TS-5: A NEW HIGH YIELDING SESAME CULTIVAR

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ABSTRACT

TS-5 is a high yield, bold and white seeded variety of sesame having branched stem. It was released for general cultivation in the year 2011. TS-5 (line-90005) was developed through selection at Oilseed Research Institute, AARI, Faisalabad, Pakistan. Homozygous progenies were bulked in 1996-97 for yield evaluation. Its performance was evaluated in station, advanced, zonal and national uniform sesame yield trials. TS-5 proved its worth in all these trials and performed better than existing varieties. Its maximum yield potential (2346 kg/ha) was achieved in 2004 in zonal varietal trial at Faisalabad. This variety gave an average yield of 855 and 842 kg per hectare compared with check TS-3 (609 and 719 kg/ha) in national uniform sesame yield trials during 2006 to 2007, respectively. TS-5 proved as resistant to both charcoal rot and phyllody diseases. It also showed tolerance to whitefly and jassid. The variety is lodging resistant having oil content of more than 50 percent. It gives higher yield (1343 kg/ha) if planted from 15th to 30th June with application of 60 kg DAP at sowing and 30 kg of urea at flowering time with 1st and 2nd irrigation.

KEYWORDS: *Sesamum indicum*, high yielding variety; agronomic characters; Pakistan.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the most ancient crops (4). It is grown throughout tropical and subtropical countries of the world (3). India and China are the largest producers of sesame, followed by Myanmar, Sudan, Uganda, Ethiopia, Nigeria, Tanzania, Pakistan and Paraguay (3). Sesame seed being highly nutritive (50% oil and 25% protein), is traditionally used for direct consumption as oil of excellent quality due to presence of natural antioxidants such as sesamin and sesamol (5). Sesame is a rich source of cis-unsaturated fatty acid such as linoleic acid (9). It exerts beneficial effects on serum lipids and improves antioxidant capacity in hypercholesterolemic patients as reported by Peyrong *et al.* (13). Sesame is highly rewarding crop due to its low cost of production and high market price, besides farmers face no marketing problem.

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Pakistan produces 33.4 thousand tons of sesame seed annually from an area of 79.8 thousand hectares (1). As Pakistan faces huge shortage of edible oil and spends billion of rupees on its import, sesame has proved its worth as import substitute crop. During 2007-08, Rs 2.15 billion were earned through its export (2).

Sesame breeding programme at Oilseeds Research Institute, Faisalabad, focusses on evolution of high yielding, disease and insect resistant varieties suitable for rainfed and irrigated areas of Pakistan. Consequently new advanced line 90005 (TS-5) was developed with unique character of profused pod bearing on central branch. It has sufficient potential of high yield and tolerance against viral and phyllody diseases.

MATERIALS AND METHODS

One hundred and eighty accessions of sesame were evaluated at Oilseeds Research Institute, AARI, Faisalabad, Pakistan for various agronomic and morphological traits. Of these 21 entries were selected on the basis of phenotypic appearance for further critical evaluation alongwith commercial varieties Til-89 and TS-3 for different traits viz. branches per plant, capsules per plant, grain whiteness and seed yield per plant. An advanced line 90005 performed better for all these traits and was evaluated in different trials during 1996-2010 as given below:-

Yield testing

Yield potential and morphological traits of TS-5 (90005) were compared with check varieties Til-89 and TS-3 in preliminary, advanced, zonal and national uniform yield trials in RCBD with four replications. Each plot consisted of four rows of 6 m length for each entry. Seed was sown with a single row hand drill and distance between rows was kept at 45 cm. All phosphatic fertilizer and half of nitrogenous fertilizer were applied at seed bed preparation, whereas remaining nitrogen was applied in two equal splits i.e. half at second irrigation and half at flowering. Thining of crop was done at four leaf stage. Cut throat flume was used to irrigate the crop considering the rainfall as well. All standard agronomic practices were applied from sowing to harvesting.

Agronomic studies

In order to determine the appropriate planting time, a trial comprising five sowing dates commencing from 1st June to 30th July with 15 days interval

was conducted. Similarly for establishing optimum fertilizer level, five NP doses were applied on line 90005 at Oilseeds Research Institute and Agronomic Research Institute, Faisalabad. Both these studies were conducted during 2007 and 2010.

Disease incidence studies

Charcoal rot and phyllody are main diseases of sesame in Pakistan. In order to see the response of 90005 against both these diseases, experiments were conducted during 2006 and 2007 at Oilseeds Research Institute, Faisalabad.

Statistical analysis

MSTAT-C was used to determine the least significant differences (LSD) at 5 percent probability level in all yield trials.

RESULTS AND DISCUSSION

Station yield trials

The promising line 90005 was tested in preliminary and advanced yield trials (Table 1 and 2) at Oilseeds Research Institute, Faisalabad during 1996 and 1997, respectively. In preliminary yield trial line 90005 gave 11.87 percent (1291 kg/ha) more yield than check variety Til-89 (1154 kg) (Table 1). In advanced yield trial line 90005 excelled in yield (864 kg/ha) against check variety Til-89 (716 kg/ha) giving 20.67 percent more yield.

Table 1. Yield performance of advanced line 90005 in station yield trials.

Year/trial	Yield (kg/ha)		Yield increase (%)
	90005	Til-89 (check)	
1996 (Preliminary)	1291	1154	11.87
1997 (Advanced)	864	716	20.67

Zonal yield trial

Zonal adaptation yield trials were conducted during the year 2003, 2004, 2006 and 2007. The advanced line 90005 outyielded check variety TS-3 in these zonal trials at all locations except Bahawalpur. During the year 2003 line 90005 produced an average yield of 1000 kg per hectare against check TS-3 (989 kg/ha) (Table 2).

In 2004, line 90005 produced 1171 kg per hectare at Sahiwal as compared to TS-3 (1126 kg/ha). On average basis, 90005 yielded 3.76 percent higher than check TS-3.

Table 2. Yield performance of advanced line 90005 in zonal varietal trials.

Name of location	Yield (kg/ha)	
	90005	TS-3 (check)
2003		
ORI, Faisalabad	1311	1256
Sahiwal	317	267
Bahawalpur	1371	1445
Average	1000	989
Increase over TS-3(%)	1.12	
2004		
Faisalabad	748	571
Sahiwal	1171	1126
Bahawalpur	508	486
Karor	1111	1227
Average	884.50	852.50
Increase over TS-3 (%)	3.76	
2006		
Faisalabad	2346	1570
Khanpur	1630	1640
Sahiwal	993	719
Bahawalpur	963	778
Average	1483	1177
Increase over TS-3 (%)	26	
2007		
Faisalabad	1391	1252
Piplan	947	791
Sahiwal	944	677
Bahawalpur	1178	944
Khanpur	1694	1644
Average	1231	1062
Increase over TS-3 (%)	15.92	

Advanced line 90005 also topped in the year 2006 with average yield of 1483 kg per hectare against check (1177 kg/ha). Overall line 90005 gave 26 percent higher yield than check TS-3.

In zonal trial conducted during the year 2007 at five locations, 90005 out-yielded in average yield (1231 kg/ha) against TS-3 (1062 kg/ha). On overall basis promising line 90005 yielded 15.92 percent higher than TS-3.

National uniform yield trial

These trials were conducted during the year 2006 and 2007 at different locations. Advanced line 90005 performed better during both years giving 40.39 and 17.10 percent higher yield than TS-3 (Table 3).

Table 3. Yield performance in national uniform sesame yield trial (2006-2007).

Name of location	Yield (kg/ha)	
	90005	TS-3 (check)
2006		
NARC, Islamabad	465	544
D.I. Khan	1296	815
Faisalabad	1241	937
Chakwal	848	336
Quetta	424	411
Average	855	609
Increase over TS-3(%)	40.39	
2007		
Quetta	508	465
Tandojam	659	715
D.I. Khan	1037	904
Faisalabad	1163	793
Average	842	719
Increase over TS-3(%)	17.10	

On an average of all locations, promising line 90005 produced 855 and 842 kg per hectare as compared with check (609 and 719 kg/ha) during 2006 and 2007, respectively.

Agronomic performance

The performance of line 90005 was evaluated at five planting times commencing from Ist June to 30th July with 15 days interval during 2007 and 2010. The data (Table 4) indicated that line 90005 performed better when planted from 15th June to 15th July giving 1445.28, 1343.84 and 1162.40 kg per hectare, respectively.

Table 4. Yield performance in sowing date trials.

Date of sowing	Seed yield (kg/ha)		Average seed yield (kg/ha)
	2007	2010	
1st June	962.95	1249.36	1106.155
15th June	1271.82	1618.74	1445.28
30th June	1012.33	1675.35	1343.84
15th July	813.17	1511.64	1162.405
30th July	467.37	1003.68	735.525

Sowing date trials also revealed that new variety TS-5 when planted in the month of June performed better and matured in 100 to 120 days. So the new

variety can be well fitted in our cropping pattern as most of the land is fallow after harvesting of wheat crop. Farmers can earn more profit by planting sesame crop as it has low cost of production than any other crop.
Yield performance of 90005 was also tested at five fertilizer treatments during 2007 and 2010. It was observed that line 90005 yielded better (1350.5 kg/ha) at existing standard dose i.e. 60:60 kg NP per hectare (Table 5). Similar results have also been reported earlier (7, 8).

Table 5. Yield response to different fertilizer levels.

NP fertilizer (kg/ha)	Seed yield (kg/ha)		Average yield (kg/ha)
	2007	2010	
0-0	572	842	707.0
30-30	968	945	956.5
45-45	1110	1171	1140.5
60-60 (standard)	1274	1427	1350.5
75-75	1254	1300	1277.0

Reaction to diseases

The screening studies were carried out during 2006 and 2007 against diseases. The line 90005 was placed in tolerance group both in charcoal rot and phyllody diseases (Table 6).

Table 6. Reaction against charcoal rot and phyllody diseases.

Variety/line	Average disease percentage under natural condition.			
	2006		2007	
	Charcoal rot	Phyllody	Charcoal rot	Phyllody
90005	0	2.0	0	0
TS-3 (check)	0	8.0	0	0.9

Spot examination, seed purification and multiplication

The strain 90005 was evaluated by Spot Examination Committee during October 2010. The committee recommended for submitting its case before Expert Sub-Committee for approval. The Expert Sub-Committee approved 90005 as new commercial variety named as TS-5 and forwarded to Punjab Seed Council for its final approval. The variety was approved for general cultivation in Punjab during the year 2011. The BNS and pre-basic seed was 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 Federal Seed Certification and Registration Department, Islamabad. TS-5 is bold seeded having good characteristics suitable for edible purpose. It is earlier than TS-3 and matures within 100-120 days. The growth habit and plant type is determinate. Its leaf is mid green, semi erect and lobed in type. The flowers are tubular; pendulant, bell shaped, and two lipped with white colour as quoted by Martin and Leonard (12) and takes 40-45 days for opening. Capsule shape is rectangular in attitude and its shattering is low. It has 60-75 capsules per plant and 60 seeds per capsule. Seed colour is sharp white and it has 50-56.51 percent edible oil. Its 1000-seed weight is 3.59 g.

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