



Evaluation of Physical, Processing and Quality Attributes of Cashew Varieties Grown under Odisha Condition

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ABSTRACT

A study was undertaken during November, 2021–June, 2022 to evaluate twenty-four varieties of cashew collected from Cashew Research Station, All India Co-ordinated Research Project on Cashew, OUAT, Bhubaneswar. The experiment was laid on experimental design RBD comprises of 24 treatments and 2 replications investigated for the physical, processing and quality attributes which included nut weight, breadth, length, thickness, kernel weight, shelling percentage, kernel count, percentage yield, moisture %, protein, fat, carbohydrate and sugar content of whole kernel. Cashew, an important nut crop in the world market, including India and this influenced adaptation of breeding program for targeting higher yield and profitability with good quality kernel of consumer's interest. Results indicated that significant differences were observed for various traits for studied cultivars. Highest nut weight (8.33 g), nut length (3.90 cm), nut width (2.76 cm) and nut thickness (19.45 mm) were observed in BPP-8 followed by Jagannath. However, for processing attributes best results observed in Jagannath for characters kernel weight (2.49 g), shelling percentage (32.02), percent yield of whole kernel (85.95%) and kernel count (182) followed by Balabhadra, BPP-8 and Vengrula-7. Balabhadra showed best results for quality attributes like Protein content (21.91%) and fat content (42.87%) while vengrula-7 (H-255) showed best quality attributes like carbohydrate content (22.05%) and sugar content (0.220 %). Out of 24 commercial cashew genotypes BPP- 8 and Jagannath variety exhibited better yield and processing quality.

KEYWORDS: Physical characters, processing, cashew, nut parameters

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1. INTRODUCTION

Cashew (*Anacardium occidentale* L.) having its origin in Brazil in the South American region has been cultivated in India since the 16th century after its introduction by the Portuguese explorers (Mwaikambo and Ansell, 2001; Sivagurunathan et al., 2010). Though it is an alien horticulture crop, the congenial climatic condition combined with the hardy nature of the crop made it one of the most cultivated cash crops in the country. This crop grows well in areas with annual rainfall ranging from 50 to 350 cm (Singh et al., 2010; Rejani and Yadukumar, 2010). Although, cashew is primarily cultivated for its kernel, cashew apple, testa and Cashew Nut Shell Liquid (CNSL) are also having their own importance. India is the largest cashew growing country and stand as the second largest producer in the world. In India, the total cashew production stands at approximately 7.81 lakh t from an area of 11.92 lakh ha, yielding a productivity of 766 kg ha⁻¹. In Odisha, production reaches around 1.21 lakh t from 2.23 lakh ha, with a lower productivity rate of 655 kg ha⁻¹ (Anonymous, 2024).

Cashew is mainly cultivated for its delicious and nutritious kernels. This is an important dollar earning crop whereby it stands as the third highest foreign exchange earner among all agricultural products and contributed significantly to Indian economy. India accounted for 15% export of cashew to different parts of world with total valuation US\$ 339.21 million during April, 2023 to March, 2024 (Rout et al., 2025). The kernel is an excellent source of nutrition, containing a unique composition of protein (21%), carbohydrates (22%), fat (47%), vitamins and minerals (Anand et al., 2015 and Rico et al., 2016). This makes its nutritional profile comparable to that of milk and eggs. Notably, approximately 82% of its total fat content consists of unsaturated fatty acids, which help maintain or lower blood cholesterol levels. Additionally, cashews offer a naturally sweet flavor without contributing excessive calories (Ogunwolu et al., 2015). In a 100 gram reference quantity, raw cashews provide 553 Calories, 67% of the Daily Value (DV) in total fats, 36% DV of protein, 13% DV of dietary fiber and 11% DV of carbohydrates (Anonymous, 2015). Cashew nuts generally differ in their sizes, shapes, colour and morphometric characteristics due to segregation resulting from outcrossing. Apart from the genetic factors, the differential cashew nut sizes, shapes, shell thicknesses and proportion of kernels with raw nuts also depend upon various climatic and edaphic factors (Yadukumar et al., 2001; Poduval and Yadukumar, 2011; Tripathy et al., 2015; Yuvaraj et al., 2015; Mangalassery et al., 2019). The low potential productivity of cashew nut in the country as well as in the state were due to use of traditional varieties and existence of old and senile plantations etc. (Chandrasekhar et al., 2018 and Rout et al., 2025). Low production can be

effectively resolved by planting superior cashew varieties with high yield potential in the region (Nayak et al., 2019; Ramteke, 2022; Janani et al., 2022). These morphological and structural characteristics of seed play an important role in the determination of yield, protein and seed oil contents as well as in designing and developing the equipment for post-harvest operation and processing. The physical properties like weight and moisture content determine the market and export value of cashew nuts. The physical, chemical and quality character of the nut processability largely regulates its nutritional value and market value. Hence, an experiment was carried out for evaluation of nuts for physical, processing and quality parameters for varieties grown under Odisha condition.

2. MATERIALS AND METHODS

Twenty four varieties of cashew were collected during November, 2021–June, 2022 from Cashew Research Station, All India Co-ordinated Research Project on Cashew, OUAT, Bhubaneswar. The good quality nuts of selected cashew variety were collected for evaluation of physical, processing and quality parameters following the statistical design, Randomized Block Design (RBD) replicated twice. The selected varieties were Balabhadra, Jagannath, Dhana, BPP-8, Priyanka, VRI-3, H-68, Vengurla-7 (H255), Jhargram-1, NRCC Sel-2, Bhubaneswar-1, Bhaskara, Goa-1, UN-50, Chintamani-1, Madakkathara-2, Madakkathara-1, Vengurla-1, Vengurla-4, BPP-4, Amrutha, H-1598, Ullal-1 and Ullal-3. These nuts were used to study the physical, processing and quality attributes. Physical parameters included weight, length, breadth and thickness of nuts. Processing characters included kernel weight, shelling percentage, percentage yield of whole kernel and kernel count. Quality parameters included moisture, protein, fat, carbohydrate and sugar content. The data, collected for all the characters involved in the study were subjected to statistical scrutiny for proper interpretation (Table 1). The standard method of analysis of variance technique was used as described by Panse and Sukhatme (1967).

3. RESULTS AND DISCUSSION

3.1. Evaluation of physical characters

Physical parameters like nut weight, nut length, nut breadth, and nut thickness were found statistically significant among twenty-four tested cashew varieties (Table 2). It was revealed that the nut weight varied from minimum value in variety Bhubaneswar-1 (5.85 g) to maximum value in BPP-8 (8.33 g). The variety BPP-8 recorded maximum value was closely followed by variety Jagannath (8.32 g), Vengurla-7 (H255) (8.11 g), Dhana (8.05 g), NRCC-Sel-2 (7.96 g) and UN-50 (8.05 g) which were statistically at par. Cashew nut length

Table 1: Details of sources of cashew varieties used in the study (Chandrasekhar et al., 2018)

Sl. No.	Name of cashew types	Source
1.	Balabhadra, Jagannath, Bhubaneswar-1	Cashew Research Station(CRS), Bhubaneswar, Odisha
2.	BPP-4, BPP-8	Cashew Research Station(CRS), Bapatla, Andhra Pradesh
3.	Chintamani-1, Ullal-1, Ullal-3	Cashew Research Station(CRS), Hogalagere, Kar-nataka
4.	Vengurla-1, Vengurla-4, Vengurla-7	Regional Fruit Research Station(RFRS), Vengurle, Maharashtra
5.	Bhaskara, NRCC Sel-2	Directorate of Cashew Research Puttur(DCR), Kar-nataka
6.	Madakkathara-1, Madakkathara-2, Pri-yanka, Amrutha, UN-50, Dhana, H-68, H-1598	Cashew Research Station(CRS), Madakkathara, Kerala
7.	VRI-3	Regional Research Station(RFRS), Vridhachalam, Tamil Nadu
8.	Jhargram-1	Cashew Research Station(CRS), Jharagram, West Bengal
9.	Goa-1	ICAR Research Complex for Goa, Ela, Old Goa

Table 2: Evaluation of physical parameters of cashew varieties grown under Odisha condition

Treatment No.	Variety	Nut weight (g)	Nut length (cm)	Nut width (cm)	Nut thickness (mm)
1	Balabhadra	7.69	3.30	2.62	17.41
2	Jagannath	8.32	3.81	2.68	18.78
3	Dhana	8.05	3.45	2.65	18.89
4	BPP-8	8.33	3.90	2.76	19.45
5	Priyanka	7.75	3.62	2.53	18.14
6	VRI-3	7.05	3.26	2.41	17.45
7	H-68	7.35	3.47	2.53	19.03
8	Vengurla-7 (H-255)	8.11	3.77	2.64	19.13
9	Jhargram-1	6.22	3.10	2.32	18.10
10	NRCC-Sel-2	7.96	3.27	2.58	19.00
11	Bhubaneswar-1	5.85	2.89	2.23	16.76
12	Bhaskara	7.20	3.09	2.33	17.83
13	Goa-1	7.65	3.45	2.49	18.52
14	UN-50	8.05	3.61	2.31	16.91
15	Chintamani-1	6.80	3.16	2.41	18.17
16	Madakathra-2	7.09	3.18	2.38	16.98
17	Madakathra-1	6.10	2.98	2.54	18.70
18	Vengurla-1	6.05	3.09	2.41	18.17
19	Vengurla-4	7.60	3.21	2.25	18.44
20	BPP-4	5.90	3.24	2.36	16.65
21	Amrutha	6.99	2.99	2.40	16.91
22	H-1598	6.70	2.80	2.25	16.84
23	Ullal-3	6.95	2.99	2.34	17.06
24	Ullal-1	6.60	3.02	2.36	16.92
SEm±		0.12	0.04	0.19	0.27
CD ($p=0.05$)		0.36	0.13	0.06	0.80

recorded significantly maximum in variety BPP-8 (3.90 cm) while variety Madakathra-2 (2.98 cm) recorded lowest nut length among twenty-four tested varieties. Variety Vengurla-7 (H-255) (3.77 cm) and Jagannath (3.81 cm) showed statistical par with BPP-8 (3.90 cm). The average nut breadth was found significant among tested varieties. The nut breadth BPP-8 (2.76 cm) recorded significantly highest nut width whereas variety Bhubaneswar-1 (2.23 cm) recorded lowest nut value in breadth among the tested cashew nut varieties. Variety Dhana (2.65 cm), Vengurla-7 (H255) (2.64 cm), Balabhadra (2.62 cm), Jagannath (2.68 cm) were statistically at par with Variety BPP-8. Cashew nut thickness was recorded significantly maximum in variety BPP-8 (19.45 mm) closely followed by Dhana (18.89 mm), H-68 (19.03 mm), NRCC Sel-2 (19.00 mm), Vengurla-7 (H255) (19.13 mm), Madakathra-1 (18.70 mm), Jagannath

(18.78 mm) which was statistically at par. The minimum recorded in BPP-4 (16.65 mm). The variation in the physical parameters was primarily influenced by genetic factors (Tripathy et al., 2015); Chandrasekhar et al., 2018). Different cashew genotypes exhibited distinct physiological and metabolic characteristics, contributing to variations in physical parameters Ramteke (2022) and Jacob et al. (2022).

3.2. Processing characters of cashew kernel

The kernel weight in cashew determined the nut weight and nut yield. The maximum kernel weight was recorded in Jagannath (2.74 g). Variety Vengurla-7 (H255) (2.34 g) was statistically at par with variety Jagannath (2.74 g). Minimum kernel weight was recorded in BPP-4 (1.33 g). The shelling percentage contributed more towards kernel yield, kernel size and quality which were of economic importance in

Table 3: Evaluation of processing parameters of cashew varieties grown under Odisha condition

Treatment No.	Variety	Kernel weight (g)	Shelling percentage (%)	Percentage yield of whole kernel (%)	Kernel count
1	Balabhadra	2.23	29.39	85.40	206
2	Jagannath	2.49	32.02	85.95	182
3	Dhana	2.04	29.01	82.70	223
4	BPP-8	2.17	28.87	85.85	209
5	Priyanka	2.05	26.45	81.90	221
6	VRI-3	1.99	28.20	77.30	228
7	H-68	2.12	28.88	82.35	214
8	Vengurla-7 (H-255)	2.34	29.08	82.45	194
9	Jhargram-1	1.78	28.56	78.15	255
10	NRCC-Sel-2	2.31	29.03	79.40	198
11	Bhubaneswar-1	1.64	30.67	77.50	277
12	Bhaskara	1.97	30.24	79.95	230
13	Goa-1	2.07	28.37	83.55	219
14	UN-50	2.28	29.20	84.85	193
15	Chintamani-1	2.02	29.66	80.00	225
16	Madakathra-2	1.82	26.71	84.45	249
17	Madakathra-1	1.60	26.22	83.75	283
18	Vengurla-1	1.80	29.80	83.00	252
19	Vengurla-4	1.94	30.03	85.75	234
20	BPP-4	1.33	24.40	84.80	341
21	Amrutha	2.05	29.29	81.25	222
22	H-1598	1.94	28.88	81.95	234
23	Ullal-3	2.00	28.75	85.25	227
24	Ullal-1	1.95	29.50	82.70	233
SEm±		0.06	2.02	2.12	6.82
CD ($p=0.05$)		0.18	0.68	0.72	20.07

cashew (Table 3). In the present investigations, among the tested varieties maximum shelling percentage was observed in variety Jagannath (32.12%) which was statistically at par with the variety Bhubaneswar-1 (31.80%), UN-50 (32.30%), Bhaskara-1 (30.02%) . The lowest value was observed in variety BPP-4 (24.40%). It was revealed that the highest percentage yield of whole kernel was recorded in variety Jagannath (85.95 %) closely followed by Balabhadra (85.40%), BPP-8 (85.85 %) and Vengurla-4 (85.75%) which were statistically at par. Variety VRI-3 (77.30%) recorded the minimum value in percentage yield of whole kernel. The average whole kernel count revealed significant variation among tested varieties. Significantly Variety BPP-4 (341) recorded significantly highest number of kernel count while variety Jagannath (182) recorded the lowest number

of kernel count. Variety UN-50 (193) and Vengurla-7 (H255) (194) were statistically at par with BPP-4. The variation in kernel traits was largely attributed to inherent genetic factors, indicating the significant role of genotype in determining kernel performance (Janani et al., 2022 and Chandan et al., 2025). The similar type of variation in kernel was reported by Hanumanthappa et al. (2014); Hore et al. (2015) and Ramteke (2022).

3.3. Evaluation of quality parameters

Quality parameters like moisture (%), protein (%), fat (%) and carbohydrates (%) were found statistically significant among twenty-four tested cashew varieties (Table 4). The result was revealed that the moisture content varied from minimum value in variety VRI-3 (5.30%) to maximum value

Table 4: Evaluation of quality parameters of cashew varieties grown under Odisha condition

Treatment No.	Variety	Moisture (%)	Protein (%)	Fat (%)	Carbohydrates (%)	Sugar content (%)
1	Balabhadra	6.80	21.91	42.87	21.55	0.215
2	Jagannath	6.45	21.50	42.46	20.70	0.207
3	Dhana	6.60	20.90	41.04	20.80	0.208
4	BPP-8	5.99	20.68	42.40	21.50	0.215
5	Priyanka	6.65	20.12	40.25	18.65	0.186
6	VRI-3	5.30	19.60	40.27	20.95	0.209
7	H-68	6.40	20.59	41.60	19.35	0.193
8	Vengurla-7 (H-255)	5.60	21.56	42.13	22.05	0.220
9	Jhargram-1	6.35	21.68	40.33	20.40	0.204
10	NRCC-Sel-2	5.70	21.34	39.12	21.55	0.215
11	Bhubaneswar-1	6.95	19.87	41.16	21.05	0.210
12	Bhaskara	6.70	20.24	41.52	19.80	0.198
13	Goa-1	6.75	20.40	41.38	20.50	0.205
14	UN-50	7.30	19.84	41.13	20.90	0.209
15	Chintamani-1	6.15	21.87	42.72	20.35	0.203
16	Madakathra-2	6.55	20.18	40.87	21.15	0.211
17	Madakathra-1	6.90	21.06	41.21	19.55	0.195
18	Vengurla-1	5.40	19.59	40.69	20.70	0.207
19	Vengurla-4	7.50	21.15	40.88	20.35	0.203
20	BPP-4	8.60	20.56	40.60	20.60	0.206
21	Amrutha	8.25	20.9	40.23	21.00	0.210
22	H-1598	7.45	20.93	41.48	20.60	0.206
23	Ullal-3	8.45	20.34	41.02	21.35	0.213
24	Ullal-1	7.80	20.24	40.88	20.95	0.209
SEm±		0.61	0.27	0.88	0.89	0.003
CD ($p=0.05$)		0.20	0.79	2.61	0.30	0.009

in variety BPP-4 (8.60%). The variety Ullal-3 (8.45%) was statistically at par with variety BPP-4 (8.60%). Protein content was recorded significantly maximum in variety Balabhadra (21.91%) while lowest protein content was recorded in variety vengurla (19.59%) among twenty-four tested varieties. Variety Vengurla-4 (21.12%), NRCC-Sel-2 (21.34%), Jagannath (21.50%), Jhargram-1 (21.68 %) and Chintamani-1 (21.87%) showed statistical at par with Balabhadra (21.91%). Significantly highest fat content was recorded in variety Balabhadra (42.87%) and lowest in variety NRCC Sel-2 (39.12%). All the varieties except NRCC Sel-2 were statistically at par with Balabhadra (42.87%). The variety Vengurla-7 (H-255) was recorded significantly maximum value of carbohydrate content 22.05 %, while minimum value 16.65% was observed in Priyanka among tested varieties. The maximum sugar content was recorded in Vengurla-7 (0.220%). The variety Vengurla-7 exhibited statistically at par with the BPP-8 (0.215%), Balabhadra (0.215%), NRCC Sel-2 (0.215%), Ullal-3 (0.213%) and Madakathra-2 (0.211%). Minimum sugar content was recorded in Priyanka (0.186%). The variation in the quality of cashew kernels was primarily influenced by genetic factors, which determined quality attributes such as protein, fat and carbohydrate content (Rico et al., 2016; Janani et al., 2022). Different cashew genotypes exhibited distinct physiological and metabolic characteristics, contributing to variations in kernel quality. Previous studies had consistently highlighted the role of genetic diversity in kernel biochemical composition (Jacob et al., 2022 and Chandan et al., 2025).

4. CONCLUSION

The cultivar BPP-8 performed better for nut physical and yield attributing traits followed by Jagannath which expressed better in terms of processing characters with respect to kernel weight, shelling percentage, kernel count and percentage yield of whole kernel however Balabhadra showed best quality attributes like Protein content and fat content while vengurla-7 (H-255) conveyed best quality attributes like carbohydrate content and sugar content.

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