

sampling bias. Damaged, diseased, insect-infested, and malformed fruits were excluded from sampling. Immediately after harvest, the samples were transported to the laboratory for morphological and physical analyses.

2.4 Determination of fruit morphological characteristics

Fruit morphological characteristics, including fruit colour, fruit shape, fruit size, seed colour, seed shape, seed size, and aril colour, were recorded using freshly harvested mature fruits. Fruit maturity was identified based on characteristic peel colour and varietal appearance. Morphological descriptors were evaluated following the standard litchi descriptor guidelines described by Nacif et al. (2001) and Saikia and Kotoky (2022).

2.5 Determination of fruit physical characteristics

Fruit length, fruit width, fruit weight, pericarp weight, aril weight, seed length, seed width, and seed weight were determined using twenty representative fruits from each experimental unit. Fruit and seed length were measured from the base to the apex, while width was measured at the widest portion using a digital Vernier caliper with an accuracy of 0.01 cm. Fruit, pericarp, aril, and seed weights were measured using a calibrated digital electronic balance with an accuracy of 0.01 g.

Total soluble solids (TSS) were determined using freshly extracted juice obtained from the edible aril. The juice was filtered through muslin cloth and a few drops were placed on the prism of a hand-held digital refractometer (0–32 °Brix range). The instrument was calibrated with distilled water before each measurement, and TSS values were expressed as °Brix at room temperature. Three independent measurements were recorded for each experimental unit, and their average value was used for statistical analysis.

2.6 Statistical analysis

The collected data were entered into Microsoft Excel and analyzed using R software version 4.4.0. Analysis of variance (ANOVA) was performed to determine the significance of differences among cultivars. Mean separation was carried out using Duncan's Multiple Range Test (DMRT) at the 5% level of significance ($p \leq 0.05$). Coefficient of variation (CV%) and overall treatment means were also calculated to assess experimental variability and trait performance.

3 Results and Analysis

3.1 Fruit morphology of tested varieties

Significant variation was observed in fruit morphological characteristics among the seven evaluated litchi cultivars (Table 1). Fruit colour varied from red, crimson red, pinkish red, and tyrian rose to brownish-green. Likewise, fruit shape ranged from oval and cordate to conical, oblong, and globose, while fruit size was classified as medium or large depending on the cultivar. Seedless, Calcuttia, and Muzaffarpur produced comparatively larger fruits, whereas Shahi, China, Early Large Red (ELR), and Bombai produced medium-sized fruits.

Table 1 Morphological characteristics of fruit among seven litchi (*Litchi chinensis* Sonn.) varieties evaluated in Sarlahi, Nepal

Varieties	Fruit color	Fruit shape	Fruit size
Shahi	Red	Oval	Medium
China	Tyrian rose	Cordate	Medium
Seedless	Brownish with greenish	Heart or globose	Large
ELR	Crimson red	Oval	Medium
Calcuttia	Pinkish red	Oblong or lopsided	Large
Muzaffarpur	Crimson red	Conical	Large
Bombai	Red	Oval	Medium

3.2 Seed morphology of tested varieties

Considerable variation was also observed in seed morphology among the studied cultivars (Table 2). Seed colour ranged from light brown to dark chocolate, whereas seed shape varied between elliptic oblong and elliptic oval. Seedless was the only cultivar possessing small seeds, while Calcuttia and Muzaffarpur had large seeds.