

Short Communication

Punjab Tinda 1: An early bearing new variety of round gourd [*Praecitrullus fistulosus* (Stocks) Pangalo]

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Received: March 2020 / Accepted: July 2020

Round gourd is a squash type cucurbit cultivated primarily for its immature fruits. It is also known as ‘Indian squash’, ‘Indian baby pumpkin’, ‘Round melon’, ‘Squash melon’, ‘Squash gourd’, and ‘Apple gourd’ (Schippers 2004). Its immature fruits fetch high price due to their delicious taste and demand-supply gap. The commercial cultivation of round gourd is restricted in North-Western Indian plains where it is grown during hot and dry summer months (March to June) under irrigated conditions and in post-rainy season (August to October) as a rainfed crop. However, Mandal and Mohanta (2018) have reported that it can also be successfully grown under red and laterite soils of West Bengal and have emphasized the need for developing and testing new varieties for establishing this crop in that region. At present, seeds of only a few open-pollinated varieties (S-48, Arka Tinda, Pusa Raunak, Hisar Tinda, Mahy Tinda, Chitra and Golden Tinda) of round gourd are popular. Its only variety (S-48) recommended by the Punjab Agricultural University, Ludhiana, was released in 1960’s. After serving the farmers for a long time, this variety at present has many drawbacks including late bearing, low yield potential and poor fruit quality i.e. its fruits loose hairyness, turn yellow at blossom end and mature even before attaining medium size. Therefore, the Punjab Agricultural University has developed a new variety of round gourd viz., ‘Punjab Tinda 1’ and released it for commercial cultivation in Punjab state in January 2018. This variety is developed by selection for earliness and fruit quality from accession no. PI 271363 obtained from Plant Genetic Resources Conservation Unit, Griffin, United States of America. This new variety has been assigned with the national identity number IC 627068 by NBPGR, New Delhi.

The research trials were conducted at Punjab Agricultural University, Regional Research Station, Bathinda (30° 9’36” North latitude, 74° 55’28” East longitude and 211 m altitude) during 2012-13 to 2016-17. The soil of experimental field was alluvial loamy sand having pH = 8.1 to 8.3, EC = 0.180 to 0.280 dS/m, organic carbon = 0.17 to 0.23%, available phosphorus = 11.5 to 15.5 kg/ha, and available potassium = 225 to 265 kg/ha. The climate of Bathinda is semi-arid with average annual rainfall of 420 mm, 70-80% of which is generally received during July to mid-September. Six advance generation lines of round gourd along with a standard check (S-48) were evaluated in a randomized complete block design (RBD) with three replications for growth, yield and fruit parameters at Bathinda during 2012-13 to 2016-17 and at other farms of PAU viz., Ludhiana, Usman (Tarntaran), Kheri (Sangrur) and Ropar during 2014-15 but the results of only the best performing line released as new variety ‘Punjab Tinda 1’ and check (S-48) are discussed here. During 2016-17, the new variety along with check were compared (without replication) for total yield (q/ha), number of fruits/vine and fruit weight (g) at 25 locations in adaptive research trials (ARTs) on farmers’ fields across the state on a plot size of 25 m² for each entry. Bed and furrow system (width 1.5 m) of planting was followed. Two seeds per hill were sown on both sides of the bed at a spacing of 45 cm in second fortnight of March and later on thinning was done to retain one plant per hill. Net plot size for each entry was 4.5 m × 1.5 m accommodating 20 plants. Recommended dose of inorganic fertilizers (100: 50: 50 kg/ha of N: P₂O₅: K₂O) were used. Full dose of phosphorus and potassium along with half dose of nitrogen were applied before bed making at 15 cm distance on both sides of the bed mark and the furrows were made in this 30 cm width. The remaining half dose of nitrogen was applied as top dressing in the furrows at 30-40 days after sowing followed by earthing up. Furrow irrigation was provided

at 5 to 7 day interval throughout the crop season. The first flush of fruits was borne very early. These fruits remained very small, were unmarketable and therefore were removed as soon as they appeared for proper vegetative growth to occur. The fruits of later flush attained marketable size and were harvested when tender and hairy at 2 to 3-day interval. A total of 13-16 pickings were done in a span of 35-40 days. The data were recorded for days taken from sowing to first marketable harvest, early yield (cumulative yield of first three pickings in q/ha), fruit number/vine, immature fruit weight (g), fruit shape index (ratio of polar to equatorial diameter), vine length (at final harvest in cm), number of primary branches/vine (at final harvest), 100-seed weight (g) and total yield (q/ha). The fruits obtained from peak harvest were analyzed for quality traits viz., dry matter (%), ascorbic acid (mg/100g) and ash content (%) (Sadasivam and Manickam 1992).

Disease index (DI) of mosaic was calculated using formula, $DI = \frac{[(s \times n) / (S \times N)] \times 100}{100}$, where s = disease rating scale, n = number of plants with each disease rating, N = total number of plants observed and S = highest disease rating scale. Afterwards, entries were categorized as highly resistant (HR) ($d'' 5\%$), resistant (R) ($5\% < DI d'' 20\%$), moderately resistant (MR) ($20\% < DI d'' 40\%$), intermediate susceptible (IS) ($40\% < DI d'' 64\%$) and highly susceptible (HS) ($DI > 64\%$) (Tian et al. 2015). The severity of downy mildew was assessed using scale of 0 to 5 i.e. 0 (no infection), 1 (0 to 10% leaf area covered with mildew growth), 2 (10.1 to 15%), 3 (15.1 to 25%), 4 (25.1 to 50%) and 5 (>50% leaf area covered with mildew growth). After calculating disease index (DI), entries were categorized in to 4 groups, viz., resistant (R) (DI = 0-25%), moderately resistant (MR) (DI = 26-40%), susceptible (S) (DI = 41-60%) and highly susceptible (HS) (DI > 60%) (Charoenwattana et al. 2017). Root knot nematode was characterized using scale of 0 to 5 i.e., root gall index (RGI) = 0, immune; RGI = 0.1 – 1.0, resistant (R);

RGI = 1.1–2.0, moderately resistant (MR); RGI = 2.1–3.0, moderately susceptible (MS); RGI = 3.1–4.0, susceptible (S); RGI = 4.1–5.0, highly susceptible (HS) (Taylor and Sasser 1978). In a separate experiment, reaction of two varieties of round gourd (Punjab Tinda 1 and S-48) against important insect-pests was recorded under unsprayed conditions at weekly interval starting from second week of April to fourth week of June and the average values over all weeks were used for comparison purpose. Leaf area eaten (%) by red pumpkin beetle and mining intensity (%) by leaf miner was recorded on a scale of 0-100. Red spider mite injury grade was recorded on a scale of 0-5 i.e., 0 (healthy leaf), 1 (white specks on lower side of leaf), 2 (white specks on both upper and lower side of leaf), 3 (web formation occurs), 4 (necrosis occurs), 5 (defoliation occurs) (Singh and Dhooria 2008). The population of thrip and whitefly adults on 3 leaves per plant was recorded on 10 plants per entry. During 2016-17, yield response of two varieties of round gourd (Punjab Tinda 1 and S-48) to three nitrogen levels (75, 100 and 125 kg/ha) was studied in a factorial RBD with three replications. The data obtained from all the trials were subjected to analysis of variance using computer software programme CPCS1 developed by Department of Statistics, PAU, Ludhiana.

Horticultural traits: Early yield is very important in cucurbits from economic point of view as it fetches high price in the market. In round gourd, early yield has been reported to have maximum contribution towards total genetic divergence, had the highest broad-sense heritability and genetic advance and therefore, can be improved by selection (Garg 2017). The new variety 'Punjab Tinda 1' was early bearing and took 7 days less for first picking than 'S-48'. Quantitatively, early yield of 'Punjab Tinda 1' (39.41 q/ha) was 2.44 times of 'S-48' (Table 3). To improve yield potential of round gourd, primary aim should be at improving fruit number as it exerts maximum positive direct effect on total yield

Table 1: Yield (q/ha) performance of round gourd lines at PAU, Regional Research Station, Bathinda

Entry	Year					Mean	Increase/ decrease (%) over S-48
	2012-13	2013-14	2014-15	2015-16	2016-17		
Punjab Tinda 1	207.6	225.0	244.9	194.2	186.3	211.6	+46.5
S-48 (check 1)	140.6	150.8	167.8	138.5	124.3	144.4	-
Mahy tinda (check 2)	-	-	208.3	-	-	208.3	-
CD (5%)	30.9	29.2	40.2	25.6	28.1	-	-

Table 2: Comparative yield (q/ha) performance of round gourd variety 'Punjab Tinda 1' with 'S-48' at on station, multi-location and adaptive research trials

Variety	Local trials (average of 5 years)	Multi-location trials (average of 5 locations)	Adaptive Research Trials (average of 25 locations)	Overall mean	Increase/ decrease (%) over check
Punjab Tinda 1	211.6	202.0	170.5	180.9	+40.7
S-48 (check)	144.4	144.0	122.4	128.6	-
CD (5%)	25.7	17.9	-	-	-

(Garg 2019). Here, one vine of 'Punjab Tinda 1' produced 15.6 fruits which were 22.8% higher than 'S-48' (Table 3). Average immature fruit weight of 'Punjab Tinda 1' (60.2 g) was 19.0% higher than 'S-48' (Table 3). This was so as the fruits of 'S-48' remain immature only when small in size and loose hairyness and become mature while increasing their size to medium. On the contrary, fruits of 'Punjab Tinda 1' retain hairyness and remain immature even after attaining medium fruit size. Fruit shape is an important quality attribute of round gourd. Round shaped fruits appear more attractive and are preferred over flattened round ones. The fruit shape of 'Punjab Tinda 1' was round as compared to flattened round of 'S-48' as depicted by their fruit shape index (Table 3). Vine length and number of primary branches are also positively correlated with total yield (Garg 2019). The vines of 'Punjab Tinda 1' were 2.8 m long that was 41.5% higher than those of 'S-48'. The new variety had significantly higher (12.2%) number of primary branches (4.4) than 'S-48' (Table 3). The presence of large sized seed in round gourd fruits impairs its quality for vegetable purpose. Therefore, genotypes having small sized seed are considered desirable. The 100-seed weight of 'Punjab Tinda 1' (6.24 g) was 23.7% lower than that of 'S-48' (Table 3). Hence, correspondingly lower seed rate per unit area will be required for growing new variety.

Yield and quality traits: High yield is the most important breeding objective in any crop improvement programme and one of the deciding factors in adoption of the variety by growers. The new variety outyielded 'S-48' by 46.5%, 40.3% and 39.3% in local, multi-location and

adaptive trials, respectively (Tables 1 and 2). The overall average yield (180.9 q/ha) of 'Punjab Tinda 1' was 40.7% higher than 'S-48' (Table 2). The higher yield of 'Punjab Tinda 1' could be attributed to comparatively higher fruit number, fruit weight, vine length and number of primary branches than 'S-48' as these traits contribute positively towards high yield of round gourd (Garg 2019). Besides yield, quality of vegetables is of utmost importance and affects the acceptance of variety by consumers. Fruits of 'Punjab Tinda 1' had 6.67% dry matter which was 10.5% lower than that in 'S-48' (Table 3). It implied that water content was comparatively higher in fruits of new variety rendering them tender. Ascorbic acid in fruits of 'Punjab Tinda 1' was 19.6 mg/100 g which was 40% higher than that in 'S-48'. The fruits of 'Punjab Tinda 1' recorded 11.7% ash content (on dry weight basis) which was 11.4% lower than that in 'S-48' (Table 3).

Reaction against diseases and insect-pests: Upon screening against mosaic under natural field conditions, 'Punjab Tinda 1' recorded slightly higher disease index (38.1%) than 'S-48' (34.2%) but both varieties were graded as moderately resistant (Table 4). Upon screening against downy mildew under artificial inoculation conditions, 'Punjab Tinda 1' recorded comparatively lower disease index (46.5%) than 'S-48' (56.4%) but upon grading both varieties were found susceptible (Table 4). Similarly, 'Punjab Tinda 1' and 'S-48' recorded a root gall index of 2.8 and 2.9, respectively and were graded as moderately susceptible to root knot nematodes when screened under artificial conditions in pots (Table 4). Foliar damage in 'Punjab Tinda 1' due

Table 3: Comparative performance of round gourd variety 'Punjab Tinda 1' with 'S-48' for various horticultural traits (average of 2012-13 to 2016-17)

Trait	Variety		CD (5%)
	Punjab Tinda 1	S-48 (check)	
Days taken from sowing to first marketable harvest	53.5	60.5	3.5
Early yield (q/ha)	39.41	16.17	6.16
Fruit number per vine	15.6	12.7	2.2
Immature fruit weight (g)	60.2	50.6	4.8
Fruit shape index	0.91	0.80	0.04
Vine length (cm)	282.4	199.6	26.7
Number of primary branches per vine	4.4	3.9	0.4
100-seed weight (g)	6.24	8.18	0.72
Dry matter (%)	6.67	7.45	0.51
Ascorbic acid (mg/100g)	19.6	14.0	1.6
Ash content (% dry weight)	11.7	13.2	1.1

Table 4: Comparative performance of round gourd variety 'Punjab Tinda 1' with 'S-48' against important diseases (average of 2014-15 and 2016-17)

Variety	Mosaic		Downy mildew		Root-knot nematodes	
	(under natural field conditions)		(under artificial inoculation conditions)		(under artificial conditions in pots)	
	DI (%)	Rating	DI (%)	Rating	RGI	Rating
Punjab Tinda 1	38.1	MR	45.5	S	2.8	MS
S-48 (check)	34.2	MR	56.4	S	2.9	MS

Table 5: Comparative performance of round gourd variety ‘Punjab Tinda 1’ with ‘S-48’ against important insect-pests under unsprayed conditions

Variety	Red pumpkin beetle		Leaf miner		Red spider mite	No. of thrips (per 3 leaves/ plant)	No. of whitefly adults (per 3 leaves/ plant)
	Leaves infested (%)	Leaf area eaten (%)	Leaves infested (%)	Mining intensity (%)	Injury grade		
Punjab Tinda 1	13.74	4.28	25.96	5.00	1.60	1.49	0.42
S-48 (check)	12.57	4.43	22.87	4.57	1.50	2.38	0.74

to red pumpkin beetle, leaf miner and red spider mite under unsprayed conditions was comparable to that in ‘S-48’ (Table 5). On the other hand, the population of thrip and whitefly adults on ‘Punjab Tinda 1’ was comparatively lower than that on ‘S-48’ under unsprayed conditions (Table 5).

Response to nitrogen dose: The Punjab Agricultural University has recommended a nitrogen dose of 100 kg/ha for cultivation of round gourd in medium fertile soils of Punjab. The new variety yielded significantly higher than ‘S-48’ at all nitrogen levels (Table 6). Both ‘Punjab Tinda 1’ and ‘S-48’ registered maximum yield (171.0 and 112.5 q/ha) at a nitrogen dose of 125 kg/ha which was statistically at par with that at 100 kg N/ha and significantly higher than that at 75 kg N/ha. Similar results have been reported by Kanwar et al. (1994) in round gourd variety ‘S-48’ under Ludhiana conditions. However, ‘Punjab Tinda 1’ was more responsive to nitrogen application as it exhibited a yield increment of 43.4% when nitrogen dose was increased to 100 from 75 kg/ha as compared to 35.9% increase shown by ‘S-48’ (Table 6). The probable reason for responsiveness of round gourd to nitrogen application is that it has a

Table 6: Comparative yield (q/ha) performance of round gourd variety ‘Punjab Tinda 1’ with ‘S-48’ as influenced by nitrogen dose during 2016-17

Nitrogen dose (kg/ha)	Variety		Mean yield
	Punjab Tinda 1	S-48	
75	112.5	80.8	96.7
100	161.3	109.8	135.6
125	171.0	112.5	141.8
Mean	148.3	101.0	
CD (5%)			
Variety		7.3	
Nitrogen		9.0	
Variety × Nitrogen		12.7	

shallow root system which has comparatively lower nutrient absorbing ability from the soil.

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