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STUDY OF FRUIT MORPHOLOGICAL AND PHYSIO-CHEMICAL CHARACTERS OF LITCHI VARIETIES IN TROPICAL HORTICULTURE CENTRE, NAWALPUR, SARLAHI

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ABSTRACT

The performance of six litchi cultivars (namely "Shahi", "McLean", "Early Large Red", "Muzaffarpur", "China" and "Seedless") on the physical and biochemical quality of fruits was evaluated. Fruit samples were collected at maturity during June from 15-year-old trees of Tropical Horticulture Centre, Nawalpur, Sarlahi, Nepal. There was a significant difference among the varieties. The fruit weight ranged from 18.15-35.04gm, percent recovery of flesh 63.73-83.41%, TSS 17.98-20.58%, and, total sugar 10-19.2%. Seedless variety showed the best performance i.e. highest fruit weight (35.04±4.25gm), percent recovery of flesh (83.41±4.4%), length (3.84±0.31cm), breadth (3.62±0.21gm) and TSS (20.335±0.77%). Therefore, litchi genotypes such as the Seedless variety may have a unique potential for further enrichment of genetic improvement in litchi germplasm.

Keywords: *litchi, biochemical characters, TSS, Sarlahi*

Introduction

Litchi (*litchi chinensis) belonging* to the family Sapindiaceae is the third most important summer fruit in the Nepalese context (after mango and banana). (MOALD, 2021). The current production area of Litchi is 8,493 ha, and the total production is 42,736 MT with a yield being 7.41 MT/ha (MOALD, 2022). 50% of the total production of litchi is produced from Madhesh Pradesh alone, although it covers only 33% of the total production area. This is due to climate and topographical conditions that are suitable for litchi production as it is favored in places with short, dry, and frost-free winters (Nath V, 2022). Sarlahi also located in Madhesh Pradesh is also an important litchi-growing district with production of 1094 MT/year (MOALD, 2021). The world's litchi production is estimated at 3.5 million tons of which 80% (2.8 million tons of litchi was produced in China in 2018. The major producers are India, Vietnam, Madagascar, and Thailand (Mitra, 2020).

Although the demand as well as the production of litchi is increasing exponentially, limited literature has been mentioned regarding the morphological and biochemical quality of various litchi varieties. No systematic research on fruit characteristics, or biochemical composition of the available litchi varieties has been made in Nepal. Therefore, this research can be relevant in this context.

Materials and Methods

This study was conducted at Tropical Horticulture Centre, Nawalpur, Sarlahi (latitude 27.05° N and longitude 85.63° E), Nepal from February to July 2022. Around 15-year-old plants varieties of litchi viz. Early Large Red, China, Shahi, McLean, Seedless, and Muzaffarpur were included in this trial. Four plants of each variety were selected at random from a large plantation to represent four replicates. thirty fruits per plant were randomly harvested. Length, breadth, circumference, and weight of fruit and seeds were recorded using standard methods and procedures. The percentage of skin, pulp, and seed of the fruit was also calculated. Total soluble solids (TSS) were recorded by hand refractometer (expressed degree Brix), titrable acidity (%), and sugars (%) were estimated per A.O.A.C (1984). Data analysis was done with the help of MS Excel version 2016 and SPSS. Values of fruit shape were obtained by dividing the values of fruit length over fruit diameter. (Lal N, 2021) $fruit\ shape\ index = \frac{fruit\ length}{fruit\ diameter}$

Results and Discussion

Morphological parameters

Table 1
Fruit characteristics of six litchi varieties

Varieties	Physical characteristics			Composition of fruit				Fruit shape index
	Length of fruit (cm)	Diameter of fruit (cm)	Circumference of fruit (cm)	Weight of fruit (gm)	Skin (%)	Pulp (%)	Seed (%)	
Shahi	3.54±0.15ab	3.22±0.09b	10.11±0.29b	20.91±1.2b	10.69±1.23b	68.23±3.6a	18.87±3.8b	1.01
McLean	3.39±0.28ab	3.02±0.12a	9.49±0.38a	18.15±1.36a	12.17±2.13bc	65.03±8.59a	20.50±2.26b	1.12
Early large red	3.37±0.19ab	3.27±0.16b	10.29±0.5b	19.98±1.59ab	12.93±1.33c	63.73±4.05a	19.30±2.75b	1.02
China	3.37±0.21a	3.22±0.15b	10.11±0.46b	21.12±1.48b	13.54±1.6c	68.05±7.71a	18.07±0.61b	1.05
Seedless	3.84±3.31c	3.62±0.21c	11.38±0.64c	35.04±4.25c	7.49±1.7a	83.41±4.4b	3.98±0.61a	1.06
Muzaffarpur	3.57±0.31b	2.94±0.18a	9.25±0.55a	19.58±1.52ab	13.74±2.61c	65.75±4.59a	20.59±3.56b	1.21

The fruits of the six litchi varieties differed concerning their physical characteristics and composition (Table 1). Variety China had the smallest fruit length (3.37±0.19cm) while it was longest in the case of Seedless (3.84±0.31cm). maximum breadth of fruit was found in seedless (3.62±0.21cm) _ and the minimum breadth was that of Muzaffarpur (2.94±0.18cm). circumference of the fruit ranged from 9.25cm to 11.38cm. The heaviest among all the varieties was seedless

(35.04±4.25gm) and the lightest was McLean (18.15±1.36cm). Islam MS (2002) and Talang (2023) also recorded variations in the size and weight of litchi varieties.

Skin is the non-edible waste portion of the fruit hence the less the skin-to-weight proportion the better the performance. The seedless variety showed the lowest skin percentage (7.49±1.7%), while the highest skin percentage was seen in Muzaffarpur (12.93±1.88%). Singh et al. (2012) pointed out that fruits with small or aborted seeds and a high percentage of aril are considered good quality parameters of litchi, which is the major area of focus in the breeding program of litchi. The highest aril percentage was seen in the Seedless variety (83.41±4.4 %) while the other varieties ranged from 63.73% to 68.23%. furthermore, Seedless had the lowest seed percentage (3.98±0.61%) and other seed characteristics like length (1.66±0.14cm) and circumference (24±4.05cm) (Table 2). The variation in fruit morphology might be due to genetic effects, and agro-climatic conditions on different cultural management practices (Rymbai et al.,2014). The fruit shape index demonstrates the shape of the fruit, FSI nearer to one indicates the fruit to be round; Shahi, Early Large Red, China, and Seedless are rounded while McLean and Muzaffarpur are comparatively elongated.

Table 2
Seed characteristics of fruits of six litchi varieties

Varieties	Length of seed (cm)	Breadth of seed (cm)	Circumference of seed (cm)
Shahi	2.38±0.15c	13.36±1.37b	41.97±4.31b
McLean	2.32±0.16c	12.87±1.01b	40.43±3.19b
Early large red	2.32±0.17c	12.77±1.14b	40.12±3.58b
China	2.37±0.12c	13.08±1.2b	41.09±3.77b
Seedless	1.66±0.14a	7.64±1.27a	24±4a
Muzaffarpur	2.00±0.35b	12.71±1.29b	39.91±4.05b

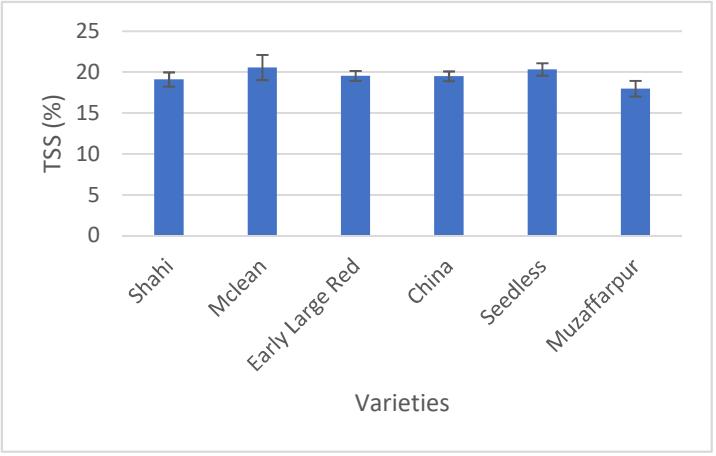
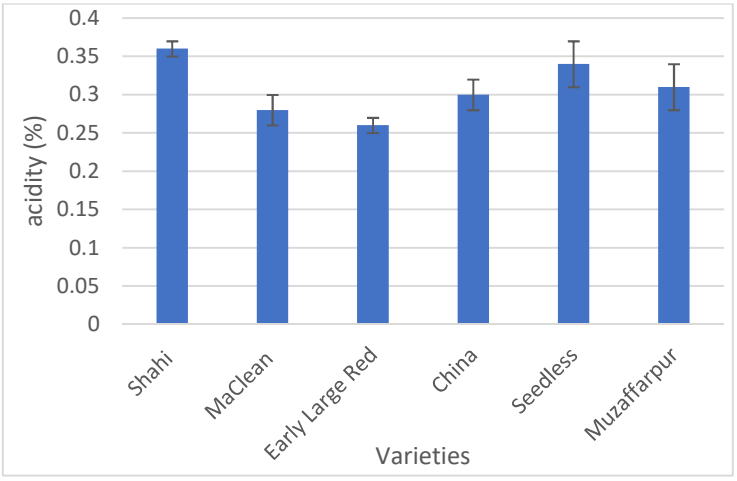


Figure A


0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
acidity (%)
Shahi
MaClean
Early Large Red
China
Seedless
Muzaffarpur
Varieties

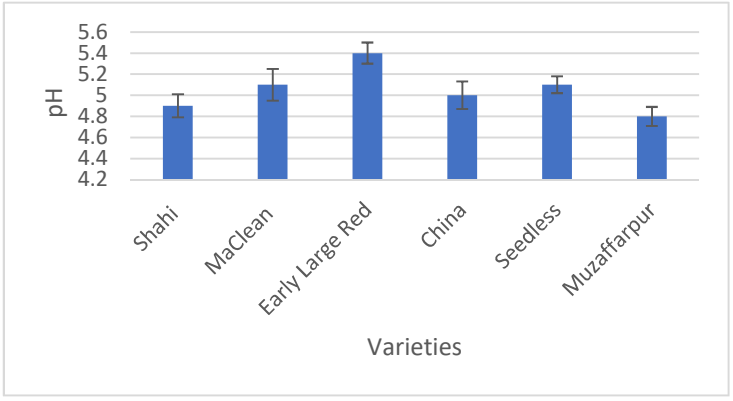
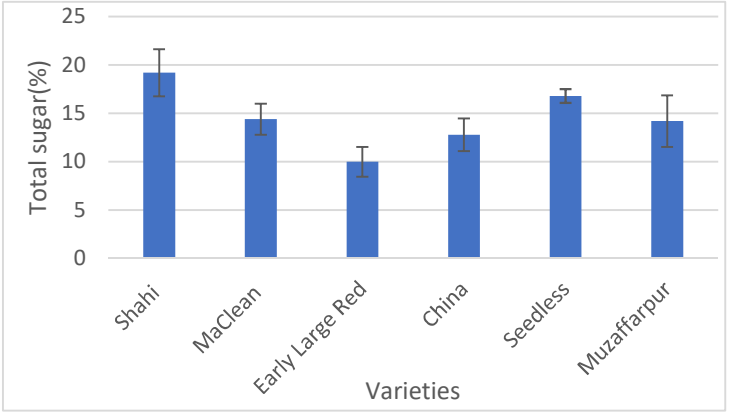

5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
pH
Shahi
MaClean
Early Large Red
China
Seedless
Muzaffarpur
Varieties

Figure A


25
20
15
10
5
0
Total sugar(%)
Shahi
MaClean
Early Large Red
China
Seedless
Muzaffarpur
Varieties

The mean value of four replications (each replication consisted of 10 fruits) with ± S.E

Fig. 1: Biochemical characteristics of fruits of different genotypes of litchi in Sarlahi. A- total soluble solids (%), b- titrable acidity (%), c- pH, d- total sugar (%).

Biochemical parameters

The experiment showed a significant variation for biochemical traits (fig. 1). The PH of litchi varieties varied from 4.8 to 5.4. the TSS values obtained varied from medium to highest, the highest being that of seedless (20.32±1.54%). Islam (2002) and Samson (1980) reported close the range of TSS for other varieties. The total sugar % was highest in Shahi (19.2±2.44%). Varietal differences in litchi have also been observed by Tripathi et al. (1987), Jain et al. (1988), Islam et al. (2003), and Haq and Rab (2012). These differences in TSS and titrable acidity of litchi might occur due to varietal differences, changed environment, as well fruit production inputs (Sayal et al., 1999). Similarly, Haq and Rab (2012) also observed a wide variation in the total sugar content of litchi. The variations in total sugar content of the litchi genotypes could have been caused by the conversion of starch into sugar which may be due to inherent varietal character. The present finding is in line with Tripathi et al. (1987), Ghosh et al. (1988), and Jain et al. (1988). The different in ascorbic acid content in fruit of litchi has also been observed by Singh et al. (2010)

Conclusion

The above-mentioned findings indicated that the Seedless variety is superior to others in terms of physical characteristics like length, breadth, pulp%, seed% and skin %. Hence it can be of the most economical value to Nepalese farmers. However, Shahi and McLean showed good biochemical characteristics. Thus these varieties can be exploited in the breeding processes.

Conflict of interest: The authors declare that they do not have any conflict of interest.

Ethical Review: This study does not involve any human or animal testing.

Informed Consent: Written informed consent was obtained from all study participants.

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