

PERFORMANCE OF “THAL 2006” A HIGH YIELDING AND DISEASE RESISTANT VARIETY OF CHICKPEA

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ABSTRACT

“Thal 2006” is a high yielding bold seeded desi chickpea variety which is moderately resistant to blight with semi erect growth habit. It was developed at Arid Zone Research Institute, Bhakkar, Pakistan and released in the year 2006 for arid zone (Thal region). This variety originated from a cross made during year 1991-92 between CN82/87 (a high yielding and disease tolerant line developed by mutation breeding) and C-44 (a local genotype well adapted to chickpea growing area of arid zone). F₁ to F₄ segregating generations were raised during the year 1992-93 to 1995-96. Plant progenies of this cross were advanced by pedigree method of selection. Single plant selections were made from F₂ to F₄ and uniform populations were bulked in F₅ generation. Resistance to blight (blight score 3-5), bold seeded, drought tolerance and high yield potential (2300 kg/ha) are major attributes of variety Thal-2006. This variety is semi erect with average plant height of 60 cm, with 2-5 primary and 4-25 secondary branches. Pods are large size having 2.8 cm length, 1.28 cm width and 1.16 cm thickness with average of 96 pods per plant. 1000-seed weight of this variety is 280 g. Flower colour is blue and is of medium size. It performs better in arid zone when planted in second fortnight of October using 75 kg seed per hectare.

KEYWORDS: *Cicer arietinum*; high yielding variety; performance; disease resistance; Pakistan.

INTRODUCTION

Pulses are not only a rich source of protein but also enhance dietary value through supplementation of deficient amino acids. Among pulses, chickpea (*Cicer arietinum*) alone contributes 75 percent to total pulses grown in the country. Consequently, availability of pulses mainly depends on the production of chickpea. Punjab province alone contributes about 80 percent to chickpea production of the country. This crop occupies an area of 928.1 thousand hectares with a production of 741.1 thousand tons in Punjab during 2006-07 (1).

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In Punjab, 90 percent of chickpea crop is planted in rainfed area, out of which 75 percent is concentrated in Thal comprising districts of Bhakkar, Khushab, Layyah, Mianwali and a part of Jhang. This crop is also grown in Pothowar area and in Minchinabad tehsil, district Bahawalnagar while irrigated area of chickpea is scattered throughout the Punjab, which has dropped from 26 percent in 1970-71 to as low as 10 percent at present. Therefore, development of high yielding chickpea varieties suitable for rainfed and irrigated areas is essentially required to increase chickpea production.

The yield per unit area may be increased substantially through evolution of high yielding genotypes, possessing good combination of all yield components (9). A light resistant variety of chickpea "Dasht" has been released for Pothowar and rice based areas (2). Blight resistance in chickpea is not a simple trait. It is controlled by many genes acting in additive manner (3). As trend of chickpea sowing is increasing, so there is a need to include more varieties for general cultivation to overcome the disease manace and achieve sustainable production. Moreover revival of chickpea cultivation in irrigated areas needs to develop high yielding varieties with disease resistance.

Present breeding programme of Arid Zone Research Institute, Bhakkar was aimed to develop a bold seeded, high yielding, blight and wilt tolerant variety of chickpea.

MATERIALS AND METHODS

Variety Thal-2006 was developed at Arid Zone Research Institute, Bhakkar from a cross between two genotypes i.e. CM82-87 (a mutant line high yielding and tolerant to *Ascochyta* blight developed at Nuclear Institute for Agriculture and Biology, Faisalabad) and C-44 (a bold seeded and locally adapted variety). The hybridization was performed during year 1991-92 and pedigree method of selection was used to develop this variety. The segregating population was evaluated for desirable traits and advanced to F₄ generation. The progenies were bulked in F₅ and uniform families were included in replicated preliminary A, B and C yield trials during 1996-97 with progeny code of 91A001. The advanced line was finally tested in national uniform yield trials during 1998-99 and 1999-2000. This variety was also evaluated on farm yield trials before recommendation for general cultivation.

Hybridization

Parental lines (male and female) were sown alternatively during October 1991 keeping line to line distance 60 cm and plant to plant 30 cm. Crossing

between parental lines was done early in the morning. Emasculation of female flower was also done in the morning before pollen shedding and immediately pollination was done with male parent. The emasculation and pollination techniques were followed as described by Singh (10). The F_0 seeds were harvested from female parent and advanced to F_1 population by space planting.

Generation advancement

A single row of 4 m length of F_1 hybrid seed was sown alongwith parental lines. The seeds were planted by dibbling maintaining 20 cm plant to plant and 30 cm row to row distance. Selections of single plants were done in F_2 generation for desirable traits and continued upto F_4 generation. Single plant progenies of homozygous lines were bulked for conducting preliminary yield trials.

Yield evaluation trials

Thal-2006 was evaluated consecutively for three years in preliminary and advanced yield trials. Planting of material was almost done in first week of November. First the testing was performed in preliminary and advanced yield trials and then in National Uniform Yield Trials. All yield trials were laid out in RCBD with four replications. The row to row and plant to plant distance was maintained at 30 cm and 10 cm, respectively. Planting was done with single row drill in four rows of 4 m length. Plant population was maintained by thinning at seedling stage. One to two standard checks were included in every experiment for comparison. Disease reaction (blight) was also recorded under artificially inoculated conditions following Reddy and Singh (8).

RESULTS AND DISCUSSION

The results (Table 1) revealed that variety Thal 2006 topped in yield ranging from 925 to 3458 kg per hectare in preliminary, adaptation and national trials conducted during year 1996-97 to 2000-2001 against standard variety Punjab-91 (875 to 3008 kg/ha). On an average basis this new variety produced 2096 kg per hectare which was 22 percent higher than variety Punjab-91 (1716 kg/ha). Similar results have been reported by Bakhsh *et al.* (2).

Table 1. Yield performance of Thal-2006 in different yield trials during 1996-97 to 2000-2001

S. No.	Year	Trial	Yield (kg/ha)		Percent increase	LSD at 5%
			Thal-2006	Punjab-91		
1.	1996-97	Chickpea yield trial-A (Irrigated)	3458	2756	25	772
2.	1996-97	Chickpea yield trial-A (Rainfed)	1583	920	72	191
3.	1997-98	Chickpea regular yield trial-B (Irrigated)	925	875	6	NS
4.	1997-98	Chickpea regular yield trial-B (Rainfed)	1092	1077	1	205
5.	1998-99	Chickpea micro yield trial	3146	3008	4	NS
7.	1999-2000	Chickpea micro yield trial	2347	1840	27	178
9.	2000-01	On farm yield trials	2120	1946	9	244
		Average yield	2096	1716	22	-

Adaptation yield trials

The results of micro and adaptation yield trials (Table 2) revealed that variety Thal 2006 yielded higher (400 to 3146 kg/ha) than standard varieties Bittal-98 (280-2339 kg/ha) and Punjab-91 (320-3008 kg). On an average the new variety Thal 2006 excelled in yield (1430 kg/ha) at 19 different locations as compared to standard varieties Bittal-98 (1193 kg) and Punjab-91 (1147 kg). New variety produced 20 and 24 percent higher than standard varieties Bittal-98 and Punjab-91, respectively.

National uniform yield trials

The results of national uniform yield trials (Table 3) showed that on average basis variety Thal-2006 produced 29 and 2 percent more (1986 kg/ha) than standard varieties Punjab-91 (1538 kg) and Bittal-98 (1954 kg), respectively during 1998-99. During year 1999-2000 Thal-2006 was tested at eight locations and stood first in average grain yield (2115 kg/ha) as compared to standard varieties Punjab-91 (1621 kg) and Bittal-98 (1978 kg) which was 30 and 7 percent higher than standard varieties.

Ascochyta blight reaction

The disease score of variety Thal-2006 and two check varieties (Table 4) showed that Ascochyta blight score of varieties was 3-5 which was comparable with already approved varieties being sown in the area.

Table 2. Yield performance of Thal-2006 in adaptation yield trials during 1997-98 to 2002-03.

S. No.	Year	Trial	Thal-2006	Punjab-91 (Standard)	Bittal-98 (Standard)
1.	1997-98	Micro yield trial at Land Reclamation Farm 37/TDA, Bhakkar	1139	-	1008
2.	1998-99	Chickpea micro yield trial (AZRI, Bhakkar)	3146	3008	-
3.	2000-01	Chickpea adaptation yield trial (Irrigated)	2120	-	1771
4.		Chickpea adaptation yield trial (Rainfed)	810	-	711
5.		Adaptation yield/sowing date trial (Irrigated) (Agronomic Research Station Karor)	2295	-	2324
6.		Adaptation yield/sowing date trial (Rainfed) (AZRI, Farm Bhakkar)	1096	-	1007
7.	2001-02	Chickpea adaptation trial AZRI, Bhakkar	764	-	630
8.		Chickpea adaptation/sowing date trial (Rainfed), AZRI, Bhakkar	2354	-	2339
9.		Chickpea adaptation/sowing date trial (Rainfed) (AZRI, Bhakkar)	1066	-	980
10.		Farmer's field 205/TDA, Bhakkar	2047	-	1714
11.		Punjab Seed Corporation Seed Farm Piplan	1355	-	981
12.	2002-03	Chickpea adaptation trial AZRI, Bhakkar (Rainfed)	1599	1289	1489
13.		Farmers field 211/TDA, Mankera (Rainfed)	1172	833	1007
14.		Farmers field Nusrat wala, Mankera (Rainfed)	1927	1198	1589
15.		Livestock Farm, Rakh Ghulama, Kallurkot (Rainfed)	1153	1039	953
16.		Gram Breedings Res. Sub-station, Kallurkot (Rainfed)	400	320	280
17.		Farmers field 8/TDA, Darya Khan (Rainfed)	1019	1058	938
18.		Farmers field, Muslim Kot, Bhakkar (Rainfed)	1210	1168	1051
19.		Farmers field, Pelun Viens, Khushab, (Rainfed)	480	400	400
		Average	1430	1147	1193
		% Increase		24	20%

Table 3. Grain yield (kg/ha) of Thal-2006 as compared to check varieties tested at various locations in National Uniform yield trials.

S. No.	Name of location	Thal-2006	Punjab-91	(Bittal-98)
1998-99				
1.	GBRS Kallurkot	2500	1528	2083
2.	NARC, Islamabad	2901	2387	2471
3.	NIAB, Faisalabad	2313	1457	2520
4.	AZRI, Bhakkar	1934	1203	1337
5.	BARI, Chakwal	1403	1003	1503
6.	RARI, Bahawalpur	2188	2396	2708
7.	AARI, Faisalabad	667	796	1111
	Average yield (kg/ha)	1986	1538	1954
	Increase (%)	-	29%	2%
1999-2000				
1.	AZRI, Bhakkar	2263	1823	1997
2.	NIAB, Faisalabad	2246	1871	1925
3.	GBRS, Kallurkot.	2847	1528	2773
4.	AARI, Faisalabad.	683	905	1075
5.	BARI, Chakwal	2583	2944	2250
6.	NARC, Islamabad	2474	1183	2445
7.	ARI, D. I. Khan	1431	1391	1257
8.	AZRI, D. I. Khan	2395	1327	2102

Average yield (kg/ha)	2115	1621	1978
Increase (%)	-	30%	7%

Table 4. Evaluation of Thal-2006 against blight disease on 1-9 scale.

S. No.	Varieties	1999-2000	2000-2001	Reaction
1.	Thal-2006	3	5	Moderately resistant (MR)
2.	Punjab-91	3	-	MR
3.	Paidar-91	3	5	MR
4.	Bittal-98	3	5	MR

Disease scale (1-9)

Sowing date and seed rate trials

Variety Thal-2006 was also compared with standard variety Bittal-98 in sowing date trials. Thal-2006 gave higher yield (1599 kg) when sown on 20th October in both years (Table 5) usually practiced by the farmers of area.

Table 5. Yield of sowing date trial (rainfed) conducted at AZRI, Bhakkar.

Sowing dates	Average yield (kg/ha)	
	Thal-2006	Bittal-98
1st October	800	720
10 th October	1081	987
20 th October	1599	1420
30 th October	1280	1195
10 th November	720	715

The results of seed rate trials (Table 6) revealed that seed rate of 75 kg per hectare gave higher yield (1115 kg/ha). The seed was sown with drill to maintain plant population of 85-90 thousand plants per hectare to get higher seed yield.

Table 6. Yield of seed rate trials conducted at AZRI, Bhakkar.

Seed rate (kg/ha)	Average yield (kg/ha)
50	839
62.5	1070
75	1115
87.5	988
100	975

Characteristics of variety Thal-2006

Botanical description

Thal-2006 is a high yielding bold seeded desi chickpea variety as compared to standard varieties Pubjab-91 and Bittal-98. It is drought tolerant and has vigorous growth habit and performs better under moisture stress conditions. The plant is semi-erect and green in colour. Hairiness and presence of anthocyanin on stem are medium. Number of primary branches varies from 2 to 5 whereas secondary branches ranges from 4 to 25 depending upon growth habit and environment. Leaf colour is green, number of leaflets varies from 15-17 and rachis length is 7-8 cm. Leaf and leaflet shape is ovate and leaf tip is round.

Flower, pod and seed characteristics

Its flower colour is blue, with medium size. It takes 95 days to 50 percent flowering after sowing and flowering duration is 65 days. Pod length is 2.8 cm, width 1.28 cm and thickness is 1.16 cm. Pod size is large and beak length is 2 mm. It bears an average of 96 pods per plant and 1-3 seeds per pod with an average of 2 seeds per pod. Seed colour is brown and shape is ram head with dots. It has seed length 9.2 mm, width 6.9 mm and thickness of 6.8 mm with medium beak size. Its 1000-seed weight is 280 g.

CONCLUSION

Variety Thal-2006 is a high yielding, bold seeded with vigorous growth habit. Its performance is better under moisture stress conditions and is moderately resistant to chickpea blight disease. It gives 4 to 11 percent higher yield than standard varieties. It is recommended for commercial sowing in Thal area. With adoption of this variety yield of farmers will be increased and overall it will have definitely positive effect on national economy.

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