J. Indian Soc. Coastal Agric. Res. 44(1):124-130(2026) https://doi.org/10.54894/JISCAR.44.1.2026.170067

Short Communication

Harvesting Tenderness: The Story of Vengurla-10 MB Cashew

L.S. KHAPARE[1]*, M.S. GAWANKAR[1], R.C. GAJBHIYE[2], V.S. DESAI[3], P.M. HALDANKAR[4], S.G. BHAVE[4], G.S. MOHANA[5], J.D. ADIGA[5] and T.N. RAVIPRASAD[5]

[1]Regional Fruit Research Station, Vengurla, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Sindhudurg - 416 520, Maharashtra, India
[2]College of Horticulture, Dapoli - 415 712, Maharashtra, India
[3]Department of Entomology, College of Agriculture, Dapoli-415 712, Maharashtra, India
[4]Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri-415 712, Maharashtra, India
[5]ICAR-Directorate of Cashew Research, Puttur-574 202, Karnataka, India

Received: 19.01.2026 Accepted: 14.06.2026

Maharashtra is a major contributor to India's cashew production, with 191.45 thousand hectares under cultivation and an annual output of approximately 189.71 thousand metric tons. The Konkan region accounts for the majority of this area, making it a key zone for cashew development. With the rising demand for tender cashew kernels in culinary applications and direct consumption, the AICRP-Cashew unit at the Regional Fruit Research Station, Vengurla identified and evaluated a promising genotype for tender kernel suitability. The selected accession, later released as Vengurla-10 MB, demonstrated intermediate shell thickness, low cashew nut shell lquid (CNSL) content (7.85%), and a higher tender kernel recovery rate (32%) compared to the reference variety Vengurla-4 (13.05% CNSL and 24% recovery). These traits contribute to easier shelling, reduced skin irritation, and greater processing efficiency, especially in manual and small-scale operations. Sensory evaluation also revealed superior quality in taste, texture, and appearance, enhancing its appeal for the tender kernel market. Based on its overall performance, Vengurla-10 MB was officially released in 2024 and is now recommended for cultivation in coastal Maharashtra, particularly in regions focused on value addition and tender kernel processing.

(***Key words:*** *Cashew, Shell thickness, Tender kernel, Vengurla-10 MB)*

India is the largest producer of raw cashew nuts, contributing around 20% of global production. Maharashtra leads the country in both cashew production and productivity, with 191.45 thousand hectares under cultivation and an annual output of 189.71 thousand metric tons (Femina, 2024). Cashew is valued for its nutritional, industrial, and economic importance, earning the reputation of a "dollar-earning crop" due to its significant role in foreign exchange earnings.The cashew fruit consists of a swollen, juicy cashew apple (hypocarp) and a true kidney-shaped drupe (nut) at its tip (Yadav and Swami, 2025). The nut matures 55-70 days after flowering and contains a single seed enclosed in a hard, double-layered shell filled with anacardic acid, a phenolic compound that can cause severe skin irritation (Mog *et al.,* 2022).

The cashew kernel, an exalbuminous seed, comprises two large white cotyledons, a small embryo, and a reddish-brown testa, which accounts for about 5% of the nut's weight. The edible kernel forms 20-25% of the total nut and holds the highest nutritional and commercial value (Shinde *et al.,* 2024). In Maharashtra, tender cashew kernels are increasingly consumed directly or used in culinary dishes, especially in urban markets and hotels. Districts like Raigad and Ratnagiri use 10-15% of total cashew production for tender nuts, while Sindhudurg utilizes around 5%, reflecting a growing trend toward value-added tender kernel consumption.

Tender cashew nuts, traditionally used in Kerala (Sobhana and Mathew, 2014), are now gaining popularity in Maharashtra. Harvesting at the tender stage reduces pest and climate-related losses and offers economic benefits (Sharon and Sobhana, 2021). However, no variety has been developed specifically for tender kernel use, and using mature nut varieties for this

**Corresponding author:* E-mail: lalitkhapare8@gmail.com

purpose compromises overall yield and potential.

Shelling tender cashew nuts is challenging due to their hard shell, high CNSL content, and brittle kernels. According to Kilanko *et al.* (2019), it is the most critical and labour-intensive step in cashew processing. A major challenge during manual shelling is exposure to cashew nut shell liquid (CNSL), a phenolic oil present in the shell. CNSL contains compounds such as anacardic acid, cardol, and cardanol, which are highly irritating to the skin. Consequently, workers frequently suffer from burns, dermatitis, and other occupational injuries while removing kernels by hand. The risk is particularly high when processing fresh or raw nuts without adequate protective equipment.

In view of these constraints, there is a growing need to develop and identify cashew varieties possessing lower CNSL content and shells that can be peeled easily without extensive thermal treatment. Such varieties would facilitate safer and more efficient kernel extraction, reduce labor requirements, minimize occupational health hazards and improve the utilization of tender kernels for culinary applications. Furthermore, easy-peeling varieties could enhance the economic value of cashew by increasing kernel recovery and reducing processing costs. Therefore, breeding and selection efforts should focus on genotypes combining high kernel quality with reduced shell adherence and lower CNSL content, thereby promoting safer and more sustainable cashew processing practices.

In order to identify cashew genotypes suitable for tender kernel consumption, surveys were undertaken in selected cashew-growing areas of Ratnagiri and Sindhudurg districts. Germplasm accessions exhibiting desirable traits, particularly low CNSL content and easy shellability for tender kernel extraction, were collected and maintained at the Regional Fruit Research Station, Vengurla. Subsequent evaluation of these accessions revealed that RFRS-195 was superior in terms of ease of kernel removal and reduced CNSL content. Consequently, RFRS-195 (released under the name Vengurla-10 MB) was selected for comparative evaluation against the commercially cultivated variety Vengurla-4 (V4), which is commonly used for tender kernel purposes.

The study was conducted at the AICRP on Cashew, Regional Fruit Research Station (RFRS), Vengurla, (Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli), located in Sindhudurg district of Maharashtra, falling under Agro-Climatic Zone 12-Western Coastal Plains and Ghats. The site experiences high and assured annual rainfall (3000-3500 mm) from June to September, high humidity and a moderate temperature range of 15-35°C. As part of the germplasm collection and evaluation programme, a survey was conducted, and promising genotypes were planted at a spacing of 7 × 7 m in 2008.

The genotype RFRS-195 was evaluated from 2013-2023 against Vengurla-4, with trees managed as per recommended practices. Harvest data (2017-2023) were used for the comparative study. Shell thickness was measured using a vernier caliper (0.01 mm). CNSL was extracted from 25 g tender nut shells using a Soxhlet apparatus with n-hexane, followed by rotary evaporation after a 10-hour extraction.

Tender kernel recovery (%) was calculated by manually shelling 50 tender nuts, recording kernel (with testa) and shell weights, and applying the formula:

$$\text{Tender kernel recovery (\%)} = \frac{\text{Kernel weight}}{\text{Total nut weight}} \times 100$$

Similarly, shelling percentage was also estimated for mature nuts using same formula. Flowering and fruiting observations were recorded by following NRC Puttur guidelines. Pest incidence (thrips, tea mosquito bug) was scored on a 0-4 scale and averaged over six years, based on Navik and Godase (2019). Apple and nut borer infestation was recorded as per Navik *et al.,* (2019). Organoleptic evaluation of kernels for colour, flavour, and texture was done by using 9 point hedonic scale.

The distinguishing morphological and agronomic characteristics of RFRS-195, released as Vengurla-10 MB, were evaluated and compared with those of Vengurla-4 (V4), a widely cultivated variety for tender kernel production. The observed characteristics are presented in Table 1.

The comparative performance revealed notable differences in several key traits that influence the

Table 1. *Distinguishing characteristics of Vengurla-10 MB and Vengurla-4 variety*

Characteristics	Vengurla-10 MB	Vengurla-4
Shell thickness (mm)	Intermediate (2.5 mm-4.00 mm)	Thick (>4 mm)
CNSL content (%)	7.85	13.05
Shelling percent	31.18%	31%
Tender kernel recovery	32 %	24%
Flowering season	November-February	November-January
Flowering duration	116 days	93 days

suitability of the variety for tender kernel extraction and processing. Data presented in Table 1 revealed that one of the most significant differences was observed in shell thickness. Vengurla-10 MB exhibited an intermediate shell thickness, ranging from 2.5 mm to 4.0 mm, which facilitates easier and safer removal of tender kernels. In contrast, Vengurla-4 displayed a thick shell exceeding 4.0 mm, which increases resistance during shelling and makes kernel extraction more laborious and injury-prone. Thinner shells are generally preferred for tender kernel extraction, as they reduce kernel breakage, improve shelling efficiency, and lower the effort required during manual processing.

In terms of cashew nut shell liquid (CNSL) content, Vengurla-10 MB demonstrated a significantly lower content (7.85%) compared to Vengurla-4 (13.05%). CNSL is a toxic phenolic substance found between the two layers of the nut shell and is known to cause skin irritation, burns, and blisters upon contact. The reduced CNSL content in Vengurla-10 MB makes it safer to handle, especially during manual shelling of tender nuts, which is commonly practiced by rural and tribal communities in the Konkan region.

Another major difference was observed in the tender kernel recovery percentage. Vengurla-10 MB recorded a higher recovery of 32%, while Vengurla-4 yielded only 24%. A higher kernel recovery percentage indicates greater efficiency in processing and higher economic returns, particularly important for value-added products such as tender cashew dishes and sweets. This trait makes Vengurla-10 MB more commercially viable. Moreover, Vengurla-10 MB exhibited a longer flowering duration of 116 days, in contrast to 93 days observed in Vengurla-4. A prolonged flowering phase can result in staggered nut availability allowing flexibility in picking and potentially reducing pest pressure during peak flowering period. This trait can also be advantageous for managing labor and processing schedules in farms with large-scale cashew cultivation.

Collectively, these features intermediate shell thickness, lower CNSL content, higher tender kernel recovery, and extended flowering period make Vengurla-10 MB highly suitable for tender nut harvesting and processing. It offers practical advantages over Vengurla-4, particularly in manual shelling contexts and meets the growing demand for high-quality tender kernels in domestic markets.

The tender nut yield performance of Vengurla-10 MB and Vengurla-4 (Fig. 1, 2, 3) was systematically recorded over six consecutive harvest seasons and the compiled data is summarized in Fig. 4.

Data from Fig. 4 revealed that although Vengurla-4 produced a greater number of tender nuts per tree, Vengurla-10 MB exhibited a significantly higher tender kernel yield. This superiority was mainly attributable to its higher tender kernel recovery percentage (32%) compared with Vengurla-4 (24%). Consequently, Vengurla-10 MB produced approximately 15% higher tender kernel yield per tree despite bearing fewer nuts.

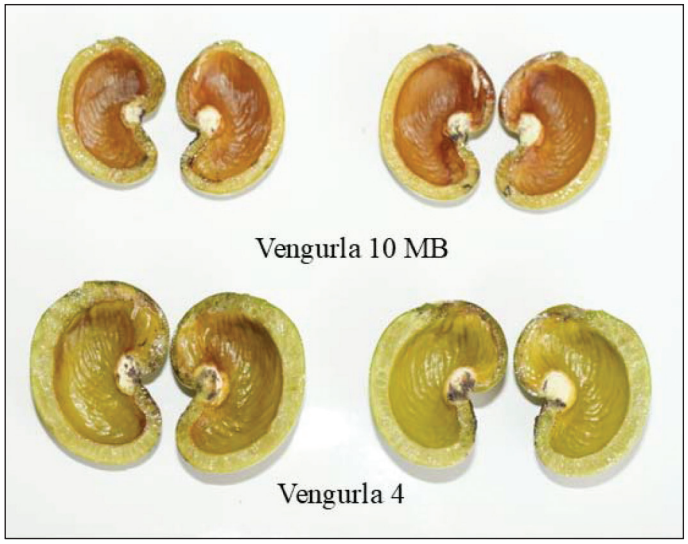

Fig. 1. *Tender nut shell thickness of Vengurla - 10 MB and Vengurla - 4*

Fig. 2. *Tender nut of Vengurla - 10 MB*

Fig. 3*. Tender kernel of Vengurla - 10 MB*

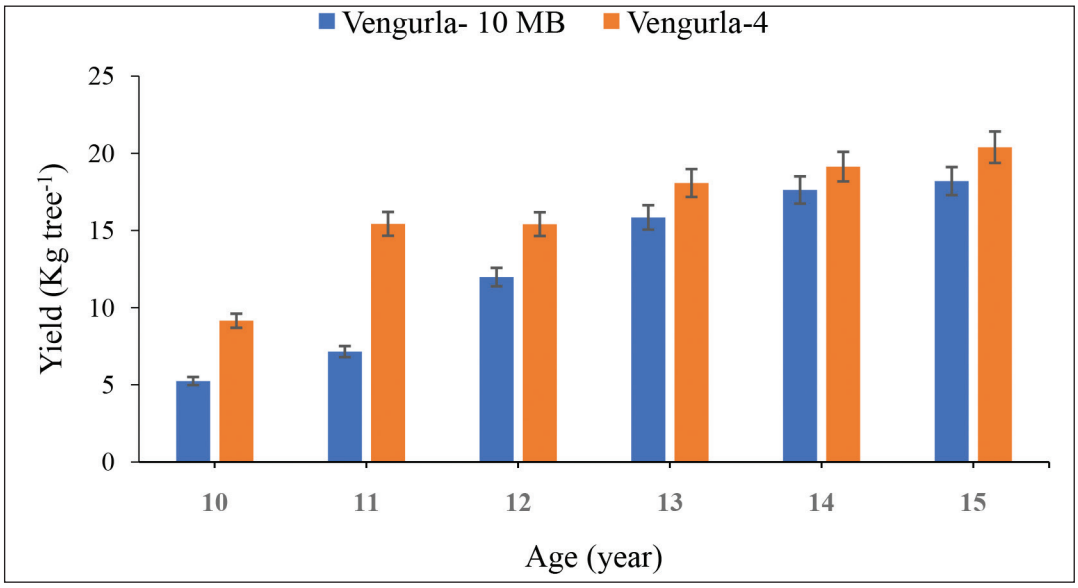

Fig. 4. *Tender nut yield (kg tree^{-1}) performance of Vengurla-10 MB and Vengurla-4. (Mean tender nut yield (kg tree^{-1}): Vengurla-10 MB = 12.68, Vengurla-4 = 16.27; Mean tender kernel yield (kg tree^{-1}): Vengurla-10 MB = 4.06, Vengurla-4 = 3.89).*

From a commercial standpoint, this characteristic offers a distinct edge. Tender kernels are primarily marketed and priced based on the number and quality of individual kernels rather than raw nut quantity. The ease of kernel extraction due to intermediate shell thickness and low CNSL content (7.85 %) in Vengurla-10 MB further enhances its processing efficiency and consumer appeal. These attributes collectively make Vengurla-10 MB a more profitable and farmer-friendly choice for cultivation, particularly in regions targeting the niche tender kernel market.

A comparative study on economics of tender kernel recovery from Vengurla-10 MB and Vengurla-4 (Table 2) revealed that Vengurla-10 MB is more cost-effective for tender kernel production.

The time and labour required to extract 1 kg of tender kernel was lower in Vengurla-10 MB due to its intermediate shell thickness, which allows easier manual shelling. Additionally, its higher kernel recovery percentage (32%) means that fewer tender nuts are needed to produce 1 kg of kernel compared

Table 2. *Comparative economics of tender kernel recovery of Vengurla-10 MB and Vengurla-4*

Sr No.	Particulars	Vengurla-10 MB	Vengurla-4
1	Time required for removal of 1 kg tender kernel (hour)	1.11 hrs	1 .27 hrs
2	Total tender kernel obtained in 8 hours	6 .76 kg	5.52 kg
3	Labour charges required for removal of 1 kg tender kernel @ Rs. 409 per 8 hours	Rs. 60.50	Rs. 74.09
4	Mean tender kernel yield (kg tree^{-1})	4.06 kg (12.68, 32%)	3.89 kg (16.27, 24%)
5	Labour charges required for removal of tender kernel per tree	Rs. 245.63	Rs. 288.21
6	Cost of raw tender nut required for recovery of 1 kg tender kernel @ 120/-	Rs. 375.60 (3.13 kg nut × 120)	Rs. 501.60 (4.18 kg nut × 120)
7	Labour charges for removal of 1 kg tender kernel + Cost of raw tender nut)	436.10	575.69
8	Gross return per kg	1200	1200
9	Net return per kg Rs.	763.90	624.31
10	B:C	2.75	2.09

to Vengurla-4 (24%). These advantages result in a lower total cost of production and a higher benefit-cost (B:C) ratio for Vengurla-10 MB. Moreover, its low CNSL content reduces the risk of skin injuries, making it safer and more suitable for manual processing in commercial operations.

Sensory evaluation data (Table 3) revealed that Vengurla-10 MB outperformed Vengurla-4 in terms of colour, texture, and flavour attributes. The mean overall acceptability score was also higher for Vengurla-10 MB, indicating its superior sensory quality. These results highlight the variety's greater appeal for direct consumption and culinary use, reinforcing its potential for the tender kernel market.

The pest resistance data (Fig. 5) showed that Vengurla-10 MB exhibited lower susceptibility to major pests compared to Vengurla-4.

The mean damage scores for tea mosquito bug (TMB) and thrips were lower in Vengurla-10 MB (0.16 and 0.26, respectively) than in Vengurla-4 (0.20 and 0.30). Additionally, apple and nut borer incidence was minimal in Vengurla-10 MB, while Vengurla-4 recorded 1.44% damage. Importantly, no cashew stem and root borer (CSRB) infestation was observed in either variety during the study period.

The study demonstrated that Vengurla-10 MB is a unique superior cashew variety for tender kernel production compared with Vengurla-4. Its higher tender kernel recovery (32%), lower CNSL content (7.85%), and favourable shell characteristics resulted in greater tender kernel yield, reduced kernel damage, and lower shelling costs. The variety also exhibited better sensory quality, higher economic returns, and lower incidence of major pests. These attributes make Vengurla-10 MB a promising and commercially viable unique variety for

Table 3. *Sensory evaluation of tender kernel of Vengurla-10 MB and Vengurla-4 variety*

Variety	Colour	Texture	Flavor	Overall acceptability
Vengurla-10 MB	8.12	8.05	8.05	8.07
Vengurla-4	7.90	7.89	8.01	7.93
Standard Deviation (SD)	0.15	0.11	0.03	0.10

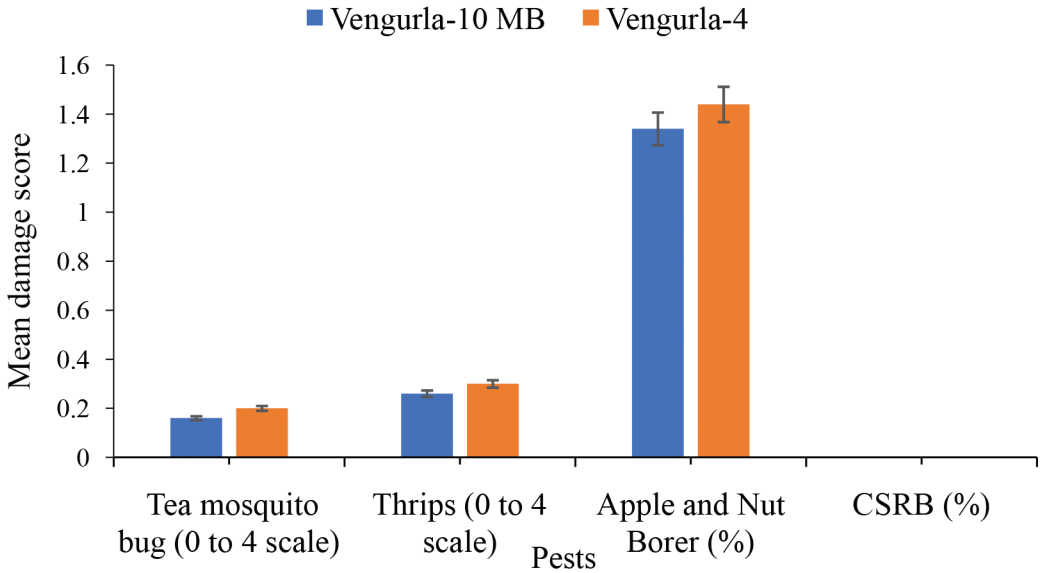

Fig. 5. *Reaction of cashew accession Vengurla-10 MB and V-4 to different pests.*

the expanding tender kernel industry, particularly in the coastal Konkan region of Maharashtra.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the Indian Council of Agricultural Research (ICAR) for providing financial support through the All India Coordinated Research Project (AICRP) on Cashew. We also extend our sincere thanks to the Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (DBSKKV), Dapoli for providing the necessary infrastructure and experimental facilities at the Regional Fruit Research Station, Vengurla, to successfully carry out this study.

CONFLICTS OF INTEREST

The authors have no conflicts of interest

REFERENCES

Femina, D. (2024). Innovative developmental strategies for sustainable cashew production, Proceedings *National conference on cashew*, Directorate of cashew, June 14 - 15, 2024, Goa, India. pp 3 - 6.

Kilanko, O., Ojolo, S.J., Inegbenebor, A.O., Ilori, T.A., Leramo, R.O., Babalola, P.O., Oyedepo, S.O., Ishola, F.A. and Onwordi, P.N. (2019). Development of Cashew nut Shelling Machine. *Journal of Physics Conference Series* **1378**(4): 2091.

Mog, B., Adiga, J.D., Preethi, P. and Nayak, M.G. (2022). Changes in growth and developmental stages of nuts of selected cashew (*Anacardium occidentale*) varieties in West Coast Region of Karnataka. *Agricultural Research* **12**(1): 62 - 71.

Navik, O.S. and Godase, S.K. (2019). Screening of cashew cultivars for resistance against tea mosquito bug, *Heliopolis antonii* Signoret. *Journal of Entomological Research* **43**(1): 11-14.

Navik,O, Godase, S.K., Masal, M.S. and Dhekale, J.S.(2019). Screening of cashew cultivars against the pests of Cashew. *Journal of Entomological Research* **43**(4): 475 - 479.

Sharon, J. and Sobhana, A. (2021). Qualitative and organoleptic evaluation of immature cashew kernels under storage. *Journal of Horticultural Sciences* **16**(2): 287- 292.

Shinde P.U., Kadam J.H., Ranveer R.C. and Relekar P.P. (2024). Studies on individual quick freezing of mature raw cashew (*Anacardium Occidentale* L.) kernels. *Brazilian Archives of Biology and Technology* **67**: e24240076.

Sobhana, A. and Mathew, J. (2014). Studies on the utilization of immature cashew nuts. *International Journal of Tropical Agriculture* **32**(3 - 4): 647 - 653.

Yadav, S.S. and Swami, S.B. (2025). Cashew apple and its many functional components as related to human health: A review. *International Journal of Food and Fermentation Technology* **15**(01): 225 - 244.