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PUNJAB SARSON: AN INTRODUCTION OF NEW CANOLA VERSION HIGH YIELDING VARIETY RELEASED FOR GENERAL CULTIVATION IN THE PUNJAB

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The promising strain RBN-03052 is an outcome of hybridization (KS-75 x Rainbow) and selected through pedigree method of selection since 1998-99. Homozygous progenies of pedigree number F6-6052 were bulked in 2003-04 for yield evaluation. Its performance was evaluated through station, zonal, micro yield trials and National Uniform Rapeseed Yield Trials. RBN-03052 has proved its worth in all yield trials and its performance is better than all the existing cultivated varieties. Its maximum potential of 2833 kg/ha was achieved in 2005-06 at Oilseeds Research Station, Khanpur. It produced 33.96% higher yield in micro yield trials carried during 2006-07. Similarly, its yield surpassed the checks with 2.80% and 10.27% in National Uniform Rapeseed Yield Trials carried out during 2006-07 to 2007-08 respectively. The new strain showed tolerance against insect pests and diseases specially *Alternaria blight*, *Powdery mildew*, *Downy mildew* and *White rust*. Agronomic studies revealed that this variety fits in a better way with the existing agronomic package of technology. The new strain RBN-03052 named as Punjab Sarson is first canola version variety developed locally and is released for commercial cultivation in both irrigated and barani regions of the Punjab.
Keywords: Canola, Punjab, oilseed, rapeseed

INTRODUCTION

Fats and oils are important ingredients of human food. Oils are extracted from seeds of different crops. In Pakistan, more than a dozen crops are grown to extract oil from their seeds and these crops are termed as oilseed crops. But rapeseed and mustard are main edible source of oil in subcontinent and therefore, it is called traditional oilseed crop. Rapeseed is popular in Punjab, Pakistan. The country is producing 221 thousand tones of rapeseed from an area of 265.8 thousand hectares whereas Punjab produces 120.2 thousand tones from an area of 135.6 thousand hectares. The domestic edible oil consumption is much higher than production in the country. The data depicted that edible oil consumption was 2.764 million tons of which 0.857 million tons (31%) came from local resources and 1.907 million tons (69%) were imported (Anon, 2005). But the quality of oil is low due to presence of erucic acid and glucosinolates (Vermorel *et al*., 1986). Therefore, the concept of canola oil has gained popularity in recent years. The canola varieties have been introduced for general cultivation by public and private sector in the country. The varieties grown in Pakistan are either direct introduction or developed through mass selection from exotic germplasm. Similarly due to contamination and out crossing the existing varieties are losing their yield potential as well as deteriorating canola quality characteristics. It was therefore needed to breed new varieties that can replace the existing rapeseed varieties. Moreover, introduction of new oilseeds variety is also imperative to bridge the gap between production and consumption of edible oil which is still increasing due to increase in population, increase in per capita consumption and slow increase in local production of oilseed crops. The recent studies have shown that improved types have a yield potential of over 2500 kg per hectare which reflects that a substantial increase upto 2-3 times in average yield is possible (Khan *et al*., 2006)

The Oilseeds Research Institute, Faisalabad is continuously making enthusiastic struggle to develop and introduce new canola varieties in Pakistan. The commercial release of new canola variety i.e. RBN-03052 (Punjab Sarson) will certainly be helpful to the growers as well as to the country to increase the local edible oil production. Punjab Sarson possesses good agronomic characters when compared with Chakwal Sarson and Shiralee. In the present study, its unique features are discussed on the basis of which a first canola version variety has been released for general cultivation in the country.

MATERIALS AND METHODS

***Crossing and filial generation development*:** KS-75 adapted to Pakistan and Rainbow having low erucic acid (3.5 %) and glucosinolates (< 30 µ moles/g of oil free meal on dry

weight basis) were grown at Oilseeds Research Institute, Faisalabad. KS-75 is locally developed at Khanpur Sub-station of Oil Research Institute, Faisalabad. It is high eurcic acid (30-40%) variety with relatively long maturity (160 days) and high yield (2510 Kg/ha). Rainbow is exotic line (Origin Australia) which matures in 150 days and possesses extremely low erucic acid and its yield potential in our region has been recorded as 2085 Kg/ha. A diverse genetic cross was planned to breed high yielding canola variety. For this purpose, KS-75 was crossed as female with rainbow in 1996-97. The F_1 plants were grown during 1997-98 and self-pollinated at flowering. In the following seasons (1998 through 2003) subsequent filial generations were forwarded and superior recombinants were selected (Sadat *et al*., 2010). The brief data depicted that in F_2 generation, 45 single plants with early maturity and good plant vigour were harvested separately, 32 out of these 45 single plants were finally chosen to grow F_3 progeny rows. In F3, fifty six (56) single plants were harvested separately from the selected rows on the basis of plant health and yield. Out of these selected plants, twenty six (26) single plants were further grown as F_4 progeny rows. Desirable single plants (40) were harvested from the selected rows. Erucic acid and glucosinolates contents of each plant were analyzed. The F_5 comprising of 25 plants to row progenies with relatively low erucic acid and glucosinolates were selected. The 20 progeny rows were further selected to grow F_6. Ten superior rows of F_6 showing acceptable yield potential were selected for further study. The erucic acid and glucosinolates of these rows were determined by using standard HPLC procedure. The four homozygous F_6 lines depicting high yield in combination with quality oil were selected for yield evaluation.

Evaluation and yield testing: The four lines with canola quality were evaluated in replicated station and outstation yield trials (2003-06). The yield of RBN-03052 was compared with Rainbow and Bulbul-98. The best performing line (RBN-03052) was evaluated in Micro Yield Trial of Rapeseed (six locations) and National Uniform Rapeseed Yield Trial (eight locations) for two years (2006-08). During evaluation yield potential and morphological traits of RBN-03052 were compared with check varieties viz Chakwal Sarson and Shiralee. At each site, randomized complete block design (RCBD) with four replications was followed. Each plot consisted of 6 meter long 4 rows. Seeds were planted with the help of a seed drill and the distance between rows was kept 45cm. Standard agronomic practices were applied from sowing to harvesting. Complete plot was harvested at maturity for yield evaluation.

***Agronomic studies*:** For determining best package of production technology, response of RBN-03052 was determined to different sowing dates starting from Sep 15 to Nov 15 with fifteen days of interval in each sowing date. The fertilizer (NPK) response was checked as mentioned in table.

Fertilizer levels

Treat.	Nitrogen (kg/ha)	Phosphorus P_2O_5 (kg/ha)	Potash K_2O (kg/ha)
1	00	00	00
2	75	75	00
3	75	75	30
4	75	75	60
5	75	75	90
6	100	90	00
7	100	90	30
8	100	90	60
9	100	90	90

***Disease Incidence*:** The data on infestation of diseases (*Alternaria blight, Powdery mildew, Downy mildew* and *White rust*) was recorded after an interval of fifteen days in National Uniform Rapeseed Yield Trial at Faisalabad during 2006-07 and 2007-08. The candidate variety RBN-03052 was compared with check variety Shiralee.

***Spot examination, seed purification and multiplication*:** The strain was evaluated by spot examination committee on 12-01-2009. The committee recommended submitting this line before Experts Sub-committee for its final approval for general cultivation. The expert Sub-committee in its 60th meeting held on 15-05-2009 approved RBN-03052 as new commercial variety named Punjab Sarson and forwarded for its approval in Punjab Seed Council. The variety has been approved for general cultivation in the Punjab. The BNS and Pre-basic seed has been produced from a uniform and stable lot at Oilseeds Research Institute, Faisalabad.

***Agronomic and botanical description*:** The salient agronomic and botanical description was recorded according to descriptor established by FSC&RD, Islamabad.

***Statistical Analysis*:** The analysis of variance was performed on each measured trait using appropriate procedures of the MSTAT-C computer software package. Statistical significance was reported at a 5% level of probability. Differences among means were tested by the least significant difference test at the 5% probability level.

RESULTS AND DISCUSSION

***Cultivar performance*:** The grain yield of Punjab Sarson was considerably higher in two years replicated varietal trials conducted at the field of Oil seeds Research Institute, Faisalabad (Table 1). The mean of RBN-03052 was 2266 Kg/ha compared with 1702 Kg/ha for Rainbow and 890 Kg/ha for Bulbul-98. In the year 2005-06 replicated zonal varietal trial depicted that RBN-03052 out yielded Rainbow (check) at three locations (Table 2). The yield of candidate line RBN-03052 tested over five locations under Micro Yield Trials (Table 3) was 1628 Kg/ha compared to check variety Chakwal Sarson (1584 Kg/ha).

Table 1. Yield Performance of RBN-03052 in station yield trials at ORI. Faisalabad

Year	Name of Trial	Yield (kg/ha)			LSD 5%
		RBN-03052	Rainbow (Check)	Bulbul-98 (Check)	
2003-04	Preliminary Yield Trial (*B. napus*)	1720	1414	890	290
2004-05	Advanced Yield Trial (*B. napus*)	2812	1989	-	631
Average		2266	1702	890	

Table 2. Yield performance of RBN-03052 in Zonal Varietal Trial during 2005-06

Variety/Line	Faisalabad	Sahiwal	Khan-Pur	Average
RBN-03052	1611	1990	2833	2145
Rainbow (C)	1444	2258	2542	2085
LSD 5%	112	396	330	

Table 3. Yield performance of RBN-03052 in Micro Yield Trial, 2006-07

Line/Variety	BHK	KROR	Faisalabad	Khanpur	Chakwal	Average
RBN-03052	1261	1782	1256	1651	1900	1570
Chakwal Sarson (C)	911	1082	910	1343	1616	1172
LSD 5%	235	132	65	329	N.S.	
Percentage increase over check variety = 33.96%						

In National Uniform Rapeseeds Yield Trials in 2006-07 and 2007-08 the candidate Sarson variety (RBN-03052) was extensively tested at eight locations. The RBN-03052 was 2.8% and 10.27% higher than the check Shiralee in both years respectively (Table 4 & 5). The results depicted that the individual trial environment is a random factor and has important implications for our understanding of the precision of a trial, or its power to detect differences in genotypic value among lines in the over location trials (Cooper *et al*., 1999b; Atlin *et al*., 2000). The RBN-03052 proved its adaptability in yield performance at multi-location testing and hence introduced as a new variety for general cultivation in Punjab.

Agronomic performance: The average yield performance of RBN-03052 in sowing date trial was assessed from September 15th to November 15th with fifteen days intervals. The yield data is presented in the Table 6. The data showed that the highest mean yield 2425 kg/ha was recorded in sowing date of October 1st. In response to nine fertilizer levels maximum seed yield of 2321 kg/ha (Table 7) was achieved in treatment 6 where N:P:K was applied @ 100:90:00 kg/ha followed by treatment 5 with seed yield of 2245 kg/ha (Malik, 2004). The average of two years (2006-07 & 2007-08) data showed that the infestation of *Alternaria blight* of candidate variety RBN-03052 was less than check variety Shiralee. It is recommended that crop sown in first week of October can escape from aphid attack (Sarwar, 2010). Significant yield reduction can be expected if RBN-03052 is not sown at the optimal time. The findings of Sharghi *et al*., 2011 also depicted that late planting date and interruption of irrigation at flowering stage significantly decreased growth, yield and yield components of the Canola cultivar. Canola is similar to small grains in its response to fertilizer and levels of soil fertility. Nitrogen is the key elements for high canola yields. Nitrogen and potash materials should not be placed in direct contact with the seeds but should be broadcasted to get best results. The seed yield and maturity of canola is greatly influenced by fertility management, seeding rate and seeding date (Bailey and Grant, 1993; Scott *et al*., 1973). Zahedi *et al*. (2009) reported that yield and yield components were strongly affected by drought stress. Planting dates obviously affect canola yield and yield components therefore, a comprehensive production technology has been composed to reap higher yield from a candidate variety RBN-03052.

Table 4. Yield performance of RBN-03052 in National Uniform Rapeseed Yield Trial, 2006-07

Entry Name	NARC	CHK	FSD	B.Pur	K.Pur	DIK	T JAM	QUET	MEAN
RBN-03052	2335	1353	1406	1750	1604	2292	1167	1115	1628
Shiralee (C)	2256	1630	1439	1328	1267	2500	1094	1160	1584
LSD 5%	196	330	148	351	190	446	86	226	
Percentage increase over check variety = 2.8%									

Table 5. Yield performance of RBN-03052 in National Uniform Rapeseed Yield Trial, 2007-08

Entry Name	NARC	CHK	*FSD	B.Pur	K.Pur	NIFA	DIK	T.JAM	MEAN
RBN-03052	2574	1495	972	1517	2158	1646	2000	1458	1728
Shiralee (C)	2355	1653	648	1708	1063	1875	2042	1188	1567
LSD 5%	449	186	123	116	375	255	448	122	
Percentage increase over check variety = 10.27%									

*Yield was low due to late sowing.

Table 6. Yield performance in date of sowing trial

Sowing Date	Yield (kg/ha)		Av. (kg/ha)
	2007-08	2008-09	
15th September	2539	2138	2339
Ist October	**2301**	**2608**	**2455**
15th October	2013	1714	1864
Ist November	1468	1534	1501
15th November	1210	1217	1214
LSD 5%	76	105	

Table 7. Yield response to different fertilizer levels

Treatment	Nitrogen (kg/ha)	Phosphorus P_2O_5 (kg/ha)	Potash K_2O (kg/ha)	Seed Yield (kg/ha)
1	00	00	00	1459
2	75	75	00	2074
3	75	75	30	2209
4	75	75	60	2029
5	75	75	90	2245
6	**100**	**90**	**00**	**2321**
7	100	90	30	2146
8	100	90	60	2074
9	100	90	90	2123
LSD 5%				230

Table 8. Disease response of Punjab *Sarson*

Variety/Line	Alternaria Blight (0-9)*	Powdery Mildew (%)	Downy Mildew (%)	White Rust
RBN-03052	2	0	0	0
Shiralee (C)	3	0	0	0

Agronomic and botanical characteristics: A bold seeded new line having good characteristics suitable for edible purpose. The promising strain RBN-03052 has erucic acid 0.76% and glucosinolates 27.81 µ mole/g oil free meal and it has 42.90 % edible oil. The botanical description is depicted in Table 8. The Punjab Sarson is a suitable introduction of high yield and better oil quality in Punjab and will set a stage for sustaining cotton production in the future. Punjab Sarson is an early maturing high yielding variety harvested in mid March. It encourages the early sowing of BT cotton. In a present trend of crops in cotton zone, the area under wheat is decreasing and is replaced with canola, therefore, cultivation of Punjab Sarson would be a good choice to sustain cotton production and net profitability of farmer will be increased.

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