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Evaluation of Major Varieties of Litchi Fruit Characteristics in the Central Terai Region of Nepal

Jeet Narayan Chaudhary[1], Yuwa Raj Bhusal[2], Tek Prasad Gotame[3], Deepa Singh Shreshtha[4], Jiban Shrestha[5]

[1,2,3,4,5]Nepal Agricultural Research Council

A B S T R A C T

Litchi is a delicious juicy fruit of excellent quality and gaining popularity throughout terai region and foothills of Mahabharat range and it was introduced in Nepal during Rana Regime and planted in several horticulture farms but evaluation of it rarely carried out and documented in Nepal. That's why a field experiment was conducted to evaluate the already established orchards of Directorate of Agricultural Research (DoAR), Parwanipur Bara of Nepal during 2015/16 to 2016/17 fiscal years. Altogether 12 fruits at the time of harvesting were taken accordingly 4 fruits from different directions from 3 trees of each genotype namely Sahi, Seedless, Rose-Scented, Mclean, Koshiliya, Patharia Red and Early green. Average diameter, length and weight of fruits; weight of peel, seed and aril of fruits; peel, seed and aril/pulp percentage in total fruits portion; thickness of aril, total soluble solid (TSS), colour size of fruits and maturity varieties were determined and data analyzed by using Gen-stat and package program of computer. Results of above mentioned parameters showed highly significant different almost in all among the tested genotype of litchi except total soluble solid. Seedless was found significantly superior in major characteristics of fruits which recorded the highest average diameter (37.4, 38.3 and 37.8 mm), fruit weight (12.24, 13.25 and 12.75), aril weight (18.3, 19.1 and 18.7 gm), aril thickness (10.47, 10.58 and 10.53 mm) and aril percentage in total fruit (18.3, 19.1 and 18.70 %) in first, second and combined years results respectively. Therefore, based on results, Seedless genotype was concluded the promising genotype among tested genotype which need to verify and disseminate to farmers field.

Keywords: Evaluation, Litchi, Fruit Genotype and Seedless litchi,

INTRODUCTION

Litchi (*Litchi chinensis* Sonn) is one of the most important tropical fruit of Nepal and It is famous for its excellent quality, pleasant flavor, juicy pulp (aril) with attractive red colour (Chadha, 2013). It is native of south China and belongs to the family Sapindaceae. Seedless, Muzaffarpur, Calcuttia, Early large Red, Late large Red, Mclean, Rose-scented, Dehradun, are mostly cultivated cultivar in Nepal (Shrestha, 1996; Thapa and Karmacharya, 2001). It was introduced in Nepal during Rana Regime and planted in several horticulture farms and even in Kathamandu by the Rana in their palaces but plants died due to cold weather and frost. Now litchi production has become one of the commercializing sectors in fruit industry in Nepal. It is grown mostly in Terai and inner Terai region followed by foothills of Mahabharat range and Government of Nepal has been prioritized 19 districts of terai and inner terai as potential litchi production area (FDD, 2008).

In Nepal, total productive area, production and productive of litchi are 4,951 ha, 39,744 Mt and 8.02 t/ha respectively (MoALD, 2020/21) which is low as compared to other countries due to lack of proper package of practices, high yielding varieties because of limited works carried out in crop. In other hand, litchi was introduced by the Rana in Nepal who ruled the country for 104 years. It is reported that the Rana were very fond of fruit farming and gardening and introduced litchi from India and Burma. But evaluation and characterization of major varieties of litchi fruits rarely studied till date. Therefore, this study was carried out to evaluate and characterize major litchi varieties fruits for dissemination in the farmers' field and genotype registration process in Nepal.

MATERIAL AND METHODS

This study was conducted at the Horticulture Research Farm of Directorate of Agricultural Reasarch (DoAR), Parwanipur, Bara of Nepal (North Latitude 27° 2', 84° 53' East Longitude and 115 masl elevation). The fruits at ripen stage were harvested from more than 30 years old trees in already established litchi orchard of Horticulture Research Farm of DoAR, Parwanipur, Bara at 3rd week of June 2016 and 2017 where all varieties were grown under same geographical condition, agronomic and cultural practices. 4 Fruits of each tree from different directions were harvested from 7 litchi varieties namely Sahi, Seedless, Rose-Scented, Mclean, Koshiliya, Patharia Red and Early green. Altogether 12 fruits from 3 trees were selected for each genotype and three replications were maintained for each parameter analysis. After harvest, fruit brought to horticulture laboratory of DoAR, Parwanipur.

Each and every fruits weighed individually by 3 digit digital balance and length, diameter and aril thickness of fruits were taken with help of digital vernier caliper. Similarly seed, pericarp and aril were separated from fruits manually and weighed in 3 digit digital balance and these were converted into

percentage of portion in a total fruit portion by using Microsoft excel program. Juice extracted from fruit manually for measuring total soluble solid which was measured by using digital hand refractor. The data were analyzed by using Gen-stat and Excel Software package of the computer.

RESULT AND DISCUSSIONS

During rainy season of 2016 and 2017, the mean fruit diameter, length and weight were differed significantly among tested varieties table 1. The higher mean fruit diameter recorded on seedless genotype 37.4 mm, 38.3 mm and 37.8 mm and lower noticed under Koshiliya genotype 27.9, 28.6 and 28.2 mm in first, second and combined years respectively. More or less similar results of fruit weight showed on Seedless genotype whereas the higher mean fruit weight obtained 23.54, 25.21 and 24.38 gm per fruit while the lower fruit weight noted under Patharia Red genotypes 12.24, 13.25 and 12.75 gm per fruit in first, second and combined years respectively. Likewise, mean fruit length measured showed significantly higher on Patharia red genotype that was 6.9, 7.5 and 7.2 cm followed by Sahi genotype (6.2 cm) and lower at Seedless genotype 3.2, 3.4 and 3.1 cm fruit length in first, second and combined years respectively. Detail of results presented below in table number 1.

Table 1. Detail of results of average fruit length and diameter of different litchi varieties.

SN	Cultivars	Fruit Diameter (mm)			Length of fruits (cm)			Weight of the fruit (gm.)		
		1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled
1	Seedless	37.4	38.3	37.8	3.2	3.4	3.1	23.54	25.21	24.38
2	Sahi	29.3	30.1	29.7	6.1	6.4	6.2	17.15	18.21	17.68
3	Early green	31.1	31.8	31.5	4.1	4.2	4.2	21.33	21.73	21.53
4	Mclean	29.3	30	29.7	4.0	4.4	4.1	15.66	17.04	16.35
5	Koshiliya	27.9	28.6	28.2	5.1	5.4	5.2	12.24	13.25	12.75
6	Pathria Red	30.5	31.3	30.9	6.9	7.5	7.2	18.3	19.59	18.95
7	Rose-Scented	30.2	30.9	30.5	4.1	4.3	4.1	17.21	18.75	17.98
F-test		**	**	**	**	**	**	**	**	**
CV (%)		3.3	3.3	2.9	8.2	5.0	5.9	6.6	8	6.8
LSD at <0.05		1.8	1.8	1.1	0.7	0.5	0.3	2.1	2.74	1.47

Data pertaining to the average weight of peel, seed and aril/pulp indicated highly significant different among the tested genotypes. The maximum fruit peel and aril weight were observed at Seedless genotype whereas, peel weight was recorded 4.2 gm, 4.3 gm and 4.2 gm. and similarly aril weight 18.3 gm, 19.1 gm and 18.7 in first, second and combined years respectively followed by Sahi genotype in peel. In other hand, the lightest weight of peel and aril of fruits found in Koshiliya genotype fruit. In case of seed weight, Patharia Red seed noted the highest 4.2, 4.3 and 4.3 gm in first, second and combined years respectively and the lightest seed weight at Seedless genotype . Detail of results presented below in table number 2.

Table 2. Detail of results of weight of peel, seed and aril of different litchi varieties.

SN	Cultivars	Weight of peel (gm)			Weight of seed (gm)			Weight of aril/pulp (gm.)		
		1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled
1	Seedless	4.2	4.3	4.2	1.1	1.8	1.4	18.3	19.1	18.7
2	Sahi	4.1	4.2	4.2	1.7	1.8	1.8	11.3	12.2	11.7
3	Early green	3.5	3.6	3.5	3.5	2.9	3.2	14.4	15.3	14.8
4	Mclean	2.8	2.9	2.9	3.2	3.3	3.2	9.6	10.8	10.2
5	Koshiliya	2.2	2.4	2.3	2.0	2.0	2.0	8.0	8.9	8.4
6	Pathria Red	4.6	4.8	4.7	4.2	4.3	4.3	9.4	10.5	10
7	Rose-Scented	3.1	3.2	3.2	3.1	3.2	3.2	10.9	12.3	11.6
F-test		*	*	**	**	**	**	**	**	**
CV (%)		20.6	20.8	18.5	17.4	33.3	25.2	15.3	11.9	10.4
LSD at <0.05		1.3	1.4	0.8	0.8	1.6	0.8	4.2	2.7	1.5

The percentage of peel, seed and aril/pulp in a total fruit portion revealed that there was highly significant difference within genotypes in given table of table 3 and non-significant different was found in first and second years on peel percentage of total fruit portion. All the genotypes showed similar results on peel, seed and aril/pulp percentage in a total fruit portion in first, second and combined years. Overall the maximum recovery percentage of peel and

seed were taken from Patharia Red 24.8 and 22.3 % while the minimum noticed under Early green 16.4 and 14.6 % respectively. Similarly, overall the highest recovery percentage of aril/pulp in total fruit portion observed in Seedless genotype 76.7 % and the lowest was at Patharia red 52.7 %. Detail of results presented below in table number 3.

Table 3. Detail of results on peel, seed and aril percentage in total fruit portion of different litchi varieties.

SN	Cultivars	Peel percentage in total fruits			Seed percentage in total fruits			Aril/pulp percentage in total fruits		
		1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled
1	Seedless	17.6	17.1	17.3	4.6	7.2	5.9	77.7	75.8	76.7
2	Sahi	23.7	23.3	23.5	10.1	9.8	9.9	66.1	66.9	66.5
3	Early green	16.2	16.6	16.4	16.2	13.0	14.6	67.4	70.4	68.9
4	Mclean	17.8	17.1	17.5	20.6	19.2	19.9	61.4	63.7	62.6
5	Koshiliya	18.4	17.7	18.0	16.1	15.4	15.7	65.4	66.9	66.1
6	Pathria Red	25.1	24.5	24.8	22.9	21.7	22.3	51.7	53.8	52.7
7	Rose-Scented	18.7	17.8	18.3	18.3	17.2	17.8	62.8	65.0	63.9
F-test		NS	NS	*	**	*	**	**	*	**
CV (%)		21.6	21.1	19.1	15.3	26.6	5.7	7.3	8.4	7.2
LSD at <0.05		-	-	4.4	4.2	7	3.6	2.4	9.9	5.5

The average aril/pulp thickness of the fruit of different genotypes was significantly varied among genotypes and it was overall spread over wide ranges of 10.53 to 5.30 mm. The data regarding the aril thickness, the highest aril thickness measured in genotype Seedless (10.53 mm) followed by Mclean (7.03 mm) whereas, lowest in genotype Koshiliya (5.10 mm) followed by Patharia Red (5.35 mm). Data regarding the total soluble solid (TSS) showed non-significant difference within tested genotypes. In terms of maturity of fruit, genotype Early green was seen early harvesting and late genotype noticed Seedless and Sahi. Similarly in fruit size, Seedless and Sahi genotype were found big size and small size in Mclean, Koshiliya and Patharia red and colour of fruit was spread in wide range according to varieties whereas, some were observed more red to brownish with greenish colour. Detail of results presented below in the table 4.

Table 4. Detail of results of aril/pulp thickness, total soluble solid (TSS) and colour of the fruits of different litchi varieties.

SN	Cultivars	Thickness of aril (mm)			TSS of Fruits (%)			Maturity	Fruit size	Colour of the Fruits
		1st Yr	2nd Yr	Pooled	1st Yr	2nd Yr	Pooled			
1	Seedless	10.47	10.58	10.53	18.57	19.18	18.87	Late	Big	Brownish with greenish
2	Sahi	6.41	7.43	6.92	18.6	19.46	19.03	Late	Big	Red
3	Early green	4.97	6.88	5.92	20.67	20.70	20.68	Early	Mediu m	Red
4	Mclean	6.93	7.12	7.03	19.43	19.51	19.47	Mid	Small	Red with greenish
5	Koshiliya	4.97	5.24	5.10	21.40	21.40	21.40	Mid	Small	Red
6	Pathria Red	5.23	5.47	5.35	20.80	20.64	20.72	Mid	Small	Red
7	Rose-Scented	6.6	6.9	6.75	18.77	19.37	19.07	Mid	Mediu m	Dark Red
F-test		**	**	**	NS	NS	NS			
CV (%)		23.3	11.9	17	6.3	4.2	4.8			
LSD at <0.05		2.7	1.5	1.63	-	-	-			

The characteristic of fruits and harvesting time of litchi is greatly affected by genotypic characteristic, management practices and agro-ecological zones climatic condition etc. which played significant role in the fruit development process and their harvesting times. In overall fruits of seedless genotypes were determined superior in terms of weight of fruit and aril/pulp and recovery percentage of aril in total fruit portion and pericarp thickness in comparison to other genotypes. Similar kinds of results were also matched with report of Rani *et al.* 2021, Chauhan V.S. 2008, Ghaffoor *et al.* 1999). Recently Seedless genotype registered in Seed Quality Control Centre, Nepal for its better quality reported by Paudel S. 2020. Similarly it is widely grown in India due to its better fruit quality reported by Chadha K.L. 2013. However, total soluble solids (TSS) of fruit showed non-significant different in this paper which findings are not comparable with those of who reported that TSS of fruit varied significantly within cultivars (Rani et al 2021, Chauhan V.S. 2008, Ghaffoor *et al.* 1999, Groff 1921,). This variation in the result an be expected due to difference in cultivars, climatic conditions, stage of maturity and method of analysis etc.

CONCLUSION

Based on overall results, Significantly in major characteristics of fruits, genotype Seedless recorded the highest diameter (37.4, 38.3 and 37.8 mm), fruit weight (12.24, 13.25 and 12.75), aril weight (18.3, 19.1 and 18.7 gm), aril thickness (10.47, 10.58 and 10.53 mm) and percentage of aril/pulp percentage in total fruit portion (77.7, 75.8 76.7 %) in first, second and combined years respectively. Therefore, Seedless genotype was concluded the promising genotype among tested genotype which need to be further verify and disseminate in the farmers.

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