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Original Research Article

Rohi Sarsoon: A new high yielding rapeseed variety released for general cultivation in south Punjab (Pakistan)

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Abstract

This paper reports the release of new variety "Rohi Sarsoon" which is high yielding with erect growth habits. This variety was released in the year 2016 for arid and irrigated areas of agricultural lands. Rohi Sarsoon has been evolved from an elite line selected from progeny of a cross between KN-120 and KN-131 at Oilseeds Research Station, Khanpur during 2001-2002. Progenies F_2-F_5 were advanced by pedigree selection method. It is tolerant to Alternaria Blight, Powdery mildew, Downy mildew and white rust with yield potential 3927 Kg/hectare. The sowing time of this variety is 1-15 October with seed rate 0.60-0.80 Kg/acre. Plant color is light green with height of 160-173 cm and growth habits is determinate type. Its 1000 seed weight has been observed about 4-4.5 g. Leaf color is light green and seed contains 44-47% oil contents in it. Its meal contains 30-35% protein. This variety takes 155-160 days to mature and due to good performance it is recommended for the Southern Punjab and Cholistan areas in meeting of Federal Seed Certifiation and Registration Department held on 12 August 2016. Moreover, Rohi Sarsoon has got resistance against lodging, tolerant to aphid and best suited for Wheat, Mung bean, Rapeseed, Bt Cotton, Wheat, Fodder, Rapeseed, Sugarcane crop rotation.

Keywords: *Brassica napus*, Disease resistant, Rohi Sarsoon, Variety, Yield

Introduction

Rapeseed and mustard is traditional oilseed crop in Pakistan and considered as main source of edible oil. The contribution of these crops in Pakistan towards edible oilseed production is about 16-20 % (Pakistan Economic Survey, 2015-16). The production of rapeseed is 21 thousand tons from an area of 4 thousand hectares. Rapeseed is popular in Punjab where its production is 120.0 thousand tons from an area of 135.6 thousand hectares. The consumption of domestic edible oil is higher than its production, 2.821 million tons, in the country out of which about 0.684 million tons are met through local resources and rest of it (2.1 million tons) is met by import (Pakistan Economic Survey, 2015-16). The bill on imported oil of Pakistan is considered to be the second largest after petroleum (Ahmad et al., 2013). Less than 2 percent erucic acid in oil and less than 20 µmol/g glucosinolates in oil free meal is described as the recommended amount of these compounds. Seed meal of Brassica contains 40 % protein with balanced amino acid but the quantity of protein percentage is lower than its demand. A huge amount of foreign exchange is being spent over the import of rapeseed oil with forcible compromise on its quality for human consumption (Pakistan Economic Survey, 2015-16). There is a dire need to reduce the gap between

domestic edible oil production and its import to maximum extent. It is the need of hour to develop new varieties with less erucic acid and glucosinolates to meet the demands of increasing population for local edible oil production.

Rohi Sarsoon is a variety suitable for arid and irrigated areas of Punjab. The Commercial release of this new rapeseed variety "Rohi Sarsoon" will certainly contribute much for the growers as well as for the country to bridge up the gap between production and demand. Rohi Sarsoon possesses good genetic potential and agronomic traits as it has performed better in yield trials.

Material and Method

Rohi Sarsoon was evolved as a result of cross KN-120 x KN-131 at Oilseeds Research Station, Khanpur. Hybridization was started during 2001-2002 for the development of this variety through pedigree method. The evaluation of elite line was done against particular traits and it was advanced to F_5 generation. During 2006-2007, best performed progeny was selected against yield and disease resistance character in F_5. This progeny/line was given the name KN-259 and evaluated against different parameters in yield trials at various locations. Finally the selected line was evaluated in National Uniform Yield Trials during 2012- 14. The average data of replication of each location was converted to kg/ha for comparison (Mustafa et al., 2008). Yield data were subjected to ANOVA and means were compared by using LSD (Steel et al., 1997). Various steps involved in the development of Rohi Sarsoon are given in Table 1.

Hybridization

KN-120, a locally developed high yielding strain, and local line KN-131 (disease resistant) were selected for hybridization. KN-120 was kept as a female parent and KN-131 as a male parent. Both parents were sown alternately, in October in crossing block at Oilseeds Research Station during crop season 2001-02. At flowering, emasculation was done in the morning, and emasculated flowers were covered with butter paper bag to avoid any foreign pollen contamination. On the next day the emasculated flower was pollinated with pollen of male parent by removing the butter paper bag. Crossed seed harvested from female parent was stored for raising generations.

Filial Generation Development

Crossed seed was sown in the field of Oilseeds Research Station Khanpur by drill method to get F_1 seed at the end of February. F_1 plants were sown during 2002-2003 and were self-pollinated at flowering to get seed for F_2 generation. During 2003-16 filial generations were developed on the basis of superior attributes selection. From F_2 generation, 62 single plants with better performance were harvested separately. Out of these single plants, 59 plants were used to grow F_3 progeny rows. Forty three plants were harvested separately from the selected rows on the basis of yield and disease resistant parameters, and were sown as progenies rows of F_4. Thirty desirable selections were made in F_4 for raising F_5 generation, through which 19 plants were selected from progeny rows to grow F_6. Twelve superior rows were selected for further study on the basis of better performance. The lines with high yield and disease resistance were evaluated in replicated yield trials for two years at different locations. Erucic acid and glucosinolates concentration of these rows were determined by National Agricultural Research Centre (N.A.R.C), Islamabad and National Institute of Food and Agriculture (N.I.F.A), Peshawar following the procedure used by Sadat et al., 2010. The best performing line (KN-259) was evaluated in Zonal Varietal Trial, Micro Yield Trial and National Uniform Rapeseed Yield Trial for two years.

Planting of Trial

Randomized Complete Block Design (RCBD) was used in all the experiments with four replications. Each plot was maintained a size of 5 m x 1.8 m. Seed was sown with the help of drill maintaining an inter row and inter plant distances of 45 cm and 10 cm respectively. All standards of agronomic and cultural practices were applied uniformly for all treatments from sowing to harvesting in each experiment. Data regarding days to flowering, days to maturity, plant height, seed yield and yield related traits were recorded and analyzed statistically on the basis of mean values (Singh and Chaudhry, 2004).

Table – 1: Various steps involved in the development of rapeseed variety Rohi Sarsoon

Year	Generations/Trials	Remarks
2001-02	Original Cross attempted (KN-120 x KN-131)	Hybrid seed was harvested for plantation.
2002-03	F_1 was raised	F_1 hybrid seed was harvested for F_2 plantation.
2003-04	F_2 generation was grown	F_2 hybrid seed was harvested for F_3 plantation.
2004-05	F_3 generation was grown	F_3 hybrid seed was harvested for F_4 plantation
2005-06	F_4 generation was grown	F_4 hybrid seed was harvested for F_5 plantation
2006-07	F_5 generation was grown	Superior line for yield and disease resistance were selected and given the number KN-259 and were forwarded to yield trials
2010-11	Zonal Varietal Yield Trials	These trials were conducted at five different locations.
2011-12	Micro Yield Trial	These trials were grown at seven different locations in Punjab under coded numbers handled by Director, Oilseed Research Institute Faisalabad.
2012-14	National Uniform Rapeseed Yield Trial (N.U.R.Y.T)	These trials were conducted by National Coordinator Rapeseed, NARC Islamabad throughout Pakistan.
2012-14	Agronomic Trials	These trials were conducted at Oilseeds Research Station Khanpur.
2011-13	Entomological Trials	These trials were conducted at Oilseeds Research Station Khanpur and resistance against different diseases were observed.
2012-13 & 2015-16	DUS Studies	Data of particular line was recorded by Federal Seed Certification and Registration Department.
2016	Spot Examination	Candidate line was evaluated by Committee and was recommended for varietal approval
2016	On the basis of better performance, it was released by Punjab Seed Council, Lahore for general cultivation with the Particular commercial identity.	

Results and Discussions

KN-259 (Rohi Sarsoon) is an advanced line of cross, KN-120 x KN-131, selected from segregating population on the basis of plant height, plant and pod shape, seed size and seed color. It showed best performance in local environmental conditions.

Station Trials

Rohi Sarsoon was tested in replicated trials for two years, Preliminary Yield Trial (2008-09) and Advanced Yield Trial (2009-10) were conducted at Oilseeds Research Station, Khanpur. Mean data of grain yield of particular variety was compared with Punjab Sarsoon (check) (Table 2). It was observed that average yield of Rohi Sarsoon was 2470 kg/ha compared with Check which yielded 2080 kg/ha showed 19% higher yield over check variety.

Zonal Varietal Trials

KN-259 was evaluated at five different locations i.e. Faisalabad, Sahiwal, Khanpur, Piplan and Bahawalpur of Punjab in Zonal Varietal Trial during 2010-11 (Table 3). Grain yield was observed at these different location and found average yield of Rohi Sarsoon 2176 kg/ha as compared to yield (1934 kg/ha) of check variety. The results depicted that particular variety gave 12% more yield that Punjab Sarsoon.

Micro Yield Trials

The performance of promising line was further evaluated in Micro Yield Trial at seven different location of Punjab during 2011-12. The average grain yield of Rohi Sarsoon was 1450 kg/ha and Punjab Sarsoon gave 1288 kg/ha. Results of new variety revealed 13% higher yield as compared to check (Table 4).

Yield performance of KN-259 at National Uniform Rapeseed Yield Trial (NURYT)

Rohi Sarsoon was evaluated in national testing system through Nation Uniform Rapeseed Yield Trial (NURYT) consecutively for two years during 2012-13 and 2013-14 across the country. The location wise

comparison of yield performance of promising line with standard variety is given in Table 5 and 6. Results of Rohi Sarsoon at eight different locations during 2012-13 showed that it gave yield 1895 kg/ha and check variety (Punjab Sarsoon) yielded 1438 kg/ha which revealed its better performance over check. During 2013-14 performance of new variety was compared with check named as Hyola-401. The mean performance depicted it was high yielder that Hyola-401. The two years performance based evaluation of KN-259 confirmed the results found on-station studies that it was high yielder as compared to check varieties. The overall good performance of new variety across the country proved that it is well adapted to various climatic conditions of Punjab and Pakistan than earlier released varieties.

Table – 2: Yield Performance of KN-259 in Station Yield Trials at Oilseeds Research Station, Khanpur

Variety/Line	Seed yield in Kg/ha			% increase over check
	P.Y.T (2008-09)	A.Y.T (2009-10)	Avg.	
KN-259	2430	2510	2470	19%
Punjab Sarsoon	2120	2040	2080	-
L.S.D 5%	110	107		

Table – 3: Yield Performance of KN-259 in Zonal Varietal Yield Trial during 2010-11

Variety/Line	Seed yield in Kg/ha						% increase
	FSD	SWL	KPR	PIPLAN	BWP	Avg.	
KN-259	2170	2020	2510	1700	2480	2176	12%
Punjab Sarsoon	1910	1850	2220	1440	2250	1934	-
L.S.D 5%	102	150	172	140	130		

Table – 4: Yield Performance of KN-259 in Micro Yield Trial during 2011-12

Variety/Line	Seed yield in kg/ha								% increase
	FSD	BWP	KPR	Bhakar	F/Jg	CHK	Karor	Avg.	
KJ-259	1605	2426	1026	2093	696	785	1520	1450	13%
Punjab Sarsoon	1530	2050	860	1940	625	624	1391	1288	-
L.S.D 5%	120	200	175	115	133	125	180		

Table – 5: Yield Performance of KN-259 in N. U.R.Y.T. (8 locations) during 2012-13

Variety /Line	Seed yield in kg/ha								Mean
	NARC Isd	BARI ChK	ORI Fsd	NIA T-Jam	Pioneer Swl	ORS K-Pur	RARI B-pur	NIFA P-War	
KN-259	2045	825	1844	1101	2177	2552	2052	2565	1895
Punjab Sarsoon	1212	540	1607	576	1835	2506	2016	1212	1438
L.S.D 5%	210	357	375	284	530	515	476	129	

Table – 6: Yield Performance of KN-259 in N. U.R.Y.T. (8 locations) during 2013-14

Variety /Line	Seed yield in kg/ha								Mean
	ORI Fsd	ORS K-Pur	Pioneer Swl	RARI B-pur	NIFA P-War	Tarnab P-war	BARS Kohat	ARI T-jam	
KN-259	1975	1625	2434	3208	3861	3927	2500	1113	2580
Hyola-401	1439	1396	1426	1983	3417	2594	1833	988	1885
L.S.D 5%	169	194	283	173	379	245	253	105	

Agronomic Performance

Agronomic trials of elite line were conducted against nine different level of fertilizer application during 2013-14. Maximum seed yield (2670 kg/ha) was obtained by treatment No. 5 in which N: P was applied @ 75:75 followed by treatment No.6 with yield of 2640 kg/ha (Table 7). The average yield performance of KN-259 in sowing date trail was assessed from 20th September to 30th October with 10 days intervals. The data (Table 8) showed that highest mean yield 2159 kg/ha was recorded when KN-259 was sown on 10th October

Table – 7: Response of KN-259 to different levels of NP at Oilseeds Research Station Khanpur during 2013-14.

Treatment	Nitrogen (Kg/ha)	Phosphorus (Kg/ha)	Seed Yield (Kg/ha)
1	60	60	2030
2	75	60	2140
3	90	60	2180
4	60	75	2560
5	**75**	**75**	**2670**
6	90	75	2640
7	60	90	2510
8	75	90	2540
9	90	90	2470
LSD5%		185	

Table – 8: Response of KN-259 to different sowing dates at Oilseeds Research Station Khanpur during 2012-13 & 2013-14.

Sowing Date	Yield (Kg/ha)		Av.(Kg/ha)
	2012-13	2013-14	
20th September	--	1850	-
30th September	1927	2292	2110
10th October	**2002**	**2315**	**2159**
20th October	1538	1366	1452
30th October	1493	824	1159
LSD 5%	136	128	

Screening against Insects and Diseases

The response of variety Rohi Sarsoon to various diseases and insects was studied at Oilseeds Research Station, Khanpur during two consecutive years 2011-12 and 2012-13. It was tested against Alternaria blight, Powdery mildew and White rust. Results of two years (Table 9) revealed that particular advance line was highly resistant against diseases. KN-259 escaped from aphid attack when it was sown in optimum time in i.e. 1st fortnight of October. Sarwar et al., (2004) has also observed that crop sown in first week of October can escape aphid attack.

Table – 9: Disease response of KN-259 at Oilseeds Research Station Khanpur during 2011-12 & 2012-13

Variety/ Line	Year	Alternaria blight	Powdery mildew	White rust
KJ-259	2011-12	0	0	0
	2012-13	0	0	0

***0= resistant, 5= susceptible**

Botanical Description of Rohi Sarsoon

Rohi Sarsoon is erect with plant height 160-173 cm. Its plant color is dark green having determinate growth habit. The color of leaf is light green with absence of hairs. Its leaf size is medium. Rohi Sarsoon takes 75-79 days to flower. Its petal color is yellow. Pod has long length conical beak shape. Its seed color is dark black having bold size.

Quality characteristics

Rohi Sarsoon contains good characters for edible use. Its quality characters were compared with check variety Punjab Sarsoon. Results revealed that it contains less than 1 percent erucic acid in oil, 83.81 µ mole/g glucosinolates in oil free meal (Table 10). The quality traits recorded by N.A.R.C, Islamabad and NIFA Peshawar depicted that new variety is better than existing varieties containing sufficient amount of chemical compounds i.e., erucic acid and glucosinolates in its oil and oil free seed meal.

Table – 10: Quality characteristics of Rohi Sarsoon

Rapeseed Lines	Erucic Acid (%)	Glucosinolates (µmole/g)	Oil Content
Rohi Sarsoon	Less than 2	83.81	47.46
Punjab Sarsoon (Check)	7.62	72.16	45.48

Spot Examination and Approval

The candidate variety was evaluated by Spot Examination Committee during February 2016. The committee has recommended for submission of variety approval case to the expert sub-committee. The Expert Sub-committee approved KN-259 as new commercial variety named as Rohi Sarsoon and forwarded to Punjab Seed Council (PSC) for its final approval. The Punjab Seed Council approved variety for general cultivation in meeting held on 12 August 2016. Conclusively, Rohi Sarsoon is not only high

yielding variety but also resistant to various diseases and pests with better quality traits. Due to its better adaptability, it can be substituted with already existing approved varieties.

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