	1400	2217	334	575	508	1143	924	1309	1327

S.r No	Entry Name	Location wise Mean Yield															Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	ORI-FSD	Quettta	k.pur	
23	MS-40	2523	1470	2634	2528	1253	2098	1117	1797	2189	371	625	1008	1833	689	1909	1784
24	BRJ-1458	2136	1798	2513	2472	1447	1623	1608	2019	2347	574	628	897	1955	941	1617	1805
25	VX-III	1928	1495	1994	1972	982	1940	1767	2317	2245	948	661	606	2050	901	1734	1750
26	ZS-4546	2023	1472	1894	2278	924	1861	1550	1636	2133	854	616	940	1559	706	1450	1598
27	18CBJ-005	1856	1220	1260	2222	930	1742	1400	1776	2091	626	446	613	1294	832	1309	1454
28	17CBJ-007	2261	2060	1800	2194	925	1465	1608	1767	2030	675	503	590	1455	959	1508	1634
29	Diamond 2525	2386	1167	1610	2527	1069	2454	1375	2331	2320	718	676	686	1795	882	1700	1768
30	NX-888	2123	1763	2367	2250	1002	2969	1800	3269	2225	859	752	895	1776	984	1658	1994
31	KJ-286	2189	1888	1514	2528	929	1980	1600	1795	2292	685	675	1026	1577	947	1650	1719
32	KJ-315	1792	1850	1760	2333	1219	1940	2000	2201	1917	503	725	1803	1870	918	1842	1762
33	MMVEGEOILA	2064	1292	2507	1805	924	1979	1775	3171	2097	563	440	302	1464	834	1284	1726
34	45S55	2328	1544	1687	2166	1230	1980	2108	2461	2026	822	655	473	1615	819	1425	1734
35	SH-11	1778	1300	1900	1750	1074	1900	2125	1968	2118	872	578	473	1870	893	1325	1625
36	DM-400	2184	2250	1520	2166	1102	2415	1708	2289	2028	1148	533	635	1568	767	1500	1744
37	VR-22S66	2281	1386	1660	1861	1009	1781	1900	2309	2139	342	565	885	1587	771	1484	1643
38	3024	2306	1853	1160	1944	929	2455	1692	2459	2245	1029	560	1145	1634	809	1417	1711
39	MMD MOILA	2456	1440	1467	2083	637	2573	1975	1695	2408	458	730	873	1842	913	1700	1773
40	BRJ-1778	2145	1762	1460	2139	1087	2613	1550	2059	2228	1156	643	1607	1729	1046	1500	1739
41	DM-444	2636	1241	1574	2167	1437	2731	2075	1985	1941	735	610	1607	1408	841	1692	1742
42	18CBJ-001	1967	1342	1187	2028	1430	1465	1321	1770	2389	848	530	996	1795	782	1475	1504
43	86M45	2661	1039	1733	2416	1022	2771	1558	1934	2100	700	623	1756	1747	897	1675	1763
44	BRJ-1775	1639	1210	2137	1805	937	2098	1684	1586	2381	668	482	758	1795	861	1517	1599
45	MS-2102	2045	1553	1900	2305	1175	2257	1610	1715	1986	1091	512	693	1709	1080	1875	1712

S.r No	Entry Name	Location wise Mean Yield															Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	ORI-FSD	Quettta	k.pur	
46	11V22	1895	1715	1467	2750	913	2256	1459	1675	1831	474	743	880	1615	801	1575	1648
47	MS-60	1917	1272	1274	1817	1124	2415	1642	1746	2014	659	565	981	1776	854	1450	1562
48	MS-012	2000	1467	1460	1833	1115	2336	1967	1729	2073	880	648	706	1823	885	1367	1632
49	MS-57	1739	1724	1894	1888	989	2138	1725	2084	2404	1237	640	1595	1983	860	1442	1710
50	Kehkshan	2128	1672	2600	2222	699	2455	1492	1707	2263	767	482	1048	1700	845	1534	1758
51	R-88	2017	1408	1253	1972	607	1980	1317	1333	1882	436	698	1112	1813	1012	1417	1508
52	MSC-2029	2067	1602	1407	2083	883	2494	2050	1611	2093	1281	575	950	1700	897	1775	1696
53	M-12	1989	1243	1507	2139	1116	2138	1575	1127	1898	885	665	968	1672	797	1517	1522
54	YG SOLO SUPER	1650	1285	2154	2083	787	1940	1417	2215	2007	925	782	815	1587	812	1600	1627
55	ZS-4445	2306	1202	2174	1944	1283	2296	1650	1853	2374	918	791	580	1851	873	1467	1732
56	26LN11	1933	1229	1787	2416	1425	2058	1584	2118	2153	972	800	595	1559	730	1558	1660
57	SW-313	3261	1177	1327	2222	1274	1544	1509	1584	2313	502	715	945	1521	640	1558	1614
58	Super Raya (Check)	2150	1834	1380	2139	786	1821	1800	1931	2302	1007	801	1025	1615	920	1534	1685
59	TS-3435	2583	1420	1894	2250	938	2336	1733	1606	2253	430	720	978	1332	710	1500	1695
60	KJ-284	2567	2096	1220	2222	1186	3048	792	1564	1967	421	631	1122	1587	920	1425	1670
61	Mark-7**	739	1366	2487	2166	904	2890	1434	2268	1945	156	619	2085	1880	1080	1833	1748
62	ICS-CN-01**	561	1590	3380	2028	175	2311	2043	1545	1750	1298	638	2025	1568	638	1284	1539
63	TCH-01**	2083	1109	1474	2083	592	2613	1467	1887	1390	769	524	1681	1247	695	1275	1429
Mean* **		**2145**	**1480**	**1764**	**2193**	**1055**	**2154**	**1646**	**1881**	**2141**	**714**	**629**	**960**	**1685**	**859**	**1607**	
CV* **		**19**	**19**	**30**	**16**	**37**	**23**	**22**	**19**	**11**	**53**	**19**	**46**	**18**	**15**	**13**	

*** Excluding data from location(s) having CV> 30%**
**** Moved (post analysis) from NURYT data**
***** Excluding entries moved from NURYT**

Varietal behaviors were statistically highly significant. Table 1.6 further shows that NX-888 produced the maximum seed yield of 1994 kg/ha, followed by RBJ-15013 seed yield 1823 kg/ha.

B. WINTER RAPESEED– FAISALABAD 2021-22

Project 1. MAINTENANCE OF GENE POOL

135 entries of *B. napus* were studied.

Project 2. DEVELOPMENT OF FRESH CROSSES

Following crosses were made keeping Rachna Canola as male parent having canola quality, high yielding and lodging resistant traits. Enough seed of each cross was saved for growing F_1 generation.

Sr. No. Crosses

1. RBN-21016 x Rachna Canola
2. RBN-21023 x Rachna Canola
3. RBN-21025 x Rachna Canola
4. RBN-21046 x Rachna Canola
5. RBN-21056 x Rachna Canola
6. RBN-21057 x Rachna Canola
7. RBN-18006 x Rachna Canola
8. RBN-16014 x Rachna Canola
9. KN- 327 x Rachna Canola
10. 18CBN008 x Rachna Canola

Project 3. STUDY OF FILIAL GENERATIONS

The breeding material studied in F_1 to F_7 generations is given in table 1.6.

Table 1.7

Generations	No. of crosses studied	No. of progenies studied	No. of plants selected	No. of lines selected for PYT
F_1	12	-	**Whole material**	-
F_2	11	Whole material	74	-
F_3	28	93	138	-
F_4	12	106	130	-
F_5	12	71	57	-
F_6	07	48	47	-
F_7	07	72	--	08 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.

74 plants were selected from 12 crosses of F_2 generation to raise F_3 generation. In F_3 generation, 138 plants were selected to raise F_4 in the next year. In F_4 generation, 130 plants were selected to raise F_5 generation. In F_5 generation 57 plants from 71 progenies derived from 12 crosses were selected. In F_6 generation 47 plants from 48 progenies derived from 7 crosses were selected. In F_7 generation, 08 lines were selected for PYT out of 72 progenies of 07 crosses.

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

Eleven *B. napus* lines were tested along with the standard variety "Rachna Canola". The data collected on seed yield and other agronomic traits are given in table 1.8.

Table 1.8

Performance of 12 entries of *Brassica napus* in Preliminary Yield Trial at Oilseeds Research Institute, Faisalabad during Rabi 2021-22.

Rank	Entry Name	DF	DM	Oil Content (%)	Plant Height	No. of Branches	Silique Length (cm)	Seeds/ Silique	1000 seed weight	Yield kg/hac
1	RBN-21003	76	149	43	186	8	6.9	26	3.9	1450
2	RBN-21001	85	150	42	182	7	6.5	25	3.6	1437
3	**Rachna Canola(C)**	**83**	**150**	**38**	**209**	**8**	**7.7**	**26**	**2.8**	**1415**
4	RBN-21025	92	150	41	202	7	6.9	26	3.6	1141
5	RBN-21015	85	146	40	190	8	7.0	27	3.1	1133
6	RBN-21046	89	144	43	206	8	6.1	23	4.3	1052
7	RBN-21056	85	155	43	197	8	6.4	23	4.6	1037
8	RBN-21057	90	154	40	190	6	6.1	24	4.1	1022
9	RBN-21012	69	150	44	189	7	6.4	21	4.0	985
10	RBN-21013	68	147	42	178	6	7.2	24	4.1	956
11	RBN-21016	78	155	37	183	7	6.6	24	3.4	933
12	RBN-21023	57	153	42	191	7	7.0	25	3.3	896
LSD 5%										162

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	10.10.2021

The perusal of table 1.8 indicates that RBN-21003 gave highest yield i.e, 1450 kg/ha followed by RBN-21001 kg/ha. Days to flowering ranged from 57-92 and days to maturity 144-155cm. Plant height ranges from 178-209cm. Number of branches ranged from 06-08. Maximum seeds per silique were observed by RBN-21015. 1000 seed weight ranged from 2.8-4.6. Oil content% ranged from 37 to 44%. Max oil contents % are found in RBN-21012.

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

Four *B. napus* lines were evaluated along with "Rachna Canola". The results are presented in table 1.9.

Table 1.9
Performance of 5 entries of *Brassica napus* for Advanced seed Yield Trial, 2021-22 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-18008	76	155	41	185	6	6.8	22	3.3	1841
2	RBN-13012	78	153	41	199	7	6.9	24	3.1	1519
3	RBN-18013	70	156	40	191	6	6.0	23	3.2	1500
4	**Rachna Canola (C)**	**85**	**157**	**39**	**196**	**6**	**7.4**	**23**	**3.6**	**1435**
5	RBN-20046	93	155	37	202	6	6.4	19	2.2	1019
LSD 5%										285.1

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	10.10.2021

The perusal of table 1.9 indicates that RBN-18008 gave highest yield i.e, 1841 kg/ha followed by RBN-13012 gave 1519kg/ha. Days to flowering ranged from 70-93 and days to maturity 153-157. Plant height ranges from 185-202cm. Number of branches ranged from 06-07. Maximum seeds per silique were observed by RBN-13012. 1000 seed weight ranged from 2.2-3.6. Oil content % ranged from 37 to 41. Max oil contents % is found in RBN-13012 and RBN-18008.

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

Seven *B. napus* strains were evaluated along with Sandal Canola and Rachna Canola for seed yield & other agronomic traits. The data recorded are given in table 1.10 (a).

Table 1.10 (a)
Seed Yield (kg/ha) of nine entries of *B. napus* in Micro Yield Trial conducted over 08 locations in Punjab, 2021-2022

Rank	Entry Name	FSD	ORS-K/pur	Karor	ORS-BWP	RARI-BWP	Fateh jhang	Chk	Piplan	Seed yield (kg/ha)
1	RBN-16014	1485	1833	2417	889	1407	659	1204	1454	1418
2	RBN-17014	1701	1767	1552	852	1322	792	1444	1611	1380
3	**Rachna Canola (C)**	**1600**	**1641**	**2222**	**926**	**841**	**796**	**1311**	**1685**	**1378**
4	**Sandal Canola (C)**	**1367**	**1756**	**2222**	**741**	**1185**	**1137**	**1463**	**935**	**1351**
5	RBN-18009	1500	1844	1530	667	833	1006	1333	1685	1300
6	KN-356	1304	1804	1222	556	1026	1278	1407	1694	1286
7	19-CBN002	1009	1367	2111	556	915	1081	1493	1435	1246
8	19-CBN004	1111	1896	1278	815	667	739	1472	1722	1212
9	KN-366	1248	1367	1204	556	722	897	1424	1491	1114
LSD 5%		228	190.0	169.8	131.28	185.52	57.8	229.7	146.3	

Perusal of the table 1.10 (a) indicated that RBN-16014 surpassed all the entries included in the trial by giving seed yield of 1418 kg/ha followed by RBN-17014 (1380kg/ha).

Table 1.10(b)
Other parameters of advance lines of Micro seed Yield Trial recorded at the Oilseeds Research Institute, Faisalabad during 2021-2022

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-17014	70	149	40	200	6	10.0	30	3.8	1702
2	**Rachna Canola (C)**	**79**	**152**	**39**	**217**	**7**	**9.6**	**30**	**3.3**	**1600**
3	RBN-18009	77	150	40	197	6	9.2	27	3.8	1500
4	RBN-16014	69	150	39	193	7	9.9	31	3.5	1485
5	**Sandal Canola (C)**	**78**	**150**	**42**	**199**	**7**	**9.4**	**29**	**3.4**	**1367**
6	KN-356	84	160	41	200	7	8.9	27	2.9	1304
7	KN-366	78	157	42	207	7	9.6	25	3.4	1248
8	19-CBN004	91	160	39	231	7	9.8	23	2.9	1111
9	19-CBN002	88	157	39.	233	7	10.3	27	2.5	1009
LSD 5%										**228**

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	10.10.2021

The perusal of table 1.10(b) indicates that RBN-17014 gave highest yield at ORI, Faisalabad i.e. 1702kg/ha. Days to flowering ranged from 69-91, days to maturity from 149-160, Highest 1000 seed weight (3.8) was observed in RBN-17014 and RBN-18009.

Project 7. NATIONAL UNIFORM RAPESEED YIELD TRIAL (NURYT)

The objective of this trial was to test the performance of rapeseed varieties at different locations. These trials were sown with the material supplied by the Pakistan Agricultural Research. The data recorded are given in table 1.11.

Table 1.11 . Seed Yield (kg/ha) in National Uniform Yield Trial (NUYT) of Rapeseeds for 2021-22 Cropping Season

S. No	Entry Name	Location wise Mean Yield																Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	OR-FSD	Quetta	K. Pur	BARS	
1	SC-026E	2722	3358	1560	1044	99	4592	1592	3053	2334	1015	640	1057	1955	903	1208	719	2068
2	Crystal Canola-702	534	1367	2447	2778	330	1465	1534	1934	2011	842	885	1528	1700	1068	950	0	1569
3	CHYB3393TT	2361	2347	1247	955	160	2256	2084	2880	2386	704	719	985	1511	973	1483	214	1759
4	RBN-18006	1522	2893	1720	1400	234	2652	1842	2487	1835	818	763	1525	1880	664	1217	234	1763
5	Hyola-402	1123	1887	867	1011	129	1979	1883	1872	1701	674	783	1287	1728	918	1134	164	1490
6	RBN-18021	1372	2506	1387	972	408	3246	1242	2525	1987	704	685	1353	1785	844	1467	122	1726
7	FBS-101	933	3218	833	1000	403	2969	1684	3075	1965	665	624	718	1284	879	975	137	1767
8	Kingola	375	263	0	250	235	0	1759	2009	2015	855	756	1298	0	534	500	130	808
9	R00-125/12	3528	1550	2630	1500	832	1979	1542	2004	1889	517	620	1357	1256	297	1342	234	1398
10	C-3	2256	3317	807	1028	39	2731	1392	2692	2059	953	780	1282	1559	693	1317	149	1757
11	RP21038	Moved to NUMYT data																
12	Sitara-601	1187	2975	630	1150	584	2454	2109	1992	1935	505	736	718	1209	789	900	104	1625
13	Sitara-602	1092	2058	610	1139	305	2098	1433	2434	2084	287	720	665	89	616	909	950	1358
14	HC-055W	972	3510	853	1178	25	1861	1509	2182	1854	557	674	861	1011	649	909	119	1533
15	HC-021C (C)	2611	3400	1010	1089	300	3880	1217	2306	1867	661	743	1085	1577	915	1058	102	1805
16	17CBN007	1389	2167	1187	983	119	2256	1442	2280	1878	866	793	1863	1436	889	984	784	1511
17	CRH-102	700	2202	690	1111	10	2059	1875	2520	2139	452	730	714	595	967	958	284	1515
18	CRH-394	839	2017	1084	1305	57	1861	1858	1265	1967	622	683	2535	756	781	892	400	1338

S. No	Entry Name	Location wise Mean Yield																Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	OR-FSD	Quetta	K. Pur	BARS	
19	18CBN001	1264	2392	1293	1361	358	2256	1784	1190	1928	467	660	1240	1370	753	967	434	1466
20	18CBN008	1034	2284	787	1650	45	1742	2000	1998	1825	664	721	1310	1351	614	1017	154	1520
21	HC-025D	1800	3462	1720	1583	613	2890	1717	2020	1903	710	622	843	1662	910	1134	0	1790
22	RP21035	Moved to NUMYT data																
23	RP21005																	
24	CRS-25	1489	2520	1054	1150	314	2296	1675	2218	2091	732	633	638	879	943	900	112	1530
25	Diamond 2424	2456	1783	807	1056	42	1346	1834	1453	1850	401	715	1106	1002	632	858	617	1253
26	RR-8-2	1456	3250	933	916	387	3009	1742	2488	1906	573	965	1147	1303	572	950	130	1710
27	TCH-02	1214	2034	1494	844	155	2850	1942	3140	2127	568	623	1213	1351	907	917	700	1673
28	RM-1-2	1906	3435	968	1183	89	3167	1684	2325	1861	515	680	1498	1653	880	858	634	1772
29	RM-1-9	1220	2938	2320	928	267	2533	1883	2767	1750	770	705	993	1115	867	900	1284	1638
30	KN-319	1189	2683	2840	722	170	3484	1834	2215	1889	929	685	554	1625	635	1066	339	1684
31	RRM-106-1	1200	2342	2159	944	124	2454	1776	1725	1806	516	673	932	897	742	917	290	1427
32	KN-312	1389	2309	2130	1222	160	2217	1850	2318	2049	533	615	728	1464	628	1158	12	1583
33	RR-1-4	778	1827	2454	1083	317	2692	1733	2086	1656	645	750	1013	1483	597	458	435	1436
34	AA-131	828	2452	1017	944	242	1109	1275	2329	2167	286	672	624	1304	819	992	484	1406
35	Hyola-VX-444	2567	2009	1160	861	413	2969	1559	1550	1827	459	746	1017	1464	723	1134	450	1484
36	KN-347	2289	1729	1780	1194	369	2494	1459	1784	1973	603	757	1620	1653	751	1209	734	1500

S. No	Entry Name	Location wise Mean Yield																Mean*
		NIA	NARC	AZRC	RARI	Tandojam	NIFA	Khan pur	Sahiwal	ARI	Peshawar	BARI	BZU	OR-FSD	Quetta	K. Pur	BARS	
37	HS-22-HAMOLA	1250	2217	1914	750	446	2336	1509	3363	1964	237	621	750	1303	862	1067	500	1599
38	HC-024A	386	2304	1220	944	19	2256	1500	1862	2083	278	757	977	728	824	1017	400B	1427
39	BS-411	1450	2158	973	1107	42	2336	1917	1853	1981	419	725	1146	1124	766	1075	250	1504
40	CAN-21	1450	1687	1020	1111	486	2098	1967	1801	2007	342	689	1110	1370	715	1142	567	1458
41	Super Canola (C)	1233	1888	2270	1083	392	2850	1967	2346	2049	404	708	779	1389	712	1059	834	1605
42	Canola-612	1761	1976	1244	1028	259	2811	1842	1793	1999	630	622	1473	1540	841	1267	122	1572
43	Mun-4	1100	1700	940	1222	0	2138	1634	1769	1920	606	612	744	926	796	1050	700	1376
44	Mun-2	1673	1554	1300	1094	50	2494	1975	2279	2057	478	715	547	803	810	992	284	1477
45	Sahara Canola	1044	2734	1107	1542	0	3365	1759	2003	1681	1071	631	1513	831	669	1100	600	1631
Mean		**1429**	**2283**	**1418**	**1193**	**260**	**2452**	**1705**	**2175**	**1941**	**617**	**698**	**1158**	**1280**	**772**	**1062**	**364**	
CV		38	24	45	30	98	21	21	29	11	59	17	59	23	29	23	107	

*** Excluding data from location(s) having CV> 30%**

A perusal of table 1.10 shows that the differences of means due to varieties are highly significant. SC-026E gave the seed yield of 2068 kg/ha and check i.e. Super Canola gave the yield of 1605 kg/ha.

C. 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 twelve“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.

S. No.	Name of Cross	Name of hybrid
1	786-012 x 97007-1 R	FHC-185
2	786-013 x 97007-1 R	FHC-186
3	786-015 x 97007-1 R	FHC-187
4	786-016 x 97007-1 R	FHC-188
5	786-010 x 97007-1 R	FHC-189
6	786-003 x 97007-1 R	FHC-190
7	786-012 x 96039-1 R	FHC-191
8	786-013 x 96039-1 R	FHC-192
9	786-015 x 96039-1 R	FHC-193
10	786-016 x 96039-1 R	FHC-194
11	786-010 x 96039-1 R	FHC-195
12	786-003 x 96039-1 R	FHC-196

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 1.12.

Table 1.12

Rank	Entry Name	R1	R2	R3	Ava(g/plot)	kg/hac
1	**FHC-177**	650	710	900	753	1507
2	**FHC-175**	920	720	600	747	1493
3	**FHC-174**	750	650	720	707	1413
4	**FHC-185**	1110	530	480	707	1413
5	**FHC-180**	700	650	760	703	1407
6	**FHC-176**	920	630	520	690	1380
7	**FHC-183**	550	740	710	667	1333
8	**FHC-181**	510	800	680	663	1327
9	**FHC-178**	670	700	600	657	1313
10	**FHC-184**	740	530	670	647	1293
11	**Hyola-401 (C)**	770	550	550	623	1247
12	**FHC-182**	610	530	620	587	1173
13	**FHC-179**	720	550	350	540	1080

Perusal of the table 1.12 indicated that FHC-177 surpassed all the entries included in the trial by giving seed yield of 1507 kg/ha. The standard canola hybrid “Hyola-401” gave 1247 kg seed yield per hectare.

Table. Seed Yield (kg/ha) in Adaptability Trial of Taramira for 2021-22 Cropping Season

S. No	Entry Na me	Mean*															
		NIA	**NARC**	**AZRC**	**RARI**	**Tandojam**	**NIFA**	**Khan pur**	**Sahiwal**	**ARI**	**Peshawar**	**BARI**	**BZU**	**OR-FSD**	**Quetta**	**Khair Pur**	
1	**27460**	1524	700	*1214*	1000	572	1334	835	*384*	*1599*	473	617	2023	947	1233	431	974
2	**26187**	2185	1167	*709*	922	633	1083	1506	*394*	*1986*	493	605	1907	748	1216	337	1067
3	**TM-15-01**	1400	575	*1298*	981	806	1278	733	*401*	*1929*	507	393	2081	831	1178	331	925
4	**TM-15-02**	1311	603	*1222*	1022	586	1417	796	*620*	*1492*	340	577	1830	841	1228	321	906
	Mean	**1605**	**761**	***1111***	**981**	**649**	**1278**	**968**	***450***	***1752***	**453**	**548**	**1960**	**842**	**1214**	**355**	
	CV	13	17	*35*	13	16	9	8	*38*	*40*	26	29	15	27	9	30	

*** Excluding data from location(s) having CV> 30%**

2. OILSEEDS RESEARCH STATION, KHANPUR

A. MUSTARD (*Brassica juncea*),

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

One hundred and fifty (150) 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 MUSTARD (*Brassica juncea)* THROUGH HYBRIDIZATION

Eight crosses were made keeping KJ-238 and KJ-282 as male parents, having low Erusic acid and low Glucosinolates while other parental lines having good traits. Crosses were attempted among parental lines selected on the basis of superior traits.

High yielder		Low Erusic acid
1. KJ-319	×	KJ-238
2. KJ-320	×	KJ-238
3. KJ-322	×	KJ-238
4. KJ-324	×	KJ-238
5. KJ-319	×	KJ-282
6. KJ-320	×	KJ-282
7. KJ-322	×	KJ-282
8. KJ-324	×	KJ-282

Seed of each cross was collected at maturity to raise F_1 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_1 to F_6 Mustard(*Brassica juncea*) generations during 2021-22 at Oilseeds Research Station, Khanpur.

Generation	No. of crosses	No. of progenies
F_1	8	Whole material will be studied
F_2	10	-do-
F_3	10	65
F_4	11	71
F_5	5	68
F_6	5	48
F_7	4	39

All F_1 crosses were harvested to raise F_2 generation. From 10 F_2 crosses, 99 desirable plants were selected. In F_3 to F_5 generations, the best progenies were selected and from each of those, one desirable plant was selected to raise next generation. In F_6, 5 progenies were selected for seed yield evaluation in preliminary yield trial.

TITLE 4: PRELIMINARY YIELD TRIAL MUSTARD *(Brassica juncea)*

Fifteen *B. juncea* lines were tested along with the standard varieties "Bagh-o-Bahar Raya, AARI Canola and Super Raya". The data collected on seed yield and other agronomic traits are given in Table 2.

Table 2:Performance of 15 entries of Mustard (*Brassica juncea)* in Preliminary Yield Trial (PYT) at Oilseeds Research Station, Khanpur during 2021-22.

Rank No.	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	**KJ-344**	53	69	110	203	2881
2	**KJ-330**	47	64	106	200	2363
3	**KJ-350**	53	70	114	190	2363
4	**KJ-345**	53	63	109	188	2267
5	**Bagh-o-Bahar Raya**	53	65	116	218	2244
6	**KJ-349**	51	73	107	165	2219
7	**KJ-346**	49	62	109	185	2115
8	**KJ-351**	52	68	111	173	2104
9	**KJ-343**	45	68	106	202	2011
10	**KJ-352**	50	64	113	213	1793
11	**AARI Canola**	54	65	110	192	1785
12	**KJ-353**	51	66	110	182	1767
13	**KJ-348**	47	72	106	173	1715
14	**KJ-347**	47	62	108	195	1696
15	**Super Raya**	44	74	113	205	1519
	CV%	3.43	1.49	2.23	6.86	2.16
	LSD %	2.86	1.67	4.11	22.08	74

Design	R.C.B
Plot size	5 × 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	11.10.2021

The perusal of table 2 indicates that KJ-344 gave highest yield i.e., 2881 kg/ha followed by KJ-330 i.e., 2363 kg/ha. Days to flowering (50%) ranged from 44-54 while days to flowering (100%) 62-74 and days to maturity were 106-116. The maximum plant height (218 cm) was observed by Bagh-o-Bahar Raya and minimum (165 cm) by KJ-349.

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), 2021-22 at Oilseeds Research Station, Khanpur.

Rank No.	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	**KJ-331**	49	66	113	183	2470
2	**KJ-327**	58	70	110	200	2248
3	**KJ-333**	48	64	107	200	2093
4	**KJ-321**	55	69	110	175	2015
5	**KJ-332**	50	63	108	205	1981
6	**KJ-336**	53	75	117	175	1859
7	**KJ-316**	57	68	112	193	1856
8	**AARI Canola**	49	64	112	195	1841
9	**KJ-334**	46	68	109	173	1763
10	**KJ-337**	57	72	113	195	1693
11	**KJ-341**	53	70	111	185	1648
12	**KJ-339**	57	73	114	197	1626
13	**KJ-342**	51	69	113	195	1570
14	**KJ-335**	53	72	114	195	1563
15	**KJ-338**	52	72	111	193	1552
16	**Bagh-o-Bahar Raya**	55	71	117	195	1544
17	**Super Raya**	58	74	111	187	1481
	CV%	2.31	1.61	1.54	1.57	3.19
	LSD %	2.03	1.86	2.86	2.89	96.11

Design	R.C.B
Plot size	5 × 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	11.10.2021

The perusal of Table 3 indicates that KJ-331 gave highest yield i.e. 2470 kg/ha. Days to flowering 50% and 100% was ranged from 48-58 and 64-74 respectively. Days to maturity ranged from 107 to 117. The maximum plant height (205 cm) was observed by KJ-332 and minimum (173 cm) by KJ-334.

TITLE 6: <u>MICRO SEED YIELD TRIALS *(B. juncea)*</u>

Yield performance of ten 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 ten entries of *B. juncea* in Micro Yield Trial conducted over 8 locations in Punjab, 2021-2022

Rank	Entry Code	Entry Name	Fsd	Karor	Khanpur	ORS Bahawalpur	Piplan	RARI Bwp	Chakwal	Fatehjang	Average
1	**1**	**RBJ-15017**	1722	1167	2052	622	1620	2130	2889	1276	1685
2	**8**	**KL326**	1485	1444	2378	733	1370	1593	3012	767	1598

3	**2**	**RBJ-16007**	1707	1667	1441	667	1583	1630	2519	1061	1534
4	**4**	**RBJ-17003**	1130	2278	1454	589	1713	1463	2617	919	1520
5	**3**	**RBJ-16012**	1259	1481	1456	622	1824	1796	2716	974	1516
6	**9**	**OBJ-160**	1307	1519	1530	778	1944	1685	2525	737	1503
7	**6**	**BRJ-1669**	1307	1741	1526	778	1806	1037	2957	799	1494
8	**7**	**KJ340**	1148	1259	1900	733	1500	1574	2901	785	1475
9	**10**	**Super Raya ©**	1248	1370	1674	667	1824	1704	2642	540	1459
10	**5**	**19CBJ005**	944	1111	1685	889	1713	1315	2481	913	1381
		LSD		103	300	209	188	259	297	89	
		CV		4.43%	11.37%	11.87%	7.06%	10.96%	11.74%	12.31%	

Perusal of the table 4 (a) indicate the entry RBJ-15017 ranked first with seed yield of 1685 kg/ha followed by KJ-326 (1598 kg/ha) out of all the entries included in the trial. The local entry KJ-340 showed seed yield of (1475 kg/ha).

Table 4 (b): Performance of *B. juncea* strains at different locations in the Punjab during Zaid Kharif 2021-22

Rank	Entry Code	Entry Name	Faisalabad	Karor	Khanpur	ORS BWP	Piplan	Average
1	**2**	**ZBJ-17019**	1353	2917	2522	833	1833	1892
2	**4**	**ZBJ-19008**	1494	1486	3161	1389	1924	1891
3	**1**	**ZBJ-17008**	1522	2222	3153	833	1583	1863
4	**3**	**ZBJ-18008**	1317	894	2461	1444	1777	1579
5	**5**	**AARI - Canola (C)**	800	1486	1933	1389	1944	1510
		LSD 5%	230	255	377	170	207	
		CV	12.78%	10.19%	10.55%	12.55%	8.37%	

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

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.

Sr. No	1 NIA	2 ORP NARC	3 AZRC	4 BWP	5 ARI	6 NIFA	7 KPR	8 SWL	9 ARI SWAT	10 ORI PSWR	11 CK WL	12 BZU/ MN	13 FSD	14	15
1	2339	1517	1607	2528	525	2811	1509	2063	1931	1044	555	1543	1700	1069	1683
2	2089	1493	1420	2717	1120	2375	1508	1546	2156	747	650	1408	1710	896	1592
3	2042	1480	1867	2805	1225	2652	1150	1469	1864	595	719	1305	1823	740	1667
4	1611	1454	1550	2000	1570	2415	2000	1524	2122	1070	748	1528	1634	1049	1915
5	1681	2112	2607	2528	1103	2256	1667	2134	2134	1075	530	673	1748	940	1542
6	1961	1191	1680	2750	1140	2217	1817	1705	2200	1269	730	613	1880	638	1484
7	1789	1410	1974	2028	1134	1861	2175	2179	1948	524	550	895	1587	845	1634
8	1839	1527	1827	2027	1384	2098	1492	1975	2049	555	607	836	1965	812	1875
9	1839	1257	2440	2500	1612	2138	1825	1587	1989	679	645	1524	1955	621	1900
10	1753	1734	1720	2427	828	2177	1425	1773	1942	420	710	907	1130	860	1834
11	2406	1450	1500	2361	1185	2415	1763	1618	2432	435	705	1213	2031	739	1733

12	2772	1200	1474	1694	972	1742	1800	2006	2156	321	680	1448	1445	914	1650
13	3434	1334	2254	1611	904	1425	1734	1353	2017	559	618	663	1719	1031	1742
14	2489	1230	2034	2139	1060	2415	1733	1718	2277	450	525	970	2144	914	1709
15	2039	1708	1920	2639	788	2692	1634	1784	2096	488	622	1080	1681	794	2075
16	1911	1185	1647	2167	962	1465	1242	1684	2311	611	645	951	1606	948	1717
17	2028	1479	1350	2122	1358	2178	1625	1839	2202	348	686	693	1615	867	1967
18	2064	1563	2167	2500	912	1901	1708	1829	2278	1153	527	788	1493	775	1575
19	2606	1534	1900	2278	863	1821	1509	1978	2356	484	527	863	1719	961	1617
20	1939	1425	1624	2472	917	2177	1517	1705	2245	290	597	948	1861	753	1850
21	1786	1344	1694	2278	1125	2742	1634	1838	1843	349	600	662	1483	828	1375
22	2392	474	1540	1333	825	951	1675	1400	2217	334	575	508	1143	924	1309
23	2523	1470	1634	2528	1253	2098	1117	1797	2189	371	625	1008	1833	689	1909
24	2136	1798	2513	2472	1447	1623	1608	2019	2347	574	628	897	1955	941	1617
25	1928	1495	1994	1972	982	1940	1767	2317	2245	948	661	606	2050	901	1734
26	2023	1472	1894	2278	924	1861	1550	1636	2133	854	616	940	1559	706	1450
27	1856	1220	1260	2222	930	1742	1400	1776	2091	626	446	613	1294	832	1309
28	2261	2060	1800	2194	925	1465	1608	1767	2030	675	503	590	1455	959	1508
29	2386	1167	1610	2527	1069	2454	1375	2331	2320	718	676	686	1795	882	1700
30	2123	1763	2367	2250	1002	2969	1800	3269	2225	859	752	895	1776	984	1658
31	2189	1888	1514	2528	929	1980	1600	1795	2292	685	675	1026	1577	947	1650
32	1792	1850	1760	2333	1219	1940	2000	2201	1917	503	725	1803	1870	918	1842
33	2064	1292	2507	1805	924	1979	1775	3171	2097	563	440	302	1464	834	1284
34	2328	1544	1687	2166	1230	1980	2108	2461	2026	822	655	473	1615	819	1425
35	1778	1300	1900	1750	1074	1900	2125	1968	2118	872	578	473	1870	893	1325
36	2184	2250	1520	2166	1102	2415	1708	2289	2028	1148	533	635	1568	767	1500
37	2281	1386	1660	1861	1009	1781	1900	2309	2139	342	565	885	1587	771	1484
38	2306	1853	1160	1944	637	2455	1692	2459	2245	1029	560	1145	1634	809	1417
39	2456	1440	1467	2083	1087	2573	1975	1695	2408	458	730	873	1842	913	1700
40	2145	1762	1460	2139	1087	2613	1550	2059	2228	1156	643	1607	1729	1046	1500
41	2636	1241	1574	2167	1437	2731	2075	1985	1941	735	610	1607	1408	841	1692
42	1967	1342	1187	2028	1430	1465	1321	1770	2389	848	530	996	1795	782	1475
43	2661	1039	1733	2416	1022	2717	1558	1934	2100	700	623	1756	1747	897	1675
44	1639	1210	2137	1805	937	2098	1684	1586	2381	668	482	78	1795	861	1517
45	2045	1553	1900	2305	1175	2257	1610	1715	1986	1091	512	693	1709	1080	1875
46	1895	1715	1467	2750	913	2256	1459	1675	1831	474	743	880	1615	801	1575
47	1917	1272	1274	1817	1124	2415	1642	1746	2014	659	565	981	1776	854	1450
48	2000	1467	1460	1833	1115	2336	1967	1729	2073	880	648	706	1823	885	1367
49	1739	1724	1894	1888	989	2138	1725	2084	2404	1237	640	1595	1983	860	1442
50	2128	1672	2600	2222	699	2455	1492	1707	2263	767	482	1048	1700	845	1534
51	2017	1408	1253	1972	607	1980	1317	1333	1882	436	698	1112	1813	1012	1417
52	2067	1602	1407	2083	883	2494	2050	1611	2093	1281	575	90	1700	897	1775
53	1989	1243	1507	2139	1116	2138	1575	1127	1898	885	665	968	1672	797	1517
54	1650	1285	2154	2083	787	1940	1417	2215	2007	925	782	815	1587	812	1600

55	2306	1202	2174	1944	1283	2296	1650	1853	2374	918	791	580	1851	873	1467
56	1933	1229	1787	2416	1425	2058	1584	2118	2153	972	800	595	1553	730	1558
57	3261	1177	1327	2222	1274	1544	1509	1584	2313	502	715	945	1521	640	1558
58	2150	1834	1380	2139	786	1821	1800	1931	2302	1007	801	1025	1615	920	1534
59	2583	1420	1894	2250	938	2336	1733	1606	2253	430	720	978	1332	710	1500
60	2567	2096	1220	2222	1186	3048	792	1564	1967	421	631	1122	1587	920	1425
61	739	1366	2487	2166	904	2890	1434	2268	1945	156	619	2085	1880	1080	1833
62	561	1590	3380	2028	175	2311	2043	1545	1750	1298	638	2025	1568	638	1284
63	2083	1109	1474	2083	592	2613	1467	187	1390	769	524	1681	1247	695	1275

B. RAPESEED– OILSEEDS RESEARCH STATION, KHANPUR

TITLE 1: MAINTENANCE AND EVALUATION OF GERMPLASM RAPESEEDS (*Brassica napus)*

One hundred and twenty (120) 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 RAPESEEDS *(Brassica napus)* THROUGH HYBRIDIZATION

Eight (08) crosses were made keeping KN-319 and Khanpur 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.

	High yielder		**Low Erusic acid**
1	KN-327	×	KN-319
2	KN-328	×	KN-319
3	KN-330	×	KN-319
4	KN-336	×	KN-319
5	KN-32	×	Khanpur canola
6	KN-328	×	Khanpur canola
7	KN-330	×	Khanpur canola
8	KN-336	×	Khanpur canola

Seed of each cross was collected at maturity to raise F_1 generation.

TITLE 3: STUDY OF FILIAL GENERATIONS RAPESEEDS (*Brassica napus*)

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

Table 6: Crosses/progenies studied and selections made in F_1 to F_6 Rapeseed generations during 2021-22 at Oilseeds Research Station, Khanpur.

Generation	No. of crosses	No. of progenies
F_1	8	Whole material will be studied

F_2	10	-do-
F_3	10	62
F4	10	56
F_5	9	45
F_6	4	37
F_7	4	30

All F_1 crosses were harvested to raise F_2 generation. From 10 F_2 crosses, all plants were selected. In F_3 to F_5 generations, the best progenies were selected and from each of those, one desirable plant was selected to raise next generation. In F_6, 10 progenies were selected for seed yield evaluation in preliminary yield trial.

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

Seventeen (17) *B. napus* lines were tested along with the standard varieties "Rohi Sarsoon and Khanpur Canola". The data collected on seed yield and other agronomic traits are given in Table 7.

Table 7: Performance of 17 entries of *B. napus* in Preliminary Yield Trial (PYT) at Oilseeds Research Station, Khanpur during 2021-22.

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	**KN-369**	74	85	169	162	2278
2	**KN-368**	72	84	166	193	2263
3	**KN-372**	73	84	166	205	1811
4	**KN-376**	74	81	168	170	1796
5	**KN-377**	72	83	170	187	1689
6	**Khanpur Canola**	74	81	167	188	1656
7	**KN-370**	73	82	164	202	1619
8	**Rohi Sarsoon**	70	83	164	193	1619
9	**KN-375**	74	83	166	187	1581
10	**KN-373**	73	83	163	183	1567
11	**KN-374**	74	84	163	212	1544
12	**KN-359**	71	82	167	195	1456
13	**KN-371**	72	84	167	202	1437
14	**KN-380**	73	82	166	177	1411
15	**KN-378**	73	82	167	182	1367
16	**KN-379**	75	84	168	188	1363
17	**KN-360**	71	82	165	192	1211
	CV %	1.42	1.29	0.58	6.22	7.78
	LSD %	1.72	1.78	1.61	19.56	210

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	13.10.2021

The perusal of table 7 indicates that KN-369 gave highest yield i.e., 2278 kg/ha followed by KN-368 i.e., 2263 kg/ha. Days to flowering (50%) were 70-75 while days to flowering (100%) was 81-85 and days to maturity ranged from 163-170. The maximum plant height (212 cm) was observed by KN-374 and minimum (162 cm) by KN-369.

TITLE 5: PRELIMINARY YIELD TRIAL *(Brassica napus)* CANOLA TYPE

Eleven (11) *B. napus* lines were tested along with the standard varieties "Rachna Canola and Khanpur Canola". The data collected on seed yield and other agronomic traits are given in Table 7.

Table 8: Performance of 11 entries of *Brassica napus* in Preliminary Yield Trial (PYT) Canola type at Oilseeds Research Station, Khanpur during 2021-22.

Rank	Entry Name	Plant height (cm)	Seed yield (kg/ha)
1	KN-347	1663	217
2	Khanpur Canola	1615	192
3	KN-342	1589	162
4	Sandal Canola	1363	187
5	KN-352	1289	173
6	KN-343	1233	182
7	Rachna Canola	1219	150
8	Super Canola	1207	163
9	KN-339	1196	175
10	KN-353	1107	168
11	KN-340	1067	165
	CV %	6.21	12.92
	LSD %	18.9	291

Design	R.C.B
Plot size	5 × 0.9 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	13.10.2021

The perusal of table 8 includes the varietal trial of Canola types for yield performance. The results indicate that KN-347 gave highest yield i.e., 1663 kg/ha followed by local check variety Khanpur Canola i.e., 1615 kg/ha. The maximum plant height (217 cm) was observed by KN-347 and minimum (162 cm) by KN-342.

TITLE 6: ADVANCED SEED YIELD TRIAL *(B. napus)*

Seventeen (17) *B. napus* lines were evaluated along with check varieties "Rachna Canola, Khanpur Canola and Sandal Canola". The results are presented in table 8.

Table 9: Performance of 17 entries of Advanced Yield Trial (AYT), 2021-22 at Oilseeds Research Station, Khanpur.

Rank	Entry Name	DF (50%)	DF (100%)	DM	Plant height (cm)	Seed yield (kg/ha)
1	**KN-354**	73	84	169	193	1670
2	**KN-367**	73	87	157	162	1626
3	**KN-357**	74	88	161	163	1581
4	**Rohi Sarsoon**	74	86	163	192	1544
5	**KN-360**	71	85	153	148	1530
6	**KN-359**	74	85	160	195	1496
7	**KN-353**	73	82	165	162	1448
8	**KN-346**	71	83	166	198	1400
9	**KN-342**	71	82	168	195	1367
10	**KN-355**	71	85	171	185	1359
11	**KN-362**	74	85	170	203	1344
12	**KN-368**	73	84	169	203	1333
13	**KN-361**	75	82	169	173	1296
14	**Sandal Canola**	71	81	165	193	1219
15	**Khanpur Canola**	72	81	167	192	1185
16	**KN-363**	72	84	166	168	1144
17	**KN-358**	75	85	164	205	1015
	CV %	1.83	1.16	1.01	5.88	6.28
	LSD %	2.20	1.63	2.76	18	145

Design	R.C.B
Plot size	5 x 1.35 m
Row spacing	45 cm
Fertilizer	80: 60:60 NPK kg/ha
Sowing date	13.10.2021

The perusal of Table 9 indicates that KN-354 gave highest yield i.e. 1670 kg/ha followed by KN-367 (1626 kg/ha). Days to flowering (50%) ranged from 71 to 75 and days to flowering (100 %) was 81-87. Days to maturity ranged from 157 to 171. The maximum plant height (205 cm) was observed by KN-358 and minimum (162 cm) by KN-353 & KN-367.

TITLE 7: MICRO SEED YIELD TRIALS *(B. napus)*

Nine (09) *B. napus* strains were evaluated along with Rachna canola and Sandal Canola for seed yield & other agronomic traits. The data recorded are given in table 9.

Table 10: Seed Yield (kg/ha) of nine (9) entries of *B. napus* in Micro Yield Trial conducted over 8locations in Punjab, 2021-2022

Rank	Entry Code	Entry Name	FSD	ORS-Khanpur	Karor	ORS-Bahawalpur	RARI-Bahawalpur	Fateh jhang	Chakwal	Piplan	Average
1	**5**	**RBN-16014**	1485	1833	2417	889	1407	659	1204	1454	1418
2	**6**	**RBN-17014**	1701	1767	1552	852	1322	792	1444	1611	1380
3	**9**	**Rachna Canola**	1600	1641	2222	926	841	796	1311	1685	1378
4	**8**	**Sandal Canola**	1367	1756	2222	741	1185	1137	1463	935	1351

5	**7**	**RBN-18009**	1500	1844	1530	667	833	1006	1333	1685	1300
6	**2**	**KN-356**	1304	1804	1222	556	1026	1278	1407	1694	1286
7	**3**	**19-CBN002**	1009	1367	2111	556	915	1081	1493	1435	1246
8	**4**	**19-CBN004**	1111	1896	1278	815	667	739	1472	1722	1212
9	**1**	**KN-366**	1248	1367	1204	556	722	897	1424	1491	1114
		CV%	10.14%	7.45%	6.16%	12.51%	12.14%	7.72%	10.97%	6.26%	
		LSD %	228	190.04	169.8	131.28	185.52	57.887	229.72	146.3	

Perusal of the table 10 indicated that RBN-16014 surpassed all the entries included in the trial by giving seed yield of 1418 kg/ha followed by RBN-17014 (1380 kg/ha). While local variety KN-356 ranked 6th with average grain yield of 1286 kg/ha among all the entries.

TITLE 8: 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 11.

Table 11: Results of National Uniform Rapeseed Yield Trial conducted at 16 locations during Rabi 2021-22

Sr. No.	**1 NIA**	**2 ORP NARC**	**3 AZRC**	**4 BWP**	**5 ARI**	**6 NIFA**	**7 KPR**	**8 SWL**	**9 ARI SWAT**	**10 ORI Pswr**	**11 CHAK WAL**	**12 BZU/ MN**	**13 FSD**	14	15	**16**
1	2722	3358	1560	1044	99	4592	1592	3053	2334	1015	640	1057	1955	903	1208	719
2	534	1367	2474	2778	330	1465	1534	194	2011	842	885	1528	1700	1068	950	0
3	2361	2347	1247	955	160	2256	2084	2880	2386	704	719	985	1511	973	1483	214
4	1522	2893	1720	1400	234	2652	1842	2487	1835	818	763	1525	1880	664	1217	234
5	1123	1887	867	1011	129	1979	1883	1872	1701	674	783	1287	1728	918	1134	164
6	1372	2506	1387	972	408	3246	1242	2525	1987	704	685	1353	1785	844	1467	122
7	933	3218	833	1000	403	2969	1684	3075	1965	665	624	718	1284	879	975	137
8	375	263	0	250	235	0	1759	2009	2015	855	756	1298	0	534	500	130
9	3528	1550	2630	1500	832	1979	1542	2004	1889	517	620	1357	1256	297	1342	234
10	2256	3317	807	1028	39	2731	1392	2692	2059	953	780	1282	1559	633	1317	149
12	1187	2975	630	1150	584	2454	2109	1992	1935	505	736	718	1209	789	900	104
13	1092	2058	610	1139	305	2098	1433	2434	2084	287	720	665	89	616	909	950
14	972	3510	853	1178	25	1861	1509	2184	1854	557	674	861	1011	649	909	119
15	2611	3400	1010	1089	300	3880	1217	2306	1867	661	743	1085	1577	915	1058	102
16	1389	2167	1187	983	119	2256	1442	2280	1878	866	793	1863	1436	889	984	784
17	700	2202	690	1111	10	2059	1875	2520	2139	452	730	714	595	967	958	284
18	839	2017	1084	1305	57	1861	1858	1265	1967	622	683	2535	756	781	892	400
19	1264	2392	1293	1361	358	2256	1784	1190	1928	467	660	1340	1370	753	967	434
20	1034	2284	787	1650	45	1742	2000	1998	1825	664	721	1310	1351	614	1017	154
21	1800	3462	1720	1583	613	2890	1717	2020	1903	710	622	843	1662	910	1134	0
24	1489	2520	1054	1150	314	2296	1675	2218	2091	732	633	638	879	943	900	112
25	2456	1783	807	1056	42	1346	1834	1453	1850	401	715	1106	1002	632	858	617

26	1456	3250	933	916	387	3009	1742	2488	1906	573	965	1147	1303	572	950	130
27	1214	2034	1494	844	155	2850	1942	3140	2127	568	623	1213	1351	907	917	700
28	1906	3435	1494	1183	89	3167	1684	2325	1861	515	680	1498	163	880	858	634
29	1220	2938	968	928	267	2533	1883	2767	1750	770	705	993	1115	867	900	1284
30	1189	2683	2320	722	170	3484	1834	2215	1889	929	685	554	1625	635	1066	339
31	1200	2342	2840	944	124	2554	1776	1725	1806	516	673	932	897	742	917	290
32	1389	2309	2159	1222	160	2217	1850	2318	2049	533	615	728	1464	628	1158	12
33	778	1827	2130	1083	317	2692	1733	2086	1656	645	750	1013	1483	597	458	435
34	828	2452	2454	944	242	1109	1275	2329	2167	286	672	624	1304	819	992	484
35	2567	2009	1017	861	413	2969	1559	1550	1827	459	746	1017	1464	723	1134	450
36	2289	1729	1160	1194	369	2494	1459	1784	1973	603	575	1620	1653	751	1209	734
37	1250	2217	1914	750	446	236	1509	3363	1964	237	621	750	1303	862	1067	500
38	386	2304	1220	944	19	2256	1500	1862	2083	278	757	977	728	824	1017	400
39	1450	2158	973	1107	42	2336	1917	1853	1981	419	725	1146	1124	766	1075	250
40	1450	1687	1020	1111	486	2098	1967	1801	2007	342	689	1110	1370	715	1142	567
41	1233	1888	2270	1083	392	2850	1967	2346	2049	404	708	779	1389	712	1059	834
42	1761	1976	1244	1028	259	2811	1842	1793	1999	630	622	1473	1540	841	1267	122
43	1100	1700	940	1222	0	2138	1634	1769	1920	606	612	744	926	796	1050	700
44	1673	1554	1300	1094	50	2494	1975	2279	2057	478	715	547	803	810	992	284
45	1044	2334	1107	1542	0	3365	179	2003	1681	1071	631	1513	831	669	1100	600

PLANT PATHOLOGY

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

Seventeen (17) advance lines of *B. Juncea* and 16 of *B. napus* were sown on 1st week of October, 2021 in RCBD pattern keeping plot size 6 x 1.8 m. Row spacing was kept at 45 cm while Plant spacing was maintained as 15 cm. Two rows of spreaders KJ-159 and KJ-267 (1 each) were sown after each entry, in order to facilitate the maximum pressure of disease inoculum. All cultural practices, irrigations & fertilizer applications were done as per recommendations. Artificial inoculum of *Alternaria brassicae* was prepared in the laboratory and culture suspension was sprayed on the trial by foliar application, during the month of January. Data of the diseases were recorded on the onset of the disease following 0-9 scale, as under.

Set A =*Brassica juncea*

Score	CONDITION	Reaction	Names of lines/varieties	No. of lines/varieties
0	No disease	Immune	-	-
1	A few scattered plants blighted with 1-2 spots/plant.	Very Highly Resistant (VHR)	-	-
2	A few scattered plants blighted with5-10 spots/plant.	Highly Resistant (HR)	-	
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KJ-321, Super Raya, KJ-333, Kj-335, KJ-336 and KJ-338,	6
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)	KJ-316, KJ-341, KJ-342,AARI canola and Bagh o Bahar Raya	5
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)	KJ-327, KJ-331,KJ-332, KJ-334,KJ-337,KJ-339	6
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)	KJ-159 and KJ-267	Spreaders
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)	-	-

Out of 17 test entries of *Brassica juncea*,6 lines showed Resistant (R), 5 Moderately resistant (MR) and 6 showed Moderately Susceptible response against the disease.

Set B =*Brassica napus*

Score	CONDITION	Reaction	Names of lines/varieties	No. of lines/varieties
0	No disease	Immune	-	-
1	A few scattered plants blighted with 1-2 spots/plant.	Very Highly Resistant (VHR)	-	-
2	A few scattered plants blighted with5-10 spots/plant.	Highly Resistant (HR)	-	-
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)	KN-353, KN-354, Sandal canola, Rohi sarson and Khanpur canola.	5
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)	KN-342, KN-346, KN-355, KN-357, KN-358,KN-359, KN-363, KN-367 and KN-368.	9
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)	KN-360, KN-361, KN-362	3
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)	KJ-159 KJ-267	Spreaders
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)	-	-

Data mentioned in the above given table shows that, all advance lines of *Brassica napus* fall under, Resistant (R), Moderately resistant (MR) and Moderately susceptible (MS) categories. No lines showed highly resistant response.

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

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

Set A: *B. juncea*

Reaction/category of Mustard lines against Diseases.

Sr. No.	Lines Tested *B. juncea*	Downy mildew (Category)	Powdery mildew (Category)	White Rust (%)
1	KJ-316	VHR	-	-
2	KJ-321	VHR	-	-
3	KJ-327	HR	-	-
4	KJ-331	R	-	-
5	KJ-332	HR	-	-
6	KJ-333	VHR	-	-
7	KJ-334	VHR	-	-
8	KJ-335	HR	-	-
9	KJ-336	HR	-	-
10	KJ-337	HR	-	-
11	KJ-338	HR	-	-
12	KJ-339	HR	-	-
13	KJ-341	HR	-	-
14	KJ-342	HR	-	-
15	BOB Raya	HR	-	-
16	AARI canola	HR	-	-
17	Super Raya	HR	-	-
18	KJ-159 (S^1)	HS	-	-
19	KJ-267 (S^2)	MS	-	-

Attack of downy mildew was low in almost all advance lines/entries of *Brassica juncea,* with a reaction ranging between Very Highly Resistant (VHR) to Highly Resistant (HR) category. Powdery mildew and white rust did not appear in any entry.

Set B: *B. napus*

S. No.	Lines Tested	Downy mildew (Category)	Powdery mildew(Category)	White Rust (%)
1	KN-342	HR	-	VHR
2	KN-346	HR	-	VHR
3	KN-353	R	VHR	HR
4	KN-354	R	-	HR
5	KN-355	R	-	HR
6	KN-357	HR	-	HR
7	KN-358	MR	-VHR	R
8	KN-359	R	-	MR
9	KN-360	MR	VHR	HR
10	KN-361	MR	VHR	VHR
11	KN-362	R	-	HR
12	KN-363	R	-	VHR
13	KN-367	R	VHR	VHR

14	KN-368	R	-	HR
15	Sandal canola	R	VHR	HR
16	Rohi Sarson	HR	VHR	VHR
17	Khanpur canola	HR		-
18	KJ-159 (S^1)	S	-	R
19	KJ-267 (S^2)	HS	-	R

Out of 19 promising advanced lines of *Brassica napus*, all entries showed response in varying categories against the diseases. All lines showed reactions against downy mildew, powdery mildew and white rust, within the resistant categories. i.e., VHR, HR and R reactions. No entry showed susceptible response except spreader lines.

3. OILSEEDS RESEARCH INSTITUTE, BAHAWALPUR.

RAPESEED AND MUSTARD

A. MUSTARD AND RAPESEED

Project 1. MAINTENANCE OF GENE POOL

90 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-252 x AARI canola
2. OBJ-259 x AARI canola
3. OBJ-260 x AARI canola
4. OBJ-265 x AARI canola
5. OBJ-252 x Super raya
6. OBJ-259 x Super raya
7. OBJ-260 x Super raya
8. OBJ-265 x Super raya

Seed of each cross was collected at maturity to raise F_1 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_1 to F_6 winter mustard generations during 2021-22 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_1	8	-	-	-
F_2	8	-	-	-
F_6	3	15	20	3

All F_1 crosses were harvested to rise F_2 generation. In F_6 generation, the best progenies were selected and from each of those, one desirable plant was selected to rise next generation.

Project 4. YIELD TRIALS

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

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

Table 1.2: Performance of 10 entries for seed yield in Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2021-22.

Rank	Line/Variety	Seed Yield (kg/ha)
1	OBJ-262	2555
2	OBJ-268	1999
3	OBJ-269	1890
4	OBJ-270	1885

5	OBJ-271	1850
6	OBJ-272	1820
7	Super Raya (C)	1790
8	OBJ-276	1740
9	OBJ-278	1730
10	OBJ-280	1690
LSD 5%		**275**

Design R.C.B.
Plot size 5m x 1.8 m
Row spacing 45 cm
Fertilizer 75: 75 kg NP/ha
Sowing date 14.10.2021

The perusal of table 1.2 indicates that OBJ-262 gave highest yield i.e., 2555 kg/ha followed by OBJ-268 i.e., 1999 kg/ha.

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

Nine *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, 2021-22 at Oilseeds Research Station, Bahawalpur.

Rank	Line/Variety	Yield (kg/ha)
1	OBJ-175	2910
2	OBJ-151	2289
3	OBJ-153	2255
4	OBJ-160	2222
5	Super Raya (C)	2033
6	OBJ-166	2010
7	OBJ-167	1922
8	OBJ-169	1905
9	OBJ-165	1850
LSD 5%		**225**

Design R.C.B
Plot size 6 x 1.35 m
Row spacing 45 cm
Fertilizer 75:75 NP kg/ha
Sowing date 14.10.2021

The perusal of table 1.3 indicates that OBJ-175 gave highest yield i.e. 2910 kg/ha followed by OBJ-151 that gave the yield 2289 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 2021-22.

Rank	Line/Variety	Seed Yield (kg/ha)
1	Super Raya	2380
2	SohniDharti	1860
3	Rustam Canola	1500
4	Super Raya	1460
5	Faisal Canola	1380
6	AARI Canola	1265
7	Khanpur Raya	1185
8	RohiSarsoon	900
LSD 5%		**580**

Fertilizer 75: 75 kg NP/ha

Sowing date 14.10.2021

The perusal of table 1.5 indicates that Super raya gave highest yield i.e., 2380 kg/ha followed by Sohni Dharti hybrid i.e., 1860 kg/ha.

B. SAFFLOWER

Project 1. MAINTENANCE OF GENE POOL

110 entries of safflower were studied and properly maintained.

Project 2. YIELD TRIALS

a) Preliminary Yield Trial of Safflower

8 safflower lines were tested along with the standard variety “Thori-78” in A1 and 11 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 8 entries for seed yield in A1 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2021-22.

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-145	4444

2	SAF-168	4255
3	SAF-184	4255
4	SAF-177	4066
5	SAF-148	4066
6	SAF-165	4066
7	Thori-78	4066
8	SAF-187	3990
LSD 5%		**370**

Design R.C.B.
Plot size 5m x 1.8 m
Row spacing 45 cm
Fertilizer 75: 75 kg NP/ha
Sowing date 08.11.2021

The perusal of table 1.6 indicates that SAF-145 gave highest yield i.e., 4444 kg/ha followed by SAF-168 i.e., 4255 kg/ha.

Table 1.7: Performance of 11 entries for seed yield in A2 Preliminary Yield Trial at Oilseeds Research Station, Bahawalpur during Rabi 2021-22.

Rank	Line/Variety	Seed Yield (kg/ha)
1	SAF-349	3699
2	SAF-310	3333
3	SAF-333	3333
4	SAF-324	3144
5	Thori-78	2955
6	SAF-318	2955
7	SAF-344	2800
8	SAF-346	2750
9	SAF-347	2630
10	SAF-342	2588
11	SAF-325	2500
LSD 5%		**165**

Design R.C.B.
Plot size 5m x 1.8 m
Row spacing 45 cm
Fertilizer 75: 75 kg NP/ha
Sowing date 08.11.2021

The perusal of table 1.6 indicates that SAF-349 gave highest yield i.e., 3699 kg/ha followed by SAF-310 i.e., 3333 kg/ha.

b) Advanced Seed Yield Trial of Safflower

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

Table 1.8: Performance of 8 entries of advanced seed yield trial, 2021-22 at Oilseeds Research Station, Bahawalpur.

Rank	Line/Variety	Yield (kg/ha)
1	SAF-214	4255
2	SAF-202	4066
3	SAF-209	4066
4	SAF-200	3888
5	Thori-78©	3750
6	SAF-208	3699
7	SAF-205	3510
8	SAF-220	3333
LSD 5%		**270**

Design R.C.B
Plot size 5 m x 1.8 m
Row spacing 45 cm
Fertilizer 75:75 NP kg/ha
Sowing date 08.11.2021

The perusal of table 1.8 indicates that SAF-214 gave highest yield i.e. 4255 kg/ha followed by stand SAF-202 that gave the yield 4066 kg/ha.

c) Micro Seed Yield Trial of Safflower

Eight safflower lines were evaluated along with Thori-78 as standard in six 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 2021-22.

S.No.	Line	BWP	K/Pur	KNWL	D.G K	BKR	Piplan	Avg.
1.	SAF-55	4066	3122	1766	1050	2025	1241	2211
2.	SAF-115	3888	2977	1939	1155	1890	1256	2184
3.	SAF-202	4066	3177	1860	1190	1529	1256	2179
4.	SAF-208	3699	3177	1551	1350	2025	1245	2174
5.	SAF-209	4066	3110	1250	1210	1873	1251	2126
6.	SAF-214	3333	2788	1591	1250	1823	1230	2002
7.	SAF-111	3333	2775	1310	1380	1880	1260	1989
8.	Thori-78	3399	2844	1180	1581	1785	1043	1972
	LSD 5%	**780**	**370**	**760**	**640**	**355**	**250**	

Perusal of the table 1.9 indicated that SAF-55 surpassed all the entries included in the trial by giving seed yield of 2211 kg/ha while lowest yield was taken by Thori-78 (1972 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	08.11.2021

Project 5: Demonstration block of safflower at farmer's field.

LAY OUT	
LOCATION	Bahawalpur
LINE	2(SAF-65 & SAF-111)
PLOT SIZE	1 Kanal
IRRIGATIONS	3
DATE OF SOWING	25-11-2021

Table-1.10: Performance of Safflower Line Sown at farmer's field –Rabi 2021-22

Line	SEED YIELD(kg/plot)
SAF-65	280
SAF-111	300

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

78 entries of Sesame were studied and properly maintained.

Project 2. STUDY OF FILIAL GENERATIONS

The breeding material studied from F_4 to F_7 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_4 to $F_7$of sesame generations during 2021 at Oilseeds Research Station, Bahawalpur.

Generations	No. of crosses studied
F_4	03
F_5	05
F_6	03
F_7	08

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

D. CASTOR BEAN

Project 1. MAINTENANCE OF GENE POOL

65 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 2021-22.

Rank	Line/Variety	Seed Yield (kg/ha)
1	FS-2000	1290
2	S-4	1265
3	S-15	1235
4	KR-20	1205
5	DS-30 ©	1245
6	FS-90	1150
7	KR-30	1145
8	S-29	1050
LSD 5%		**450**

Design R.C.B.
Plot size 5m x 4 m
Row spacing 1 m
Sowing date 20.07.2021

The perusal of table 1.13 indicates that FS-2000 gave highest yield i.e., 1290 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 were maintained during 2022. "A" lines were maintained by crossing manually with their respective "B" lines. B & R lines were maintained through selfing by bagging with muslin cloth bags. Data were recorded on plant height, stem thickness, head diameter, days to 50% flowering, days to maturity, yield per plant, 100 achene weight and oil contents.

Table. No. 1. Data recorded for various characters of sunflower germplasm during 2022

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

Fifteen new hybrid combinations were developed by crossing A and R Lines having good yield and oil quality parameters during 2022. Eighteen sunflower hybrids produced during Spring-2021 were evaluated in Station Yield Trial during Spring-2022 against standard check Hysun-33. Data were 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 2022

Sr. No.	Hybrids	Seed Yield (kg/ha)
1	FH-908	1936
2	FH-910	1900
3	HYSUN-33	1876
4	FH-918	1630
5	FH-905	1485
6	FH-907	1467
7	FH-108	1462
8	FH-70	1438
9	FH-917	1431
10	FH-916	1376
11	FH-906	1364
12	FH-909	1285
13	FH-914	1204
14	FH-913	1140
15	FH-912	1072
16	FH-904	1053
17	FH-915	953
18	FH-919	928
19	FH-911	829

Two sunflower hybrids showed higher yield than the check hybrid Hysun-33. Highest yield was showed by FH-908 (1936 kg/ha) followed FH-910 (1900 kg/ha).

Project No.3. Seed production of sunflower elite hybrids

Seed of sunflower 07 promising hybrids were increased for further testing in Demonstration and National Uniform Yield Trials during 2023.

Table No.3. Seed produced of elite sunflower hybrids during 2022

Sr. No.	Hybrids	Seed (kg)
1	FH-701	14
2	FH-741	8.6
3	FH-896	1.0
4	FH-675	25
5	FH-751	22
6	FH-820	1.5
7	FH-829	1.0

Project No.4. Seed increase of sunflower elite parents

Seed of 6 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 2022.

Sr.No.	CMS line	A (kg)	B (kg)	Sr.No.	Restorer line	Seed Produced (kg)
1	ORI-1	1.0	0.7	1	RL-67	15
2	ORI-42	3.8	0.8	2	RL-96	1.6
3	ORI-43	0.35	0.25	3	RL-86	2.8
4	ORI-90	0.83	0.45	4	RL-72	9.5
5	ORI-92	2.6	1.9	5	RL-58	0.5
6	ORI-106	3.7	3.6	6	RL-114	01

Project No. 5. Micro Yield Trial of sunflower hybrids 2022

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

Design RCB
Plot size 5m x 2.5m
Row to Row spacing 75cm
Plant to Plant spacing 23cm
Sowing dates 1st Jan to 15th Feb 2021

Table No. 5. Micro Yield Trial of Sunflower hybrids during 2022

Sr.No.	HYBRIDS	Faisalabad	Karror	Bahawalpur	Multan	Average kg/ha
1	FH-866	2064	3750	3133	3252	3050
2	FH-871	1349	3225	3270	3275	2780
3	Hysun-33	2019	2450	2880	3093	2610
4	FH-876	1775	3250	2448	2771	2561
5	FH-829	2179	2534	2634	2867	2554
6	FH-850	1800	3250	1993	3143	2546
7	FH-869	1483	3250	1928	3134	2449
8	FH-863	2097	2564	2256	2341	2315

Two sunflower hybrids performed better than the check hybrid Hysun-33. FH-866 gave highest yield of 3050 kg/ha followed by the hybrid FH-871 with the yield of 2780 kg/ha.

Project No.6. Demonstration trial of sunflower hybrids 2022

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 2022

SR.#	Hybrids	Plant Height (cm)	Head Diameter (cm)	Stem thickness (mm)	Days to 50% flowering	100 seed weight (g)	Yield (kg/ha)	Oil Contents %
1	**AGSUN-5270**	185	12.9	18.8	69	5.0	2645	37.2
2	**ORISUN-741**	170	15.3	24.0	66	5.6	2619	40.7
3	**Armoni**	175	14.5	20.7	69	5.0	2544	40.5
4	**AGUARA-4**	185	13.7	19.4	70	5.6	2441	40.5
5	**ORISUN-701**	186	16.1	22.4	63	6.2	2375	37.9
6	**ORISUN-751**	157	17.4	20.2	67	7.3	2351	38.7
7	**US-666**	199	19.0	21.5	71	5.5	2253	41.1
8	**Hysun33**	209	14.3	27.0	71	5.3	2152	39.6
9	**US-444**	206	15.5	32.2	73	5.4	2128	41.0
10	**AGSUN-5264**	188	16.8	22.6	68	5.4	2124	38.4
11	**ORISUN-675**	145	13.5	16.7	53	6.1	2052	40.1
12	**HSF-350A**	184	16.9	27.6	71	5.8	1927	39.7
13	**T40318**	212	14.9	19.8	70	5.7	1865	39.6

The sunflower hybrid AGSUN-5270 showed higher yield of 2645 kg/ha followed by ORISUN-741 with the average yield of 2619 kg/ha.

Project No. 7. National Uniform Sunflower Yield Trial 2021

Results of NUSYT 2021 at Punjab locations are as under:

Table No. 7. National Uniform Sunflower Yield Trials 2021.

Sr#	Hybrids	BWP	FSD	Karror	DG Khan	Multan	Mean
1	**FH-331**	1844	3670	3648	2901	2036	2819
2	**HSF-352C**	1800	2859	2743	3906	2773	2816
3	**HSF-351B**	1625	2509	2651	4725	2486	2799
4	**TAHAFUZ-4033**	1449	2727	2851	4245	2498	2754
5	**SMH-0927**	2020	2467	2939	3530	2693	2729
6	**SY-AZTEK**	1844	2908	2651	3386	2799	2717
7	**FH-741**	1229	3586	3821	2567	2140	2668
8	**SF-0060**	1361	2895	2589	3980	2061	2577
9	**SY-EDISON**	1625	2822	2508	3478	2406	2567
10	**FH-825**	1383	3181	3098	3389	1662	2542
11	**ALTIS-99**	1339	2858	2822	4055	1626	2540
12	**FH-751**	922	3199	3158	3204	2138	2524
13	**SMH-1900A**	1493	2814	2431	3596	2113	2489
14	**GULBAHAR-436**	1229	2604	2948	3539	1882	2440
15	**SF-0065**	1142	2533	2299	4112	2023	2421
16	**Es-Bella**	1800	2737	1780	3898	1839	2410
17	**ALISUN-93**	1098	2797	2932	3196	1896	2383
18	**GIF-3060-TOB-3045**	1855	2913	2618	2987	1416	2357

19	**DIAMOND-2033**	1273	2924	2909	2456	2198	2352
20	**GOLDEN-1**	1273	2001	2864	3853	1648	2327
21	**SY-CHESTER**	1010	2851	2727	2685	2348	2324
22	**SITARA-201**	1317	2858	2302	2971	2116	2312
23	**AGSUN-5264 (C)**	1449	2773	2824	2914	1502	2292
24	**SD-222**	1756	2165	2706	3375	1398	2280
25	**FH-555**	1164	2858	2946	2238	1946	2230
26	**FH-732**	1405	2693	2693	2392	1941	2224

Three sunflower hybrids FH-741 (2668 kg/ha), FH-825 (2542 kg/ha), FH-751 (2524 kg/ha) showed higher yield than check hybrids in NUSYT 2021 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-8437	X	Faisal Soybean
2.	HM-8437	X	95-1-14
3.	Prover	X	Faisal Soybean
4.	SH-1274	X	95-1-14
5.	Faisal Soybean	X	SH-1274
6.	Faisal Soybean	X	E-1092

Seed of 3 successful crosses was collected at maturity to raise F_1 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_1 to F_5 generations in 2021 at Oilseeds Research Institute, Faisalabad.

Generations	Crosses studied	Progenies studied	Plants selected
F_1	3	Whole material was studied.	-
F_2	2	-do-	35
F_3	4	50	25
F_4	4	30	12
F_5	4	10	08

All F_1 crosses were harvested to raise F_2 generation. From 02 F_2 crosses, 35 desirable plants were selected. In F_3, F_4 and F_5 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 2021.

Rank	Entry Name	Plant height (cm)	Branches /plant	Seeds /pod	Pods/plant	Seed yield (kg/ha)
1	LEE	104	3.7	2.4	94	2002
2	E-285	52	4.5	2.5	104	1981
3	**Faisal Soybean (C)**	81	3.9	2.4	104	1972
4	Bovelander	51	3.9	2.3	98	1764
5	249-313-D	43	4.2	2.2	99	1749
6	SL-4	58	4.0	2.3	107	1503
7	Gail	75	4.7	2.3	101	1224
8	ADA	79	3.5	2.4	101	1181
9	DGS-16	88	3.1	2.4	99	1108
10	SS-183	98	2.9	2.3	94	1068
11	**Ajmeri (C)**	27	4.3	2.4	95	978
LSD at 5%						258

Design	R.C.B
Plot size	5 x 0.9 m
Row spacing	30 cm
Fertilizer	75: 75:30 NPK kg/ha
Sowing date	08.08.2021

The perusal of table 1.2 indicates that Lee gave highest yield i.e, 2002 kg/ha followed by E-285 i.e, 1981 kg/ha. The maximum plant height (104 cm) was observed for Lee. Number of branches ranged from 2.9-4.7. Maximum No. of pods per plant i.e. 107 were observed for SL-4.

Project 4. <u>ADVANCED SEED YIELD TRIAL</u>

Seven 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 07 entries of advanced seed yield trial, 2021 at Oilseeds Research Institute, Faisalabad.

Rank	Entry Name	Plant height (cm)	Branches /plant	Seeds /pod	Pods/plant	Seed yield (kg/ha)

1	PROVER	53	4.2	2.28	97	2533
2	HS-17	107	1.4	2.19	68	2532
3	**FAISAL SOYBEAN (C)**	76	3.9	2.19	83	2037
4	ADAMS	57	3.7	2.27	69	2024
5	E-1097	65	2.9	2.26	81	2004
6	COLUMBUS	85	4.5	2.29	81	1624
7	**AJMERI (C)**	38	3.3	2.13	59	961
LSD at 5%						275

Design	R.C.B
Plot size	5 x 1.2 m
Row spacing	30 cm
Fertilizer	75: 75: 30 NPK kg/ha
Sowing date	08.08.2021

The perusal of Table 1.3 indicates that Prover gave highest yield i.e. 2533 kg/ha. The maximum plant height (107 cm) was observed for HS-17. Number of branches ranged from 1.4-4.5. Maximum No. of pods per plant i.e. 97 was observed for Prover.

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 three locations are given in table 1.4.

Table 1.4

Performance of soybean strains at different locations in the Punjab in Kharif 2021

Seed Yield (kg/ha)					
RANK	**Lines/Variety**	**FSD**	**MBD**	**Piplan**	**Mean**
1	HM-8468	2008	1883	778	1556
2	**FAISAL SOYBEAN (C)**	1872	1743	1036	1550
3	FS-10	1620	1375	1333	1443
4	CN-5	1631	1438	947	1339
5	SH-1274	1808	1440	556	1268
6	LAFE-40	2017	1181	583	1260
7	**AJMERI (C)**	950	1029	903	961
LSD 5%		331	202	74	

Design	R.C.B.
Plot size	5 x 1.2 m
Row spacing	30 cm
Fertilizer	75:75:30 N:P:K kg/ha
Sowing date	08.08.2021

Perusal of the table 1.4 indicated that HM-8468 surpassed all the entries included in the trial by giving average seed yield of 1556 kg/ha.

Project 6. NATIONAL UNIFORM YIELD TRIAL (KHARIF 2021)

Yield performance of thirteen soybean lines was tested under different agro-climatic conditions of the Pakistan under the office of National Coordinator (Oilseeds) PARC. The results received are given in table 1.5.

Table 1.5
Performance of soybean strains at different locations in the Pakistan in Kharif 2021

Seed Yield (kg/ha)							
RANK	**Lines/Variety**	**ARI Swat**	**ORI-AARI Faisalabad**	**Shakar Garh**	**MMRI Sahiwal**	**BARI Chakwal**	**Mean**
1	BCI-3	2434	1992	2989	1603	595	1923
2	**E-1092**	**2288**	**1359**	**3526**	**1671**	**709**	**1911**
3	BCI-1	2646	1180	3089	1504	894	1863
4	**Faisal Soybean (C)**	**2448**	**2290**	**2015**	**1810**	**529**	**1818**
5	ESB-390-A	2319	2068	2000	2023	649	1812
6	BCI-5	2569	1179	2873	1389	599	1722
7	BCI-6	2501	1355	2563	1619	419	1691
8	NBG-363	2194	826	2647	1183	893	1549
9	BCI-4	2417	931	2404	1257	734	1549
10	BCI-2	2486	915	2180	1422	699	1540
11	PGRA-9	2253	764	2033	1117	591	1352
12	Falaksar	2474	692	1713	1175	519	1315
13	White-2018	2222	378	1696	829	689	1163

Perusal of the table 1.5 indicated that candidate line of Oilseeds Research Institute i.e. E-1092 gave seed yield 1911kg/ha more than check variety i.e. Faisal Soybean (1818kg/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.

Yield Data of Germplasm (Kg/ha)

Sr.No.	No. of Entries	Range
1	15	1000-1500 Kg/ha
2	55	500-1000Kg/ha
3	20	Less than 500 Kg/ha
Sr.No.	**No. of Entries**	**Single/Branched**
1	36	Single
2	54	Branched

Project 2. DEVELOPMENT OF FRESH CROSSES

Fourteen crosses were made keeping parental lines having good traits.

Sr.No.	Crosses			Sr.No.	Crosses		
1.	19002	X	NO.56	2.	NO.56	X	19002
3.	19002	X	90004	4.	90004	X	19002
5.	L-101	X	NO.10	6.	NO.10	X	L-101
7.	16003	X	96005	8.	96005	X	16003
9.	50007	X	20001	10.	20001	X	50007
11.	86001	X	96005	12.	96005	X	86001
13.	93001-1/97	X	86001	14.	86001	X	93001-1/97

Seed of each cross was collected at maturity to raise F_1 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_1 to F_6 sesame generations during 2021 at Oilseeds Research Institute, Faisalabad.

Generation	Crosses	Plants selected
F_1	16	-

F_2	13	49
F_3	12	38
F_4	07	26
F_5	07	13
F_6	08	10
F_7	02	8 Lines

All F_1 crosses were harvested to raise F_2 generation. From F_2 to F_3 generation F_3 to F_4 generation and F_4 to F_5 was selected to raise next generation. In F_7, 8 lines were selected for seed yield evaluation.

Project 4. PRELIMINARY YIELD TRIAL (Sesame)

Ten Sesame lines were tested along with two standard varieties "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 2021.

Rank	Line/Variety	Days to 50% Flowering	No. of pods/plant	Branches/ Plant	Plant height (cm)	Seed yield (kg/ha)
1	**21001**	53	73	1	195	683
2	**21002**	51	93	1	198	931
3	**21003**	51	96	1	197	1054
4	**21004**	50	110	1	208	1057
5	**21005**	48	80	1	211	1223
6	**20002**	50	91	1	194	1183
7	**20003**	53	96	1	200	1220
8	**20004**	51	91	1	207	1294
9	**TH-6**	50	73	1	200	509
10	**21006**	53	161	6	217	406
11	**21007**	62	154	5	220	618
12	**TIL-18**	68	120	6	218	485
					LSD 5%	94.560

Design	R.C.B.
Plot size	5 x 1.35m
Row spacing	45 cm
Fertilizer	60:60:60 NPK kg/ha
Sowing date	June, 2021

The perusal of table 1.2 indicates that 20004 gave highest yield i.e, 1294 kg/ha followed by 21005 i.e, 1223 kg/ha. Days to 50% flowering ranged from 48-68. The maximum plant height (220cm) was observed by 21007 and minimum (194 cm) by 20002. Number of pod/plant ranged from 73-161. 21006 and 21007 showed maximum number of pod/plant 161 and 154.

Project 5. ADVANCED SEED YIELD TRIAL (Sesame)

Seven sesame lines were evaluated along with two checks; "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, 2021 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	**19002**	49	79	1	190	944
2	**16003**	53	83	1	195	744
3	**20001**	50	78	1	204	881
4	**17004**	49	72	1	200	615
5	**17002**	64	122	6	218	428
6	**87005**	64	182	8	211	538
7	**16005**	66	118	5	223	814
8	**TH-6**	48	72	1	190	441
9	**TIL-18**	67	116	5	208	428
					LSD 5%	87.151

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, 2021

The perusal of table 1.3 indicates that 19002 gave highest yield i.e. 944 kg/ha followed by 20001 i.e. 881 kg/ha. Days to 50% flowering ranged from 48 to 67. Number of branches ranged from 1-8 and plant height 190-223. Maximum plant height was observed by 16005.

Project 6. MICRO SEED YIELD TRIALS (Sesame)

Yield performance of ten lines of sesame were 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 2021

Rank	Line/ Variety	Karore	F/Abad	Piplan	KHAN PUR	Average
1	**87006**	363	950	722	267	576
2	**17005**	633	948	472	233	572
3	**18003**	385	907	528	320	535
4	**18002**	493	952	361	230	509
5	**19003**	389	1089	315	227	505
6	**70004**	400	773	361	347	470
7	**small pod**	278	752	556	280	466
8	**TH-6**	541	586	509	200	459
9	**No. 56**	459	663	389	200	428
10	**NIAB Sesame 2016 ©**	383	662	343	303	423
	18001	469	656	287	200	403
	LSD 5%	**57.572**	**108.52**	**45.529**	**93.047**	

Perusal of the table 1.4 (a) indicated that 87006 and 17005 surpassed all the entries included in the trial by giving average seed yield of 576 kg/ha and 572 kg/ha while lowest yield was taken by 18001 (403 kg/ha), whereas TH-6 and NIAB Sesame 2016 the standard Varieties, produced the seed yield of 459 kg/ha and 423 kg/ha respectively.

Table 1.4 (b) Others parameters of advanced lines of Micro seed yield trial, 2021 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	**19003**	49	87	1	185	1089
2	**18001**	46	72	1	171	656
3	**17005**	48	74	1	192	948
4	**small pod**	47	86	1	197	752
5	**18002**	53	82	1	190	952
6	**18003**	67	95	1	191	907
7	**87006**	65	133	10	206	950
8	**No. 56**	56	74	1	172	663

9	**70004**	67	130	8	201	773
10	**TH-6**	49	78	1	190	586
11	**NIAB Sesame 2016 ©**	68	126	9	197	662
					LSD 5%	**108.52**

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, 2021

Perusal of the table 1.4 (b) Days to 50% flowering ranged from 47-68 days. Number of branches per plant ranged from 1-10 and Plant height from 171-206 cm.

Project 7. NATIONAL UNIFORM SESAME YIELD TRIAL (NUSYT)

The objective of this trial was to test the performance of sesame varieties under different environmental conditions of Pakistan. 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 2021

Sr No.	De-Coded Entry	Location Yield (kg/ha)										
		ARI Tendojam	ARI Quetta	BARI Chakwal	PRTS Multan	ORI - FSD	NARC ISB	AZRDI Khan	ARI Tarnab	NIAB FSD	AZRI BWP	Mean
1	**17006**	420	385	92	368	697	406	436	159	Trial could not survive due to heavy rain	Result not shared by the stakeholder	458
2	**NS-5**	893	349	97	376	697	322	578	91			464
3	**NS-21**	703	315	44	370	542	388	415	167			406
4	**SGP-ll**	795	314	97	361	411	523	468	71			415
5	**NH-407**	900	362	73	347	416	625	775	152			505
6	**DM-14**	527	349	35	337	913	420	239	162			492
7	**SGP-l**	833	306	128	356	404	587	570	64			445
8	**TH-6**	650	307	115	363	763	349	453	119			447
9	**CMS-101**	176	340	88	353	888	329	339	135			450
10	**CMS-102**	210	354	45	355	856	298	395	94			452
11	**TS-5**	404	336	160	216	441	490	522	164			401
12	**NS-260-SP1-2**	775	356	136	327	583	301	762	126			466
13	**PAPA TL11**	156	315	105	325	805	257	265	47			393
14	**NH-222**	726	333	106	380	440	520	832	97			501
15	**17003**	137	366	27	359	895	299	417	123			467
16	**SGP lll**	791	321	157	362	421	453	408	96			393

Mean	**569**	**338**	**94**	**347**	**636**	**410**	**505**	**117**			
CV	**50**	**12**	**50**	**15**	**8**	**15**	**30**	**42**			

Perusal of the table 1.5 indicated that entry NH-407 surpassed all the entries included in the trial by giving average seed yield of 505 kg/ha while lowest yield was taken by PAPA TiL01 and SGP lll (393 kg/ha), whereas TS-5 and TH-6 the standard Varieties, produced the seed yield of 401kg/ha and 447kg/ha respectively.

7. OILSEEDS ENTOMOLOGY

i. Screening of Promising Lines of Sesame for Resistance/ Susceptibility against Insect Pest Complex

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

Minimum population of whitefly was found on No.56 (1.53) and maximum was found on line 18001 (2.42). Mean population of whitefly also remained below ETL. It was revealed that minimum population of mirid bug were recorded on No.56 (4.73) while maximum was recorded at line 19003 (6.79). Maximum percent infestation of pod borer was observed on line No.56 (10.97) while minimum infestation was recorded on 18002 (7.77).

Sr. No.	Variety	Whitefly/Leaf	Mirid Bug/Plant	Pod Borer (% Infestation)
1	19003	2.27 ab	6.79 a	10.31 a
2	18001	2.42 a	6.12 abc	10.13 a
3	17005	1.63 cd	4.79 d	9.79 a
4	Small Pod	1.95 bc	5.27 cd	9.06 a
5	18002	1.81 cd	5.39 cd	7.77 a
6	18003	1.65 cd	5.43 cd	8.40 a
7	87006	1.79 cd	6.45 ab	8.63 a
8	No. 56	1.53 d	4.73 d	10.97 a
9	70004	1.73 cd	5.52 bcd	10.1 a
10	TH-6	1.57 d	5.40 cd	9.03 a
11	Niab Sesame 2016	1.65 cd	5.68 bcd	9.90 a
LSD @ 5%		0.37	0.97	3.22

ii. Screening of Elite Lines of *Brassica juncea* against Mustard aphid

Twenty-two strains of *Brassica juncea* were sown to test their behavior against mustard aphid under natural conditions. The maximum aphid population was found on *Brassica juncea* line KJ-294 (14.556). Whereas, minimum population of mustard aphid was found on KJ-326 (10.200). It is also revealed that the population of mustard aphid remained below Economic Threshold Level (ETL) on all the above tested *Brassica juncea* lines.

Sr. No.	Strain/ Variety	Avg. aphid population/ 10 cm central shoot	Sr. No.	Strain/ Variety	Avg. aphid population/ 10 cm central shoot
1	RBJ-15013	11.911 ab	12	Super Raya	12.156 ab
2	RBJ-15017	11.822 ab	13	RBJ-15017	11.756 ab
3	RBJ-16007	13.067 ab	14	RBJ-16007	10.911 b
4	RBJ-17003	12.111 ab	15	RBJ-16012	12.444 ab
5	RBJ-17005	12.867 ab	16	RBJ-17003	11.133 b
6	BRJ-1775	12.733 ab	17	19CBJ-005	13.489 ab
7	BRJ-1778	11.311 ab	18	BRJ-1669	11.178 ab
8	18CBJ-001	11.311 ab	19	KJ-340	12.022 ab
9	18CBJ-005	13.489 ab	20	KJ-326	10.200 b
10	KJ-284	12.156 ab	21	OBJ-160	11.867 ab
11	KJ-294	14.556 a	22	Super Raya	13.067 ab
LSD @ 5% 3.38					

iii. Screening of Elite Lines of *Brassica napus* against Mustard aphid

Twenty-one entries of *Brassica napus* were sown to test their behavior against mustard aphid under natural conditions. The maximum aphid population was found on *Brassica napus* line KN-356 (14.889), while minimum mustard aphid population was observed on 19CBN002 (10.422). It is also revealed that the population of mustard aphid remained below Economic Threshold Level (ETL) on all the above tested *Brassica napus* lines.

Sr.No.	Strain/Variety	Avg. aphid population/10 cm central shoot	Sr.No.	Strain/Variety	Avg. aphid population/10 cm central shoot
1	RBN-14017	11.667 ab	12	Sandal Canola	11.756 ab
2	RBN-16014	10.511 b	13	KN-366	10.800 ab
3	RBN-17014	13.422 ab	14	KN-356	14.889 a
4	RBN-18006	11.511 ab	15	19 CBN 002	10.422 b
5	RBN-18007	12.689 ab	16	19 CBN 004	12.044 ab
6	18 CBN 001	10.556 b	17	RBN-16014	12.511 ab
7	18 CBN 008	13.889 ab	18	RBN-17014	13.133 ab
8	KN-312	11.556 ab	19	RBN-18009	12.822 ab
9	KN-327	11.267 ab	20	Sandal Canola	12.444 ab
10	KN-330	11.956 ab	21	Rachna Canola	13.156 ab
11	KN-336	12.422 ab			
LSD @ 5% 4.16					

iv. Identification of genetic resistance in *Brassica juncea* against Mustard aphid

The source population was sown in the field under natural conditions. Eight 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.

v. Evaluation of various Plant Extracts as Biopesticides against Mustard Aphid

Three biopesticides made from Super Canola and Super Raya were tested against mustard aphid. These biopesticides were applied @ 500 ml/acre. Biopesticide made from Super Raya gave the highest mortality (56.16%) followed by Super Canola (51.93%) respectively.

Sr. No.	Insecticides	B.T	8 HAT	24 HAT
1	Super Canola	853	634 (25.67 %)	410 (51.93 %)
2	Super Raya	796	489 (38.57 %)	349 (56.16 %)
3	Control	895	796 (11.06 %)	775 (13.41 %)
	LSD @ 5%		184.18	144.70

vi. Evaluation of different insecticides against Mustard Aphid

Three insecticides; flonicamid, thiamethoxam and carbosulfan were tested against mustard aphid. These insecticides were applied at recommended dose rates. Carbosulfan gave the highest mortality (92.83%) followed by thiamethoxam (88.84%) and flonicamid (80.44%) after 72 hours of insecticide application.

Sr. #	Insecticides	B.T	24 HAT	48 HAT	72 HAT
1	Flonicamid	956	392 (58.99 %) b	299 (68.72 %) b	187 (80.44 %) b
2	Thiamethoxam	1048	284 (72.90 %) b	176 (83.21 %) b	117 (88.84 %) bc
3	Carbosulfan	1130	179 (84.16 %) b	132 (88.32 %) b	81 (92.83 %) c
4	Control	1077	1098 (-1.95 %) a	1132 (-5.11 %) a	1170 (-8.64 %) a
	LSD @ 5%		87.33	64.40	23.58

vii. Screening of Sunflower Hybrids for their Resistance/Susceptibility against insect pests

Eight 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 (2.06) was found on hybrid ORISUN-701 while maximum population (3.21) was observed on hybrid Hysun-33. The minimum population of jassid (0.46) was observed on hybrid FH-751 while maximum population was observed on hybrid ORISUN-701 (1.23). 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 hybrid FH-847. Whereas, maximum population (0.10) per plant was observed in hybrids viz; FH-741, ORISUN-701, FH-825 and FH-751.

Sr.#	Hybrid	Whitefly/Leaf	Jassid/Leaf	Head Moth/Plant
1	FH-829	2.31	0.99	0.07
2	FH-741	2.19	0.86	0.10
3	ORISUN-701	2.06	1.23	0.10
4	FH-825	2.11	0.91	0.10
5	FH-751	2.07	0.46	0.10
6	FH-847	3.02	0.98	0.03
7	N.K.Armoni	2.85	1.10	0.07
8	Hysun-33	3.21	1.01	0.07
LSD @ 5%		0.26	0.22	0.02

viii. Screening of Sunflower Inbred lines for their Resistance/Susceptibility against insect pests

Twelve 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 (1.61) was found on RL-50 while maximum population (2.106) was observed on ORI-106B. The minimum population of jassid (0.29) was observed on RL-97 while maximum population was observed on RL-50 (1.09). 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-97. Whereas, maximum population (0.13) per plant was observed on ORI-106B, RL-112, RL-114 and RL-108.

Sr.#	Inbred Line	Whitefly/Leaf	Jassid/Leaf	Head Moth/Plant
1	ORI-43B	2.10	0.91	0.10
2	ORI-73B	1.94	1.03	0.07
3	ORI-106B	2.47	0.34	0.13
4	RL-112	1.89	1.01	0.13
5	RL-50	1.61	1.09	0.07
6	RL-92	1.72	0.71	0.07
7	RL-43	2.34	0.57	0.10
8	RL-114	2.14	0.88	0.13
9	RL-97	2.45	0.29	0.03
10	RL-108	2.07	0.89	0.13
LSD @ 5%		0.29	0.19	0.03

ix. Growing of sunflower in wheat to increase productivity per unit area

Sunflower was grown in wheat successfully. Sunflower escaped the susceptible stage from insect pest infestation.

x. 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.

xi. Evaluation of different insecticides against the whitefly

Three insecticides; Flonicamid, Afidopyropen, and Pyrifluquinazon were tested against whitefly. These insecticides were applied @ recommended doses. Pyrifluquinazon gave the highest mortality (90.35%) followed by Afidopyropen (88.58%) and Flonicamid (84.69%) after 7 days of application.

			Mortality (%)			
Sr. #	**Insecticides**	**B.T**	**24 HAT**	**48 HAT**	**72 HAT**	**7 DAT**
1	Flonicamid	121	70.65	76.07	80.61	84.69
2	Afidopyropen	135	72.57	78.81	82.74	88.58
3	Pyrifluquinazon	119	73.00	81.94	86.24	90.35
4	Control	128	-6.06	-16.67	-28.79	-37.88
	LSD @ 5%		18.36	13.82	24.15	16.42

xii. Evaluation of different insecticides against the jassid

Three insecticides; Flonicamid, Afidopyropen, and Nitenpyram were tested against jassid. These insecticides were applied @ recommended doses. Nitenpyram gave the highest mortality (86.55%) followed by Afidopyropen (83.06%) and Flonicamid (82.47%) after 7 days of application.

			Mortality (%)			
Sr. #	**Insecticides**	**B.T**	**24 HAT**	**48 HAT**	**72 HAT**	**7 DAT**
1	Flonicamid	93	69.23	73.21	78.45	82.47
2	Afidopyropen	83	70.16	74.19	80.10	83.06
3	Nitenpyram	89	71.00	73.42	82.19	86.55
4	Control	95	-2.14	-6.12	-11.39	-13.61
	LSD @ 5%		18.36	13.82	24.15	16.42

8. OILSEEDS PATHOLOGY

RAPESEED AND MUSTARD

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

09 promising cultivars of rapeseed and 10 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 will be 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 with5-10 spots/plant.	Highly Resistant (HR)
3	A few scattered plants blighted with 11-25 spots/plant.	Resistant (R)
4	A few scattered plants blighted with 26-50 spots/plant.	Moderately Resistant (MR)
5	Blighted plant more common, nearly every leaf, stem and branch infected but plant remains normal in form.	Moderately Susceptible (MS)
6	Every plant infected with about 50% of leaf area and stem.	Susceptible (S)
7	Every plant severely infected with about 75% of leaf area and stem.	Highly Susceptible (HS)
8	Every severely infected defoliation common and 95% of stem surface affected	Very Highly Susceptible (VHS)
9	Defoliation severe and 100% leaf and stem area affected and destroyed.	Completely Susceptible (CS)

REFERENCE:

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

Table -2:- During 2021-22, 09 cultivars of *Brassica napus* were screened against various diseases under natural conditions.

Sr. No.	Variety/Line	Alternaria blight %	Alternaria blight (0-9) (intensity)	Remarks	White rust %	Remarks
1	KN-366	20	3	R	-	-
2	KN-356	27	4	MR	-	-
3	19-CBN002	22	3	R	-	-
4	19-CBN004	26	4	MR	-	-
5	RBN-16014	28	4	MR	-	-
6	RBN-17014	21	3	R	-	-
7	RBN-18009	29	4	MR	-	-
8	Sandal Canola	27	4	MR	-	-
9	Rachna Canola	23	3	R	-	-

Downy mildew and powdery mildew diseases did not appear during 2021-22.

Table -3:- During 2021-22, 10 cultivars of *Brassica juncea* were screened against various diseases under natural conditions.

Sr. No.	Variety/Line	Alternaria blight %	Alternaria blight (0-9) (intensity)	Remarks	Powdery Mildew (%)	Downey mildew (%)
1	RBJ-15017	24	3	R	-	-
2	RBJ-16007	29	4	MR	-	-
3	RBJ-16012	31	4	MR	-	-
4	RBJ-17003	28	4	MR	-	-
5	19CBJ005	32	4	MR	-	-

6	BRJ-1669	34	4	MR	-	-
7	KJ-340	53	5	MS	-	-
8	KJ-326	51	5	MS	-	-
9	OBJ160	55	5	MS	-	-
10	Super Raya	37	4	MR	-	-

Whit rust, downy mildew and powdery mildew diseases did not appear during 2021-22.

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

In this experiment 03 bactericides were used against bacterial soft rot disease. Kasumin gave the best control followed by Casper and Cobox.

Table:- 4. PREVIOUS YEAR'S RESULTS (in *vivo*)

Treatments	Disease %	% disease decrease
T_1 = Kasumin (Kasugamycin) @ 2.5ml/liter of water	06	94
T_2 = Casper (Kasugamycin+ Copper Oxychloride) @1ml/liter of water	12	88
T_3 = Cobox (Copper Oxychloride) @ 2.5g/liter of water	18	82
T_4 = Control	100	0

Project-3: SCREENING OF SUNFLOWER NUSYT MATERIAL FOR ITS BEHAVIOUR AGAINST DISEASES DURING 2022.

During spring 2022, 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, 2022 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-11, NUYT-12, NUYT-13, NUYT-14, NUYT-15, NUYT-18, NUYT-17, NUYT-20, NUYT-21, NUYT-22, NUYT-23, NUYT-24, NUYT-25,	20
D	infection covered the stem length 31cm or above	Susceptible (S)	NUYT-7, NUYT-9, NUYT-10, NUYT-20, NUYT-22, NUYT-26,	06
			Total	26

Out of 26 entries of NUSYT, 20 were moderately resistant and 06 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. Phytopathomatry. Techanical 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, 2022 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
			Total	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 ADVANCE MATERIAL FOR ITS BEHAVIOUR AGAINST DISEASES DURING 2022

During spring 2022, 09 entries advance 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, 2022.

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-741, FH-820,	02
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	FH-751, FH-825, FH-841, NK-Armoni, Hysun-33	05
D	infection covered the stem length 31cm or above	Susceptible (S)	FH-829, FH-847	02
			Total	09

Out of 09 hybrids, 02 were Resistant, 05 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 2022.

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	Susceptible (S)	0	0

	rotten			
9	51% rotten and above	Highly Susceptible	FH-741, FH-751, FH-820, FH-825, FH-829, FH-841, FH-847, Hysun-33, NK-Armoni	09
			Total	09

Out of 09 entries, no hybrid was found highly resistant, resistant and moderately susceptible and susceptible. All 09 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, 2022.

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-106, RL-114, RL-50, RL-92, RL-108,	05
C	infection covered the stem length 21-30cm	Moderately Resistant (MR)	ORI-43, ORI-73, RL-39, RL-43, RL-96,	05
D	infection covered the stem length 31cm or above	Susceptible (S)	0	0
			Total	10

Out of 10 entries, 05 inbred lines were resistant, 05 were moderately resistant and no inbred line was found susceptible.

PROJECT -6: BEHAVIOR OF SESAME GERMPLASM AGAINST CHARCOAL ROT DISEASE DURING 2021 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*. 11 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 2021 at Faisalabad in sick field.

Score	Conditions	Remarks	Varieties/lines	No. of varieties/lines
0	No symptoms on plants	Immune	0	0
1	1% or less plants mortality	Highly Resistant (HR)	0	0
3	1-10% mortality	Resistant (R)	0	0
5	11-25% mortality	Moderately resistant (MR)	18001, 17005, Small Pod, 18002, 18003, 87006, TH-6, NIAB Sesame 2016	08
7	26-50% mortality	Susceptible (S)	19003, No. 56, 70004,	03
9	51% or more mortality	Highly Susceptible (HS)	0	0
			Total	11

Out of 11 varieties/lines of sesame, there was no immune, highly resistant & resistant. 08 were moderately resistant and 03 was susceptible.

PROJECT -7: BEHAVIOR OF SESAME GERMPLASM AGAINST CHARCOAL ROT DISEASE DURING 2021 AT Karor & M. B. Din

The sesame germplasm was sown at Karor & M. B. Din to note their behavior to charcoal rot disease caused by *Macrophomina phaseolina*. 11 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.

Sr. No.	Line/ Variety	Karor		M.B.Din	
		Dis. %	Remarks	Dis. %	Remarks
1.	**19003**	22.36	MR	25	MR
2.	**18001**	21.76	MR	23.11	MR

3.	**17005**	23.15	MR	20.15	MR
4.	**Small Pod**	23.45	MR	19.54	MR
5.	**18002**	24.17	MR	22.00	MR
6.	**18003**	21.51	MR	18.47	MR
7.	**87006**	24.11	MR	17.15	MR
8.	**No.56**	15.43	MR	24.00	MR
9.	**70004**	19.31	MR	20.16	MR
10.	**TH-6**	21.62	MR	22.13	MR
11.	**NIAB Sesame 2016**	18.53	MR	24.11	MR

PROJECT -8: BEHAVIOR OF SESAME GERMPLASM AGAINST PHYLLODY DISEASE DURING 2021 at Faisalabad.

The sesame germplasm was sown at Faisalabad to note their behavior to phyllody disease. 11 lines/varieties were sown under natural conditions at ORI field. The disease infection was recorded on the basis of diseased/healthy plants in each entry. The entries were classified according to the intensity of infection and the data recorded are presented in table.

Table-13:-Behavior of Sesame germplasm against phyllody disease during 2021 at Faisalabad.

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)	-	-
5	11-20% plants infected	Moderately resistant (MR)	18001, 17005, Small Pod, 18002, 18003, 87006, NIAB Sesame 2016, 19003, No.56	09
7	21-50% plants infected	Susceptible (S)	70004, TH-6	02
9	51% or above plants infected	Highly Susceptible (HS)	-	-
			Total	11

Out of 11 varieties/lines of sesame, there was no immune and highly resistant. 09 were moderately resistant & 02 were susceptible.

PROJECT -9: BEHAVIOR OF SESAME GERMPLASM AGAINST PHYLLODY DISEASE DURING 2021 at Karor & M. B. Din.

The sesame germplasm was sown at Karor & M. B. Din to note their behavior to phyllody disease. 11 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.

Sr. No.	Line/ Varaiety	Karor		M.B.Din	
		Dis. %	Remarks	Dis. %	Remarks
1.	19003	11.22	MR	19.11	MR
2.	18001	13.22	MR	15.31	MR
3.	17005	19.29	MR	19.11	MR
4.	Small Pod	15.21	MR	15.63	MR
5.	18002	12.19	MR	16.28	MR
6.	18003	23.24	MR	23.10	MR
7.	87006	19.46	MR	19.58	MR
8.	No.56	18.58	MR	19.10	MR
9.	70004	23.42	MR	17.51	MR
10.	TH-6	19.27	MR	22.14	MR
11.	NIAB Sesame 2016	24.00	MR	21.08	MR

9. OIL TECHNOLOGY

Experiment 1:- Determination of Oil Contents of National Uniform Sunflower Yield Trial

Table-1 Oil Content Results of National Uniform Sunflower Yield Trial

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	E7	39.38	30	E34	41.28
2	E2	39.87	31	E39	39.58
3	E8	42.77	32	E40	44.68
4	E9	39.36	33	E31	40.40
5	E5	40.33	34	E38	38.59
6	E3	40.14	35	E33	44.22
7	E1	38.32	36	E35	41.12
8	E6	39.99	37	E37	44.28
9	E4	39.38	38	E32	42.22
10	E10	42.53	39	E36	44.52
11	E16	41.39	40	E66	38.78
12	E20	39.58	41	E67	43.03
13	E17	40.95	42	E70	36.67
14	E11	39.68	43	E69	37.79
15	E14	41.02	44	E62	40.43
16	E12	38.78	45	E64	40.52
17	E13	40.05	46	E65	41.75
18	E18	38.14	47	E63	41.20
19	E19	39.52	48	E61	38.31
20	E15	41.04	49	E46	38.19
21	E24	37.44	50	E41	38.81
22	E23	37.68	51	E42	39.44
23	E29	38.55	52	E44	44.25
24	E22	38.53	53	E73	37.60
25	E25	37.37	54	E71	39.56
26	E28	39.03	55	E78	39.90
27	E30	40.22	56	E76	38.15
28	E27	39.15	57	E74	37.52
29	E26	39.11	58	E77	41.65

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
59	E75	38.65	68	E51	42.55
60	E72	40.69	69	E55	40.81
61	E45	42.45	70	E60	37.89
62	E47	37.17	71	E59	41.88
63	E49	38.95	72	E58	38.33
64	E50	40.21	73	E53	41.27
65	E43	41.02	74	E52	42.48
66	E48	39.01	75	E56	41.08
67	E57	38.21	76	E54	41.86

76 samples of National Uniform Sunflower Yield Trials (NUSYT) were tested for their oil contents. Maximum oil contents 44.68% were observed in E-40 followed by E-36 having oil contents 44.52%, minimum Oil Content were observed 36.67% in E-70

Experiment 2:-Determination of Oil Content of Promising Lines/Varieties of Rapeseed

Table-2 Oil Content Results of Rapeseed (Brassica *napus*) Lines

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	PYT E1	42.64	14	MYT E2	41.03
2	PYT E2	43.62	15	MYT E3	39.22
3	PYT E3	43.63	16	MYT E4	39.44
4	PYT E4	43.18	17	MYT E5	39.92
5	PYT E5	40.47	18	MYT E6	40.04
6	PYT E6	44.65	19	MYT E7	40.17
7	PYT E7	42.69	20	MYT E8	42.52
8	PYT E8	40.50	21	MYT E9	39.06
9	PYT E9	37.75	22	AYT E1	37.79
10	PYT E10	42.02	23	AYT E2	41.38
11	PYT E11	41.80	24	AYT E3	41.53
12	PYT E12	38.76	25	AYT E4	40.87
13	MYT E1	42.15	26	AYT E5	39.00

26 samples of Rapeseed (Brassica *napus*) lines were tested for their oil contents. Maximum oil contents 43.63% were observed in PYT E3.

Experiment 3:- Determination of Oil Content of Promising Lines/Varieties of Mustard

Table-3 Oil Content Results of Mustard (Brassica *juncea*) Lines

Sr. No.	Sample ID	Oil %	Sr. No.	Sample ID	Oil %
1	PYT E1	32.67	18	AYT E3	36.48
2	PYT E2	33.93	19	AYT E4	33.73
3	PYT E3	30.98	20	AYT E5	36.76
4	PYT E4	30.20	21	AYT E6	34.70
5	PYT E5	35.50	22	AYT E7	37.69
6	PYT E6	37.12	23	AYT E8	37.70
7	PYT E7	35.59	24	AYT E9	36.48
8	PYT E8	34.26	25	AYT E10	37.46
9	PYT E9	37.60	26	AYT E11	34.99
10	PYT E10	36.51	27	AYT E12	35.58
11	PYT E11	34.10	28	AYT E13	35.49
12	PYT E12	35.23	29	AYT E14	36.36
13	PYT E13	36.85	30	MYT E1	37.87
14	PYT E14	34.51	31	MYT E2	37.98
15	PYT E15	33.46	32	MYT E3	39.81
16	AYT E1	34.40	33	MYT E4	37.13
17	AYT E2	33.22	34	MYT E5	36.70

34 samples of Mustard (Brassica *juncea*) were tested for their oil contents. Maximum oil contents 39.81% were observed in MYT E3.

Experiment 4:- DETERMINATION OF QUALITY TRAITS OF PROMISING LINES OF RAPESEED

Table-4(i) Quality Traits of Rapeseed (Brassica *napus*) Lines 21-22 PYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	36.01	13.68	7.67	0.32	126
2	E2	39.05	14.37	8.01	0.68	121
3	E3	35.68	14.17	7.41	0.63	153
4	E4	36.01	12.56	6.41	0.78	130
5	E5	35.95	13.75	6.17	0.93	135
6	E6	31.37	12.04	7.65	30.12	144

7	E7	33.70	13.39	7.78	0.19	147
8	E8	42.15	15.28	6.90	1.50	141
9	E9	39.60	15.49	6.37	1.30	141
10	E10	37.05	14.20	7.26	0.60	141
11	E11	33.60	13.14	6.71	0.32	116
12	E12	46.37	15.17	6.64	1.82	144

Table-4(ii) Quality Traits of Rapeseed (Brassica *napus*) Lines 21-22 MYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	44.82	14.69	6.97	1.68	135
2	E2	46.55	15.16	7	1.93	131
3	E3	32.71	13.83	6.03	0.77	139
4	E4	34.71	13.56	5.99	1.30	153
5	E5	48.33	16.94	7.80	2.21	141
6	E6	56.58	18.24	7.53	2.82	125
7	E7	57.41	18.17	7.58	3.01	131
8	E8	45.74	15.15	7.56	1.42	121
9	E9	47.46	15.84	6.92	1.77	134

Table-4(iii) Quality Traits of Rapeseed (Brassica *napus*) Lines 21-22 AYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	43.92	16.98	6.74	1.52	146
2	E2	55.61	17.41	7.66	2.78	126
3	E3	55.37	17.20	7.49	2.33	109
4	E4	50.30	16.81	7.68	2.10	125
5	E5	46.85	15.50	6.69	1.98	130

26 samples of Rapeseed (Brassica *napus*) lines were tested for their fatty acid profile through NIR.

Maximum Erucic acid was observed 30.12% in PYT E6 and minimum Erucic acid 0.19% was observed in PYT E7. Erucic acid of 19 lines/entries was observed less than 2%.

Experiment 5:- DETERMINATION OF QUALITY TRAITS OF PROMISING LINES OF MUSTARD

Table-5 (i) Quality Traits of Mustard (Brassica *juncea*) Lines 21-22 PYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	35	21	9	0.11	147
2	E2	24	19	10	27.42	150
3	E3	41	25	10	6.13	168
4	E4	44	25	9	0.46	158
5	E5	26	19	10	24.93	149
6	E6	20	15	9	35.97	142
7	E7	22	16	9	32.57	140
8	E8	24	18	10	28.29	159
9	E9	23	17	10	29.80	144
10	E10	23	17	10	39.96	150
11	E11	38	22	11	11.44	141
12	E12	27	19	10	25.43	161
13	E13	23	18	10	28.99	157
14	E14	47	23	10	5.54	127
15	E15	26	19	9	26.17	155

Table-5 (ii) Quality Traits of Mustard (Brassica *juncea*) Lines 21-22 AYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	32	20	10	19.99	144
2	E2	33	22	10	16.85	162
3	E3	22	17	10	31.43	157
4	E4	30	20	11	21.02	155
5	E5	22	17	10	31.06	163
6	E6	17	17	8	37.56	166
7	E7	22	17	11	29.47	175
8	E8	28	19	10	24.56	161
9	E9	22	18	11	28.89	172
10	E10	28	18	10	24.63	154
11	E11	28	20	11	41.92	149

12	E12	23	19	11	28.07	153
Sr. No	**Sample ID**	**Omega 9**	**Omega 6**	**Omega 3**	**Erucic Acid**	**Glucosinolates**
13	E13	47	23	11	5.32	140
14	E14	21	18	10	32.18	158

Table-5 (iii) Quality Traits of Mustard (Brassica *juncea*) Lines 21-22 MYT

Sr. No	Sample ID	Omega 9	Omega 6	Omega 3	Erucic Acid	Glucosinolates
1	E1	19	16	10	34.58	159
2	E2	21	17	10	31.35	158
3	E3	19	15	10	36.02	149
4	E4	21	18	11	29.79	157
5	E5	38	21	11	14.68	145

34 samples of Mustard (Brassica *juncea*) lines were tested for their fatty acid profile through NIR.

Maximum Erucic acid was observed 42% in AYT E11 and minimum Erucic acid 0.11% was observed in PYT E1. Erucic acid of 2 lines/entries was observed less than 2%.

Experiment 6:- DETERMINATION OF QUALITY TRAITS OF PROMISING LINES OF NATIONAL UNIFORM RAPESEED YILED TRIALS

Table-6 Quality Traits of Rapeseed (Brassica *napus*) NURYT Lines 21-22

Sr. No.	Sample ID	Oil %	Erucic Acid %	Glucosinolates (µmol/g)
1	E-1	36	1	22
2	E-2	46	60	94
3	E-3	39	2	21
4	E-4	38	1	46
5	E-5	40	1	44
6	E-6	43	1	29
7	E-7	34	1	52
8	E-8	Sample was insufficient for analysis		
9	E-9	42	40	108
10	E-10	38	39	88
11	E-11	39	41	122
12	E-12	35	1	35
13	E-13	Sample was insufficient for analysis		

14	E-14	37	32	78
15	E-15	41	1	25
16	E-16	37	1	74
Sr. No.	**Sample ID**	**Oil %**	**Erucic Acid %**	**Glucosinolates (µmol/g)**
17	E-17	34	2	53
18	E-18	33	1	49
19	E-19	38	1	68
20	E-20	40	1	59
21	E-21	39	1	25
22	E-22	38	38	131
23	E-23	Sample was insufficient for analysis		
24	E-24	42	1	41
25	E-25	42	2	23
26	E-26	42	1	53
27	E-27	41	1	51
28	E-28	42	2	26
29	E-29	43	1	32
30	E-30	43	1	28
31	E-31	35	1	43
32	E-32	41	1	40
33	E-33	39	1	42
34	E-34	34	1	52
35	E-35	39	1	43
36	E-36	39	1	42
37	E-37	37	1	47
38	E-38	38	1	45
39	E-39	39	2	28
40	E-40	44	1	29
41	E-41	40	2	25
42	E-42	40	1	33
43	E-43	37	1	66
44	E-44	42	1	50
45	E-45	37	36	71

45 samples of National Uniform Rapeseed Yield Trials were tested for their fatty acid profile through NIR. Maximum Erucic acid was observed 60% in E2. Erucic acid of 35 lines/entries was observed less than 2%.

Experiment 7:- DETERMINATION OF OIL CONTENTS AND QUALITY TRAITS OF PROMISING LINES OF RAPESEED AND MUSTARD SAMPLES OF OILSEED RESEARCH STATION KHANPUR

Table-7 Oil Content & Quality Traits of Rapeseed & Mustard Samples From ORS Khanpur

Sr. No.	Sample ID	Oil %	Omega-9 %	Omega-6 %	Omega-3 %	Erucic Acid %	Glucosinolates
1	BJ-1	37.60	26	18	8	28	66
2	BJ-2	37.60	23	17	8	32	65
3	BJ-3	40.34	22	17	9	31	65
4	BJ-4	36.87	27	20	8	26	59
5	BJ-5	38.35	23	18	8	29	52
6	BJ-6	36.75	22	19	8	31	53
7	BJ-7	36.65	25	18	8	28	57
8	BJ-8	37.36	27	20	8	25	66
9	BJ-9	37.78	25	18	8	30	56
10	BJ-10	37.87	24	18	8	30	67
11	BJ-11	37.22	26	19	8	27	62
12	BJ-12	37.40	46	23	9	5.72	73
13	BJ-13	37.33	28	19	8	24	75
14	BJ-14	35.38	30	21	8	21	58
15	BJ-15	37.31	26	19	8	27	75
16	BJ-16	37.27	26	19	9	27	71
17	BJ-17	36.00	31	20	8	21	65
18	BJ-18	37.29	27	20	8	24	64
19	BJ-19	37.78	23	18	9	31	68
20	BJ-20	37.52	26	19	8	26	64
21	BN-1	41.05	48	17	7	0.23	47
22	BN-2	40.85	47	18	7	10.61	42
23	BN-3	40.04	44	16	6	15.82	45
24	BN-4	41.30	44	16	6	15.75	48
25	BN-5	40.86	47	18	7	0.10	46
26	BN-6	41.35	44	17	7	13.64	34

27	BN-7	39.41	47	18	7	0.25	57
28	BN-8	41.77	48	17	7	0.20	55
29	BN-9	42.09	45	17	7	13.55	45
30	BN-10	42.56	47	17	7	0.25	53
Sr. No.	**Sample ID**	**Oil %**	**Omega-9 %**	**Omega-6 %**	**Omega-3 %**	**Erucic Acid %**	**Glucosinolates**
31	BN-11	41.94	50	18	7	0.08	41
32	BN-12	41.44	48	18	7	0.07	51
33	BN-13	41.66	45	17	7	13.74	35
34	BN-14	40.78	51	19	7	0.30	50
35	BN-15	41.48	47	17	7	0.18	45
36	BN-16	40.46	49	18	7	8.77	38
37	BN-17	40.70	50	17	7	0.24	41
38	BN-18	40.63	49	17	7	0.07	40
39	BN-19	40.64	49	17	7	0.13	36
40	BN-20	40.36	49	18	7	0.11	38

40 samples of Mustard and Rapeseed samples from Oilseed Research Station Khanpur were tested for their Oil Contents and fatty acid profile through NIR. Maximum Oil Content was observed 42.56% in BN-10. Minimum Oil Content was observed 36% in BJ-17. Maximum Erucic acid was observed 32% in BJ-2. Minimum Erucic acid of 0.07% was observed in BN-18.

Experiment 8:- DETERMINATION OF OIL CONTENTS AND QUALITY TRAITS OF PROMISING LINES OF SOYBEAN

Table-8 Oil Content & Quality Traits of Soybean

Sr No.	Sample ID	Oil %	Protein %	Oleic Acid %	Linoleic Acid %	Linolenic Acid %
1	CARLIL	18.50	44	20	56	6
2	FS 85	21.29	40	14	59	8
3	BOSSIER	18.65	43	17	56	7
4	CRANFORDD	19.12	41	14	58	**9**
5	P976	17.92	42	21	55	5
6	T418	20.27	41	20	57	6
7	KWOWGYO	20.94	39	20	56	5
8	HM8437	24.62	35	17	60	6
9	SPK16	20.77	34	13	60	7
10	PROVER	18.84	41	18	56	8
11	DGS16	18.33	41	21	56	6

12	HM8468	21.38	36	15	58	8
13	952	17.98	44	19	57	6
14	SOYBEAN	21.33	40	18	56	7
15	E418	20.89	37	16	59	8
16	SEMMES	21.92	38	16	58	7
Sr No.	**Sample ID**	**Oil %**	**Protein %**	**Oleic Acid %**	**Linoleic Acid %**	**Linolenic Acid %**
17	BSR301	21.39	36	16	57	7
18	COLUMBUS	20.66	36	15	57	7
19	ADAMS	20.28	38	16	58	8
20	LAFE40	20.36	42	17	57	8
21	E1092	20.73	39	18	56	8
22	FS60	19.26	41	19	55	7
23	L16	19.43	42	19	55	7
24	SS183	17.89	43	23	55	6
25	MS4	19.84	42	18	57	8

25 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%).

10. AGRONOMY

Project 1: EFFECT OF VARIOUS DOSES OF FERTILIZER ON ELITE SUNFLOWER HYBRIDS:

Seed Yield (kg ha^{-1})			
	FH-741	**FH-751**	**Mean**
1) DAP 1½ Bag + Urea 1½ Bag + SOP 1 Bag /acer (119-85-62 NPK kg ha^{-1})	2662	2268	**2465 c**
2) DAP 1½ Bag + Urea 2 Bag + SOP 1 Bag /acer (147-85-62 NPK kg ha^{-1})	2943	2553	**2748 ab**
3) DAP 1¾ Bag + Urea 1½ Bag + SOP 1 Bag /acer (124-99-62 NPK kg ha^{-1})	2755	2502	**2629 bc**
4) DAP 1¾ Bag + Urea 2 Bag + SOP 1 Bag /acer (153-99-62 NPK kg ha^{-1})	3042	2811	**2926 a**
Mean	**2851 a**	**2533 b**	

LSD (5%) Hybrids: 238
LSD (5%) Fertilizer: 240
Interaction: NS

Design	Split plot
Replications	3
Plot size	6 m x 3 m
Row to Row spacing	75 cm
Sowing time	1st week of February

As the table shows that the treatment No. 4 (153-99-62 NPK Kg ha^{-1}) gave the maximum yield of 2926 Kg ha^{-1} followed by the treatment No. 2 (147-85-62 NPK Kg ha^{-1}) which produced yield of 2748 Kg ha^{-1}. Among hybrids FH-741 gave the higher yield (2851 Kg ha^{-1}) as compared to the FH-751 (2533 Kg ha^{-1}). Both the hybrids are normal duration hybrids. However, interaction between fertilizer doses and hybrids was found non-significant.

Project 2: EFFECT OF DIFFERENT ROW SPACING LEVELS ON THE YIELD OF SOYBEAN:

Row Spacing	**Seed Yield (Kg ha^{-1})**
1) 09″ (22.50 cm) apart rows	**1784 b**
2) 12″ (30.00 cm) apart rows	**2106 a**
3) 15″ (37.50 cm) apart rows	**1916 b**
4) 18″ (45.00 cm) apart rows	**1524 c**

LSD (5%):188

Design R.C.B.D
Replications 3
Fertilizer 100-100-60 NPK Kg ha^{-1}
Variety AARI Soybean

As the table shows that 12″(30 cm) apart rows gave the maximum yield of 2106 Kg ha^{-1}followed by the 15″(37.50 cm) apart rows which produced yield of 1916 Kg ha^{-1}whereas 18″(45 cm) apart rows produced the minimum yield of 1524 Kg ha^{-1}.

Project 3: RESPONSE OF RAPESEED & MUSTARD TO THE FOLIAR APPLICATION OF MORINGA WATER EXTRACTS.

Seed Yield (Kg ha^{-1})				
	Super canola	**AARI canola**	**Super raya**	**Mean**
0-Spray	2452	2081	2752	**2428 c**
1-Spray	2641	2210	3009	**2620 c**
2-Sprays	2988	2565	3399	**2984 b**
3-Sprays	3192	2723	3594	**3169 a**
Mean	**2818 b**	**2395 c**	**3189 a**	

LSD (5%) for Moringa Spray: 182
LSD (5%) for Variety: 196
Interaction: NS
Design Split plot
Replications 3
Fertilizer 90-85-60 NPK Kg ha^{-1}
Plot size 5 m x 1.80 m
Row to Row spacing 45 cm

1st foliar spray of Moringa water extracts: **30** Days after Sowing
2nd foliar spray of Moringa water extracts: **45** Days after Sowing
3rd foliar spray of Moringa water extracts: **60** Days after Sowing

As the table shows that the three sprays of moringa water extracts gave the maximum yield of 3169 Kg ha^{-1} followed by the two sprays of moringa water extracts which produced yield of 2984 Kg ha^{-1}. Among varieties Super raya gave the higher yield (3189 Kg ha^{-1}) followed by Super canola (2818 Kg ha^{-1}). However, interaction between moringa sprays and varieties was found non-significant.