

# Performance on the evaluation of pilot cashew nut processing unit

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■ **ABSTRACT** : Cashew (*Anacardium occidentale* L.) is one of the important tropical crops. India is largest producer, processor, exporter and consumer of it in the world. The recovery of the kernel (edible meat portion) from raw nuts by mechanical or manual means refers to processing of cashew nut. It consists of various processes in series viz., moisture conditioning, roasting, shelling, drying, peeling, grading and packing etc. A small cashew processing unit consisting of steamer, cooker, shelling machine and dryer was tested for its performance for the cashew nut variety 'Vengurla-5' (Ansure Arli). The unit has received at Zonal Agricultural Research Station, Shenda Park; Kolhapur under "Technology Park" sanctioned Commissioner, Agriculture M.S. and Pune. The six treatments consisting of various combinations for pressure and time were evaluated for the performance of unit. The study revealed that treatment combination (4.5 kg/cm<sup>2</sup> and 20 min) gain maximum recovery of whole kernels as well as over all recovery of kernels, with minimum moisture content, which is desirable for good quality product in the markets. The treatment condition consisting of keeping raw cashew nut at 4.5 kg/cm<sup>2</sup> pressure for 20 minutes duration for the given processing unit is best for maximum recovery of good quality kernels and overall total recovery of kernels with minimum moisture content.

■ **KEY WORDS** : Cashew nut, Maximum recovery of kernel, Moisture content

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Cashew (*Anacardium occidentale* L.) is one of the important evergreen tropical fruit crops. It was not considered as fruit crop in India since a long time, rather it was considered as a wild crop on non arable land. It was frequently grown as a source of fuel and to prevent soil erosion rather than a cash crop. Cashew is mostly grown in coastal area of Kerala, Karnataka, Goa, Maharashtra, Andhra Pradesh, Orissa and Tamil Nadu. The Kerala state accounts near about 50 per cent of total cashew production in India. The state has a centralized procurement system and much of the cashew processing is done on outworker basis by families. It has 25 per cent of the total cultivable area under cashew and has relatively higher yield level as compared to other states. Productivity of cashew in Kerala is estimated to be 900 to 950 kg raw cashew nuts per hectare, which is almost double the national level average.

Cashew kernels are nutritious and tasty. They are mostly used as roasted and salted nuts in snacks, alone or in mixture with other nut. Broken kernels are used in confectionary and sometimes as substitute for almonds. Ground powder can replaced peanuts butter in exotic dishes. Cashew kernels are

integrated in delicious chocolates. Cashew kernel may be used as food medium for loss of appetite, general depression, nervous weakness and scurvy. It is also a rich source of riboflavin, which keeps body active and energetic. 100 g of cashew kernel contributes about 600 kilocalories energy, 22 per cent carbohydrates, 21 per cent protein and 47 per cent fat along with minerals like Ca, Mg, K, Na and Fe (Ohler, 1979 and Nandi, 1998). Cashew nut proteins are complete, having all the essential amino acids and a kilogramme of the nut yields about 6000 calories compared to 3600 calories from cereals, 1800 calories from meat and 650 calories from fresh citrus fruit (Nambiar *et al.*, 1990). The value added products are honey coated cashew, cashew roasted with special flavours-garlic, cheese, etc. It earns maximum foreign exchange. Cashew kernel may be used as food medium for loss of appetite, general depression, nervous weakness and scurvy. It is also a rich source of riboflavin, which keeps body active and energetic. Its regular use is beneficial in the treatment of gastric, chest, urinary and liver disorders. Cashew Nut Shell Liquid (CNSL) is a by-product of cashew processing industry. It is a unique monomeric source for making various polymeric compounds.

Cashew apple is used for manufacturing of cashew apple jam, cashew apple candy, chutney, canned cashew apple, pickles, vinegar and alcoholic beverages. The distilled cashew liquor called “feni” is very famous in Goa. 100 g of cashew kernel contributes about 611 kilocalories energy. It consists of 5.9 per cent moisture, 21 per cent protein, 47 per cent fat and 22 per cent carbohydrates with vitamins. It is a rich source of minerals like calcium, magnesium, phosphorus, potassium, sodium and iron.

Cashew processing has tremendous scope in India. The processed products such as cashew kernels and CNSL (Cashew Nut Shell Liquid) bear high export potential. There are number small, medium and large cashew processing industries in India. They are now increased rapidly over the last four decades. There were 170 process units in the year 1959 and today there are now 700 units. Of which, two-thirds of processing units are in the State Kerala and the remaining are scattered all over the cashew growing states. The processing capacity of these units is near about 8 lakh tonnes per year. Cashew processing industries provides employment to more than 5 lakh people, of which 95 per cent are women. Most of the processing units are family owned business run on small scale industry basis. There is large variation in cashew processing technique depending on traditional method of region, skill, experience and environmental situations. The Maharashtra state has maximum scope for farm mechanization. Small and marginal farmers or cashew growers can initiate such type of family owned agro-business as supplementary income. Hence, by keeping all above points, present study was carried out to evaluate the performance of cashew nut processing unit received at Zonal Agricultural Research Station, Shenda Park; Kolhapur under “Technology Park” sanctioned Commissioner, Agriculture M.S. and Pune to find out the best treatment consisting of different combinations of steam pressure and cooking time for getting maximum recovery of cashew kernels for local variety of a cashew crop (Vengurla-5).

## ■ METHODOLOGY

The cashew variety Vengurla-5 (*Ansur arli*) was used for the performance evaluation of cashew processing unit, received at Zonal Agricultural Research Station, Shenda Park, Kolhapur. Vengurla-5 is most common cashew variety adopted in Konkan region and used for processing. There are 200 to 210 cashew nuts in 1 kg sample of Vengurla-5 (*Ansur arli*). 5 kg sample consisting of 1000 to 1050 cashew nuts was used for individual treatment / combination of steam pressure and cooking time. The cashew processing unit received at Zonal Agricultural Research Station, Shenda Park, Kolhapur under “Technology Park” was used for its performance evaluation. The unit is manufactured by M/s

Shree Vyankateshwara Industries, Nagpur having 20 Kg processing capacity and runs on single phase electric supply. It consists of different units given below :

### Steamer :

It is cylindrical in shape, made up of heavy M.S. sheet having diameter 27.0 cm and height 47.0 cm for generating steam for softening of raw cashew nuts. It has inlet and outlet pipe for filling of water. To maintain water level in the cylinder, the water level pipe is provided at depth of 20.0 cm. A pressure gauge to measure steam pressure up to 14 kg/cm<sup>2</sup> is also provided with the steamer.

### Cooker :

Cooker is provided for steaming the raw cashew nuts, it has cylindrical chamber with diameter 28 cm and height is 54.5 cm made up of thick gauge mild steel sheet duly painted with heat resistive paint. It is totally leak proof to prevent temperature loss during steaming process. The total capacity of cooking chamber is of 20 kg. The nuts are placed from the top and the steam is provided from the bottom of cooking chamber.

### Pedal operated shelling machine :

The pedal operated shelling table is provided with the cashew processing unit for shelling of steamed cooled cashew nuts. It is manually operated with capacity 10 Kg of kernels per day. The cutter blade is made up of special steel. It has 4.75 cm length and provided with heavy duty double springs.

### Dryer :

The cashew processing unit is provided with electric dryer for drying of shelled cashew nuts operated by single phase AC electric supply. It has thermostat arrangement for regulating temperature in between 20 to 200<sup>o</sup>C.

### Weighing balance :

Weighing balance was used for weighing cashew nut sample. It manufactured by ‘De-National Company, Mumbai’. The maximum capacity of this balance is of 1 kg with least count of 5 g. With this, the electrical weighing balance developed by ‘Precision Scales (Pvt.) Ltd., Nagpur’, also provided for taking accurate reading of dried sample having least count equal to 0.01 g.

### Methodology :

The methodology adopted for the cashew processing is presented in the flow chart shown in Fig. A.

The various treatment combinations of steam pressure and cooking time are given in the following Table A.

It is important that the kernels are neither cut nor damaged

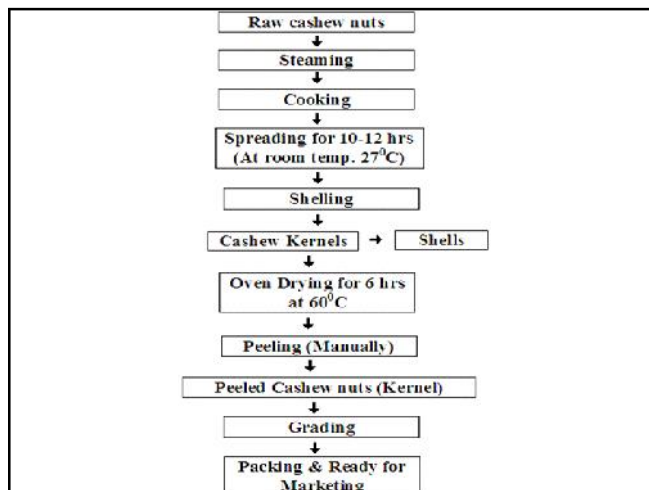


Fig. A : Methodology adopted for cashew processing unit

Treatments	Pressure (kg/cm <sup>2</sup> )	Time (min.)
B <sub>1</sub>	4.0	20
B <sub>2</sub>	4.0	15
B <sub>3</sub>	4.5	20
B <sub>4</sub>	4.5	15
B <sub>5</sub>	5.0	20
B <sub>6</sub>	5.0	15

during the peeling process. The use of knives increases the possibility of kernels to be damaged. It is also essential that the entire testa is removed. Gentle scraping of the testa with a blunt knife is the most effective way of removing it. The mechanized processes of peeling vary widely. They include air-blasting, suction, a freezing operation and a system of rubber rollers. These systems are of low efficiency due to the difficulty of removing the testa. In order to improve the viability in mechanized operation, research and development is under progress. In the present study, the peeling was done manually with the help of blunt knife.

## RESULTS AND DISCUSSION

A well known cashew variety Vengurla-5 in Konkan region was used for the processing. There are six different treatment combinations formulated from steam pressures (4.0, 4.5 and 5.0 kg/cm<sup>2</sup>) and two different cooking time (15 and 20 minutes) selected for cashew processing. The results obtained from the study are presented in the following subheadings.

### Effect of steaming pressure and cooking time on whole kernels recovery :

Whole kernels recovery and total kernel recovery depends on optimum steaming pressure and cooling time in

the processing of cashew nut. The data on recovery of whole kernels obtained from different treatment combinations of steaming pressure and cooking time are presented in Table 1. It revealed that the different combinations of steaming pressures and cooking period have greater influence on recovery of whole kernel of cashew. The treatment combination B<sub>3</sub> comprising of 4.5 kg/cm<sup>2</sup> steaming pressure and 20 minutes cooking time has recorded maximum whole kernel recovery to the extent of 62.53 per cent. It is followed by treatment combinations B<sub>5</sub> (5.0 kg/cm<sup>2</sup> steaming pressure and 20 minutes cooking time). So the steam pressure of 4.5 kg/cm<sup>2</sup> and cooking time of 20 minutes is optimum for pre-treatment of raw cashew nuts.

Table 1 : Effect of pressure and cooking time on whole kernel recovery, total per cent recovery and moisture content

Treatment	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>	B <sub>6</sub>
Pressure (kg/cm <sup>2</sup> )	4.0	4.0	4.5	4.5	5.0	5.0
Cooking time (minute)	20	15	20	15	20	15
Whole kernel recovery (%)	55.76	52.86	62.53	57.50	59.00	53.90
Total weight (gm)	1133.3	1089.4	1191.4	1116.3	1119.0	1062.5
Total per cent recovery	22.66	21.78	23.82	22.32	22.38	21.25
Moisture content after steaming (%)	10.90	11.60	10.70	10.80	11.80	13.68

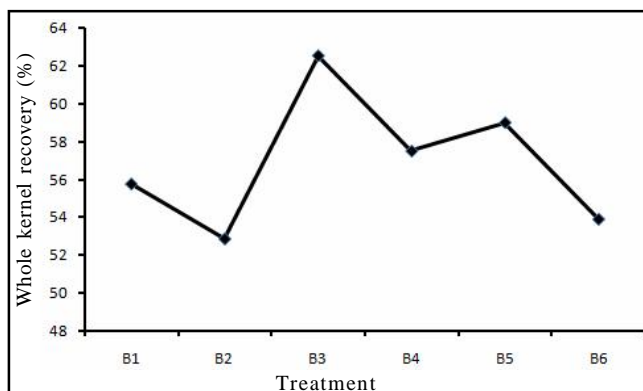


Fig. 1 : Whole kernel recovery

### Effect of steaming pressure and cooking time on total kernels recovery :

The steaming pressure and cooking time have also significant influence on total kernel recovery as presented in Table 1. The treatment combination of B<sub>3</sub> (steaming pressure 4.5 kg/cm<sup>2</sup> and 20 minutes cooking time) has given maximum total kernel recovery to the extent of 23.82 per cent (1191.49 g). It is followed by treatment combination of B<sub>1</sub> (Steaming pressure of 4.0 kg/cm<sup>2</sup> and 20 minutes duration), which has given 22.66 per cent (1133.35 g) of total kernel recovery.

### Effect of steaming pressure and cooking time on moisture content :

In steaming process, the moisture content of kernel increases and it becomes very difficult to peel the testa. Drying is therefore most essential for easy peeling of testa and to increasing its storage life. For this purpose, the optimum moisture content is 3 to 5 per cent. The moisture content of cashew nut after steaming under various treatment combinations are given in Table 1. The treatment combinations B<sub>3</sub> (Steam pressure 4.5 kg/cm<sup>2</sup> and 20 minutes cooking time) resulted into minimum moisture content up to 10.70 per cent and which is desirable for easy removing of testa and for increasing its storage life. Maximum moisture content 13.68 per cent was recorded in treatment combination of B<sub>6</sub> (5 kg/cm<sup>2</sup> steaming pressure and 15 minutes cooking time).

### Effect of grading on quality and market rates of cashew kernels :

The kernels with and without grading have significant influence on quality parameters and market rate of cashew kernels. Although the treatment combination B<sub>3</sub> (4.5 kg/cm<sup>2</sup> steaming pressure and 20 minutes cooking time) has given maximum whole kernel and total kernel recoveries, but the kernels with grading fetch maximum market rate as presented in Table 2. The market rates for the graded kernels are more as compared to ungraded kernels.

Treatments	Profit without grading (Rs./kg)	Profit with grading (Rs./kg)
B <sub>1</sub>	13.96	17.24
B <sub>2</sub>	11.53	15.92
B <sub>3</sub>	16.80	24.50
B <sub>4</sub>	13.50	17.61
B <sub>5</sub>	14.21	18.12
B <sub>6</sub>	10.43	13.84

### Effect of steaming pressure and cooking time on overall performance :

Better performance of cashew processing unit was observed for treatment combination B<sub>3</sub> (4.5 kg/cm<sup>2</sup> steam pressure and 20 minutes cooking time). It has given maximum whole kernel recovery of 62.53 per cent as well as maximum total kernel recovery of 23.82 per cent. It has also resulted minimum moisture content of 10.70 per cent, which is desirable for easy removing of testa and for increasing its storage life. The treatment combination 4.5 kg/cm<sup>2</sup> steam pressure and 20 minutes cooking time is, therefore, found to be optimum for the given cashew processing unit.

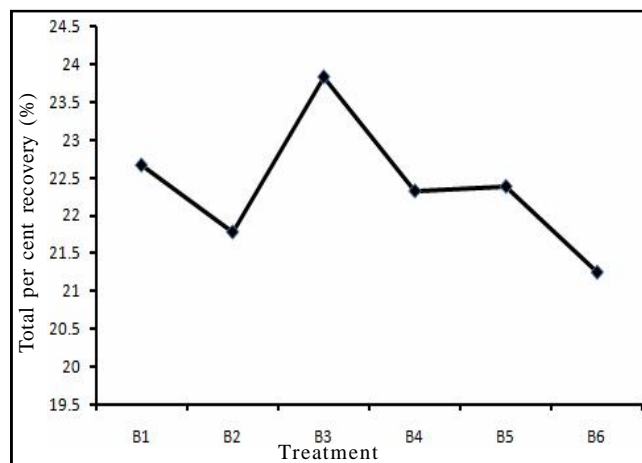


Fig. 2 : Total per cent recovery

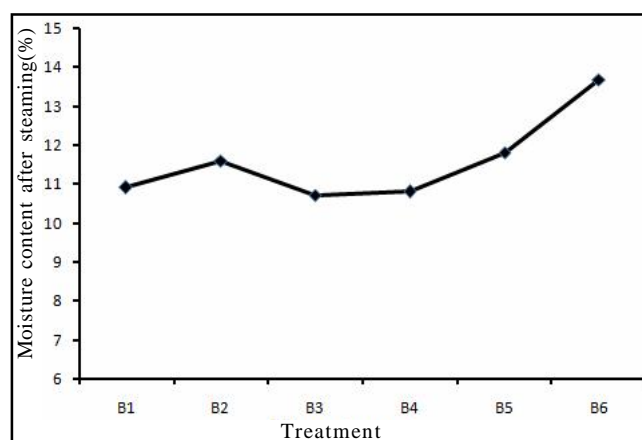


Fig. 3 : Moisture content curve at different treatment for before drying

### Conclusion :

There were six different treatment combinations formulated from steaming pressures 4.0, 4.5 and 5.0 kg/cm<sup>2</sup> and cooking times 15 and 20 min. These treatment combinations (B<sub>1</sub> to B<sub>6</sub>) were evaluated on the basis of whole kernel and total kernel recoveries and moisture content, resulted after steaming. The steam pressure and cooking time have significant influences on whole kernel and total kernel recoveries. It has also significant impact on moisture content of the steamed nuts. The treatment combination steaming pressure 4.5 kg/cm<sup>2</sup> and cooking time 20 minutes gives higher recovery of whole kernels as well as high average recovery of total kernels. It also results minimum moisture content in the kernels after steaming which is desirable for easy removal of testa and longer storage life. Steaming pressure 4.5 kg/cm<sup>2</sup> and cooking time of 20 minutes is the suitable combination for the given cashew processing unit.

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