



## Evaluation and comparative performance of six loquat (*Eriobotrya japonica* Lindl.) varieties under Punjab conditions

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**Abstract:** Evaluation and comparative performance of six loquat *Eriobotrya japonica* Lindl. cultivars viz. selections, pathankot, tanaka, golden yellow, pale yellow and improved golden yellow was studied under Punjab conditions in 2012-13 and 2013-14. The main objective of the study was to evaluate and recommend the loquat variety with higher yield potential and better fruit quality for the growers of Punjab. Among the six varieties of loquat, cv. Tanaka was found most promising on the basis of the maximum fruit weight (23.5g), fruits per cluster (12), fruit length (4.5cm) fruit breadth (3.64 cm) Pulp weight (29.52g) fruit yield (34.0g), TSS (11.03%) with minimum acidity (1.12%), seed weight and seed number. Moreover 'Tanaka' fruits had higher consumer acceptance (7.83 out of 9) as compared to other loquat varieties under comparison. These varieties were compared with recommended varieties as standard check. The study indicate that cv Tanaka has the potential to excel under Punjab conditions as compared with the prior existing cultivation.

**Keywords:** Cultivars, Loquat, Punjab, Quality, Tanaka, Yield

### INTRODUCTION

Loquat (*Eriobotrya japonica* Lindl.) the *Japanese plum* or *medlar* is a subtropical fruit tree. It originated in China but, owing to its wide adaptability it is grown in more than 30 countries of the world (Feng *et al.*, 2007). Loquat cultivation is picking up and gaining commercial importance in China, Spain, Turkey Pakistan, India, Italy and Brazil (Hussain *et al.*, 2011). Under Punjab conditions, it is available in the months of March-April. During this period very few fresh fruits are available in market and sells at premium price. It is highly nutritious fruit rich in vitamins (A, B and C), minerals (phosphorous and calcium) and sugars (Karadeniz, 2003). Besides yielding nutritious fruit, other parts of the plant are reported to have medicinal uses i.e. its leaves are used as therapeutic agents to inhibit inflammation and fibrosis (Yoshioka *et al.*, 2010), cure skin diseases (Nishioka *et al.*, 2002), cough (Sakuramata *et al.*, 2004) and tumor (Ito *et al.*, 2002) in China and Japan. Even loquat seed extract is reported to help in curing liver disorders (Yoshioka *et al.*, 2010). Loquat cultivars are broadly classified into two categories namely Chinese and Japanese type based on its fruit shape and quality characteristics. The Chinese type is characterized by large, pear shaped fruits with yellow flesh, whereas Japanese type are small, round shaped fruits with white or pale-yellow flesh. Loquat is highly preferred fruit for kitchen gardens in Punjab and is also being grown on a small scale in the orchards at Amritsar, Gurdaspur, Hoshiarpur, Ropar, Jalandhar and Patiala districts of Punjab. In addition to its fresh consumption the loquat fruit can be processed into a number of products like jam, jelly,

squash etc. Not much research work has been carried out on evaluation and comparative performance of different loquat cultivars under Punjab conditions (Singh, 2010). The present study was conducted to evaluate and recommend the loquat variety with high yield potential and better quality fruits for the fruit growers of Punjab.

### MATERIALS AND METHODS

The present study was conducted at college orchard, Department of Fruit Science PAU, Ludhiana during 2012-13 and 2013-14. Loquat trees of six varieties planted during 1996 at a spacing of 6.5 X 6.5m were used as experimental material. The experiment was laid out in a randomized block design with 3 replication per treatment (cultivar) and one tree per replication. Data of both years were pooled and analyzed for variance by using the SAS (V 9.3, SAS Institute Inc., USA) package. The treatment means that were statistically different were subjected to pairwise mean comparison using LSD ( $p \leq 0.05$ ). The selected trees of uniform health and vigour were tagged and maintained uniform cultural and phytosanitary practices as recommended by Punjab Agricultural University. Four branches from each direction were tagged and used to work out average number of fruits per cluster. Fifty randomly selected fruits from each replication were used to assess fruit quality characters like fruit weight (g), fruit size in terms of length and breadth (cm), fruit yield (kg/plant) pulp weight (g) and fruit shape. Seed characters like seed number per fruit and seed weight (g/fruit). Total soluble solids (TSS) content was determined with the help of an Erma hand-held refractometer, Japan, and expressed in percent soluble solids after mak-

ing the temperature correction at 20°C. Titratable acidity was estimated by the method described by AOAC (2005). Palatability rating was determined on the basis of colour, texture and taste of fruit by a panel of 10 expert judges using a Hedonic scale (1– 9 points) as described by Amerine *et al.* (1965).

## RESULTS AND DISCUSSION

In the present investigation, the fruit weight of different varieties ranged from 17.0 to 23.5 g. The maximum fruit weight was recorded in variety Tanaka (23.5 g) which was significantly better than cv. Pathankot. Among rest of varieties, fruits of Loquat selection are heavier but not statistically significant as compared to other varieties. Singh (2010) also observed maximum fruit weight in variety Tanaka (24.03 g) which was followed by Pathankot. Fruit weight of five genotypes evaluated in Pakistan ranged from 9.54g to 16.20g (Hussain *et al.*, 2011). Highest fruit weight was observed in Emanwil and Yahoda cultivars grown in Egypt during two successive years (Elsabagh and Haeikl, 2012). The average fruit length of different varieties was recorded in the range of 3 to 4.5 cm. The maximum fruit length was recorded in variety Tanaka (4.5cm). All the varieties differ significantly with each other in fruit length except Loquat Selection do not differ significantly with golden yellow and pale yellow. Singh (2010) also recorded maximum fruit length (4.45cm) in variety Tanaka which was statistically at par with Pathankot (4.15cm). Hussain *et al.* (2007) also studied the fruit length in 19 different loquat genotypes

in Pakistan reported that fruit size in range from 2.68 to 5.10 cm. Fruit length of five genotypes evaluated in Pakistan ranged from 2.87 cm to 3.66 cm (Hussain *et al.*, 2011). Highest fruit length was achieved by Emanwil cultivar grown in Egypt in both the seasons (Elsabagh and Haeikl, 2012). Fruit breadth of different varieties ranged from 2.88 to 3.64 cm. The maximum fruit breadth was recorded in variety Tanaka (3.64 cm). All the varieties differ significantly with each other in fruit breadth except Loquat Selection and golden yellow as they were at par with each other. Similarly Pathankot and pale yellow do not differ significantly from each other. The range/trend of fruit breadth (2.88 to 3.64 cm) recorded in present study is in conformity with Singh (2010) i.e. 2.88 to 3.35cm recorded in different loquat varieties. Fruit breadth of five genotypes evaluated in Pakistan ranged from 2.53cm to 3.18 cm (Hussain *et al.*, 2011) Highest fruit breadth was observed in Yahoda cultivar grown in egypt (Elsabagh and Haeikl, 2012)

No of fruits per cluster differ significantly with each other in all the varieties. The maximum no of fruits per cluster was recorded in variety Tanaka (12) followed by Loquat Selection (11.5). The minimum no of fruits per cluster was recorded in Pathankot (10). Range for no of fruits/cluster depicted in the present study falls within the range (8.83- 16.27) given by Hussain *et al.* (2009) and (5-21) by Karadeniz and Senyurt (2007) in loquat. However Hussain *et al.* 2011 revealed that no of fruits per cluster in five loquat genotypes cultivated in Pakistan ranged from 11.05 to 18.92. The fruit shape

**Table 1.** Fruit characteristics of loquat varieties under Punjab conditions.

Variety	Fruit weight	Fruit size		No of fruits (per cluster)	Fruit shape
		Length (cm)	Breadth (cm)		
Loquat Selection	19.2 <sup>c</sup>	3.47 <sup>cd</sup>	3.20 <sup>c</sup>	11.50 <sup>b</sup>	Oval ovate
Pathankot	21.0 <sup>b</sup>	4.08 <sup>b</sup>	3.46 <sup>b</sup>	10.00 <sup>f</sup>	Ovate pyriform
Tanaka	23.5 <sup>a</sup>	4.50 <sup>a</sup>	3.64 <sup>a</sup>	12.00 <sup>a</sup>	Oblong pyriform
Golden Yellow	17.8 <sup>c</sup>	3.70 <sup>c</sup>	3.14 <sup>c</sup>	10.20 <sup>e</sup>	Globose
Pale Yellow	18.8 <sup>c</sup>	3.37 <sup>d</sup>	3.45 <sup>b</sup>	10.35 <sup>d</sup>	Ovate globose
Improved Golden Yellow	17.0 <sup>c</sup>	3.00 <sup>e</sup>	2.88 <sup>d</sup>	10.55 <sup>c</sup>	Globose ovate
LSD(P ≤ 0.05)	2.17	0.26	0.07	0.09	-

Means with the same letter are not significantly different (at  $p < 0.05$ ) according to LSD. Each value represents pooled mean of 2 years (2012-13 and 2013-14).

**Table 2.** Seed characteristics of Loquat varieties under Punjab conditions.

Variety	Pulp wt (gm)	Seed wt (gm)	Seed no (Per fruit)	Fruit Yield (Kg / plant)
Loquat Selection	20.60 <sup>d</sup>	4.63 <sup>a</sup>	4.0 <sup>a</sup>	25.0 <sup>d</sup>
Pathankot	26.1 <sup>b</sup>	4.40 <sup>c</sup>	3.0 <sup>b</sup>	30.5 <sup>bc</sup>
Tanaka	29.52 <sup>a</sup>	4.38 <sup>c</sup>	3.0 <sup>b</sup>	34.0 <sup>a</sup>
Golden Yellow	24.60 <sup>c</sup>	4.50 <sup>b</sup>	3.0 <sup>b</sup>	29.2 <sup>c</sup>
Pale Yellow	26.73 <sup>b</sup>	4.37 <sup>c</sup>	4.0 <sup>a</sup>	31.2 <sup>b</sup>
Improved Golden Yellow	20.60 <sup>d</sup>	3.50 <sup>d</sup>	4.0 <sup>a</sup>	24.1 <sup>d</sup>
LSD(P ≤ 0.05)	1.29	0.04	0.10	1.99

Means with the same letter are not significantly different (at  $p < 0.05$ ) according to LSD. Each value represents pooled mean of 2 years (2012-13 and 2013-14).

**Table 3.** Biochemical constituents and sensory evaluation of loquat varieties under Punjab conditions.

Variety	TSS (%)	Acidity (%)	Sensory evaluation Organoleptic scores
Loquat Selection	10.89 <sup>e</sup>	1.20 <sup>bc</sup>	5.66 <sup>c</sup>
Pathankot	9.90 <sup>f</sup>	1.29 <sup>b</sup>	5.66 <sup>c</sup>
Tanaka	11.03 <sup>d</sup>	1.67 <sup>a</sup>	7.83 <sup>a</sup>
Golden Yellow	11.5 <sup>c</sup>	1.12 <sup>c</sup>	5.50 <sup>d</sup>
Pale Yellow	11.64 <sup>b</sup>	1.21 <sup>bc</sup>	5.67 <sup>c</sup>
Improved Golden Yellow	11.79 <sup>a</sup>	1.25 <sup>b</sup>	7.00 <sup>b</sup>
LSD(P ≤ 0.05)	0.11	0.10	0.036

Means with the same letter are not significantly different (at  $p < 0.05$ ) according to LSD. Each value represents pooled mean of 2 years (2012-13 and 2013-14).

varied in different loquat varieties, it was oval ovate in Loquat Selection, ovate pyriform in Pathankot and oblong pyriform in Tanaka. The fruit shape of Golden Yellow, Pale yellow and Improved Golden Yellow was globose, ovate globose and globose ovate respectively. These results are in confirmation with Singh (2010); Hussain *et al.* (2011) observed fruit shape of five different loquat genotypes *viz.* HW1, HW2, HW3, HW4 and HW5 ranged from round to obovoid obtuse type at basal end and flat to raised at the apex.

Pulp weight of various loquat varieties varies from 20.60 gm to 29.52 gm. The maximum Pulp weight was recorded in variety Tanaka (29.52) which was significantly better than the other varieties. However, Pulp weight of loquat selection and Improved Golden Yellow are at par. Similarly pulp weight of variety Pathankot and Pale yellow do not differ significantly and are at par. Singh (2010) also observed maximum pulp percentage (62.09%) in variety Tanaka followed by Pathankot (60.58%). Seed weight of various loquat varieties varies from 3.50 gm to 4.63 gm. The maximum seed weight was recorded in Loquat selection (4.63) and minimum seed weight was recorded in variety Improved Golden Yellow (3.50). Seed weight of variety pale yellow was at par with variety Tanaka and Pathankot. Contrary to the present study, Insero *et al.* (2003) reported average seed weight per fruit was 7.3g in Tanaka whereas 9.5g was observed by Llacer *et al.* (2003). However, the present results are within the range (2.9 to 7.4 g) given by Polat (2007) and 3.93g to 5.10g given by Singh (2010) in different loquat varieties.

The highest no of seeds per fruit (4) was observed in Loquat Selection, Pale yellow and Improved Golden Yellow. Singh 2010 also observed four seeds in Loquat Selection, Pale yellow and Improved Golden Yellow. Minimum no of seeds observed (3) in Pathankot Tanaka and Golden Yellow. Singh (2010) also found no of seeds in Pathankot Tanaka and Golden Yellow to be three. In the present study no of seed per fruit in variety Loquat selection, Pale yellow and improved Golden Yellow differ significantly from seed no of variety Pathankot Tanaka and Golden Yellow. Singh and Rajput (1961) reported variable seed number per fruit in Pale yellow (4.08), Tanaka (2.70), Improved Golden Yellow (3.06) and Golden Yellow (4.83). The number of seeds per fruit ranged from 2.99 to 4.69 in

different loquat genotypes as recorded by Hussain *et al.* (2011) Number of viable seeds per fruit in Emanvil (3.47), Yahoda (4.7), Zekeim (2.97) and lowest in Akka (2.3) grown in Egypt (Elsabagh and Haeikl, 2012). The fruit yield of different varieties ranged from 24.1 to 34 g. The maximum fruit yield was recorded in variety Tanaka (34g). All the varieties differ significantly with each other in fruit yield except Pathankot and Golden Yellow where fruit yield do not differ significantly. In the same way Loquat selection and Improved Golden Yellow do not differ and were at par. Similar results were reported by Singh (2010) who also observed maximum fruit yield in variety Tanaka (43g) as compared to other five varieties. Minimum fruit weight was recorded in variety Improved Golden Yellow. Fruit yield per tree ranged from 30.50 kg to 50.30 kg in five loquat genotypes (HW1,HW2,HW3,HW4 and HW5) cultivated in Pakistan (Hussain *et al.* (2011). Total soluble solids ranged from 9.90 to 11.79 per cent and was found maximum in Improved Golden Yellow (11.79%) which differ significantly with other varieties. Singh (2010) also reported maximum total soluble solids (12.45%) in Improved Golden Yellow which differ significantly from Pathankot (10.29%) and Tanaka (11.19%). Karadeniz and Senyurt (2007) observed that total soluble solids ranged from 9.5 to 18.5 % in different loquat genotypes in Turkey. The total soluble solids ranged from 10.18 to 13.22% with maximum in Zekeim (13.33 %) evaluated in Egypt (Elsabagh and Haeikl, 2012) The titratable acidity content ranged from 1.12 to 1.67 % and was found minimum in Golden Yellow (1.12%) which was at par with loquat Selection and Pale Yellow. The titratable acidity content was maximum in variety Tanaka (1.67%). Acidity range in present study fall within acidity range (1.09 to 1.61%) reported by Singh (2010). Karadeniz and Senyurt (2007) reported that acidity content ranged from 0.87 to 16.41 per cent in different loquat varieties. Total acidity ranged from 0.058 to 0.122% with minimum (0.07%) in Emanvil and maximum in Yahoda (0.122%) Sensory evaluation ranged from 5.50 to 7.83 and was found maximum in variety Tanaka (7.83) followed by Improved Golden Yellow (7.00) which differ significantly with all other varieties. However sensory evaluation of Pale Yellow,

Loquat Selection and Pathankot do not differ significantly.

### Conclusion

In conclusion, Among the six varieties of Loquat evaluated Tanaka was rated best on the basis of fruit characteristics (4.5cm fruit length, 3.64 cm fruit breadth, 12 no of fruits per cluster, 29.52 gm fruit pulp) seed characteristics (4.38gm seed weight, three no of seeds per fruit) biochemical constituents (11.03% total soluble solids and 1.67 % acidity) and sensory evaluation (7.83 Organoleptic scores) of loquat varieties under Punjab conditions.

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