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# A comparative study of cost economics of traditional and mechanical method of *Chironji* processing

■ P.K. NISHAD* AND R.K. NAIK
Swami Vivekanand College of Agricultural Engineering and Technology and Research Station (I.G.K.V.), RAIPUR (C.G.) INDIA
Email: praween.nishad@gmail.com

*Author for Correspondence

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SUMMARY :

The edible *Chironji* kernel is rich in protein content, which may be sweet or bitter depending on the type. It is used in different forms and preparations of sweet dished and directly consumed in many parts of India. The traditional method of *Chironji* nut decortication was done manually by small stone *Chakki* (*Jatta*) and manually separation of kernel. This is very tedious and time taking process. In the developed mechanical method of processing; all the process is similar to that of traditional method except the decortications of nuts by *Chironji* decorticator machine and separation of kernels by grader. In this method 150 to 200 kg of nuts could be decorticated in a day and it also saves Rs. 9.30 per kg as compared to traditional method.

KEY WORDS : *Chironji*, *Buchanania lanzan*, Traditional processing, Mechanical processing

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*Chironji* one of the important multipurpose forest species brings income to the local inhabitants. *Chironji* (*Buchannania lanzan*) also known as char, piyal or achar belongs to the family Anacardiaceae. It is subtropical, underutilized nut fruit native to India (Narayan *et al.*, 2014). The tree is natural wild growth in the tropical deciduous forests mostly in the states of Chhattisgarh, Jharkhand, Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Gujarat, Rajasthan and Maharashtra. Its kernels are good source of (Siddiqui *et al*., 2014).

*Chironji* has great medicinal value. All the parts of the *Chironji* tree are used in traditional Indian medicine. Kernel is rich in protein content (20-30%). The oil extracted from kernel is used for treating skin diseases and it is considered as a substitute for almond oil in traditional medicinal preparations. The *Chironji* nut has very good demand in India as well as in foreign markets and thus, has become an important crop (Deshmukh *et al.*, 2016).

The present of hard seed coat is one of the major shelling problems in decortications of nuts, its small size let's to damage the seed at the time of decortications (Singh *et al.*, 2012). Processing of *Chironji* nuts through traditional method for kernel extraction, farmers yield less kernel recovery due to unsuitable extraction process. The valuable *Chironji* kernel is to be procured at high price

*i.e*. approx. Rs. 700-1200 per kg, whereas the *Chironji* nut could be purchased at the rate of Rs. 100-125 per kg (Singh *et al.*, 2015). As the kernel is valuable, it was necessary to get maximum recovery during decortications so as to reduce the cost. Therefore, a study was done to improve the processing technique and work out the cost economics of the both practices.

## EXPERIMENTAL METHODS

The study was conducted at Swami Vivekanand College of Agricultural Engineering and Technology and Research Station, Faculty of Agricultural Engineering, Raipur (IGKV) in 2016. In traditional practice, fully mature green colored skins *Chironji* fruits are harvested manually. In order to removed the skins; fruit are usually soaked overnight in plain water and rubbed between palms or with jute sack. The water containing fine skin are decanted and washed with fresh water to obtain cleaned nuts. The cleaned nuts are then dried in sunlight to optimum moisture level for decortications. The dried *chironji* nuts are decorticated by rubbing with a two pair of small stone *Chakki* (Fig. A) on rough surface followed by manual separation of kernels from the hull (Kumar *et al*., 2012).

**Fig. A : Traditional method using by small stone *Chakki* (*Jatta*)**

In the mechanical method of processing, all the process was similar to that of traditional method except the decortications of *Chironji* nuts by *Chironji* decorticator machine and separation of *Chironji* kernels by grader. The *Chironji* decorticator (Fig. B) was developed by IGKV, to remove outer shell from the *Chironji* nuts to get kernels (Nishad *et al*., 2017). All other steps were repeated as in case of traditional methods.

**Fig. B: Mechanical (improved) method using by *Chironji* decorticator**

The hourly cost of operation was calculated considering fixed and operational cost taking the unit purchase price, annual use, salvage value, interest rate, maintenance cost and life of the machine (Kepner *et al.*, 1987).

## EXPERIMENTAL FINDINGS AND ANALYSIS

The traditional practice an average 10-15 kg of dried *Chironji* nuts could be decorticated by one man in a day. Table 1 shows effect of number of passes on the yield recovery of whole and broken kernel. It can be seen that the weight of whole and broken kernel gradually decreased as the number of passes increased. For complete decortications of 15 kg nuts the seven numbers of passes are required. It reveals that after one passes 2.37 per cent whole kernel and 1.41 per cent broken kernel recovery was obtained while after six passes the recovery reduced to 0.11 per cent and 0.32 per cent indicating 2.26 per cent loss in the whole kernel and 1.09 per cent loss in the broken kernel recovery. It is worth mentioning here that the number of passing may affect the recovery percentage. There is possibility of loss of *Chironji* kernel with the more passed. Therefore, decorticating of *Chironji* nut is critical parameter.

In this mechanical (Improved) method 150 to 200 kg of *Chironji* nuts could be decorticated in a day. The result of the mechanical method is given in Table 1. The

table depicts that the recovery of whole kernels were slightly higher but broken kernels were slightly lower than the traditional method. It can be seen that after seven passes the whole kernel recovery was increased only be 0.5 per cent and broken kernel recovery was decreased only be 0.14 per cent as compared to traditional method. On the other hand, the capacity of decortications by decorticated one unit or one man was increased by more than 10 times. This method is also helped in reducing the drudgery and labor requirements. The whole kernel percentage was also found to be more in this case.

Fig. 2 shows that the compassion of traditional and mechanical method of decortications. The variation in

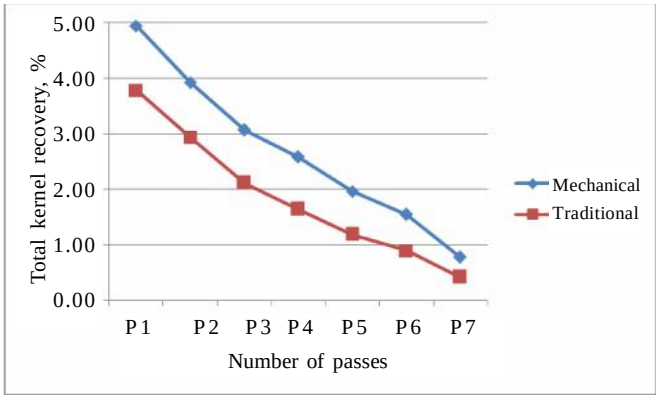


**Fig. 1 : Variation in *Chironji* kernel recovery with number of passes**

**Table 1: Effect of number of passes on the recovery of kernel in both methods**

| Sr. No. | Number of passes | Mechanical method | | Traditional method | |
|---|---|---|---|---|---|
| | | Whole kernel (%) | Broken kernel (%) | Whole kernel (%) | Broken kernel (%) |
| 1. | P1 | 4.15 | 0.79 | 2.37 | 1.41 |
| 2. | P2 | 3.39 | 0.54 | 1.96 | 0.98 |
| 3. | P3 | 2.69 | 0.38 | 1.40 | 0.71 |
| 4. | P4 | 2.23 | 0.35 | 1.03 | 0.62 |
| 5. | P5 | 1.67 | 0.30 | 0.72 | 0.47 |
| 6. | P6 | 1.33 | 0.22 | 0.51 | 0.39 |
| 7. | P7 | 0.61 | 0.18 | 0.11 | 0.32 |

**Table 2: Cost economics of traditional and mechanical method for decortications of *Chironji* nut**

| Sr. No. | Cost/benefits | Traditional method (Small stone *Chakki*) | Mechanical method (*Chironji* decorticator) |
|---|---|---|---|
| 1. | Cost of machine/*Chakki* | 1,000.00 | 65,000.00 |
| 2. | Expected life, y | 10.00 | 10.00 |
| 3. | Annual use, h/y | 250.00 | 250.00 |
| 4. | Depreciation @ 10 % per hour after deduction of salvage value (Rs./h) | 0.36 | 23.40 |
| 5. | Interest @ 10% in invest (Rs./h) | 0.22 | 14.30 |
| 6. | Miscellaneous @1.5% in investment (Rs./h) | 0.06 | 3.90 |
| **A** | **Total fixed cost (4+5+6), Rs./h** | 0.64 | 41.60 |
| 7. | Repair and maintenance @ 5% initial cost (Rs./h) | 0.20 | 13.00 |
| 8. | Electricity charge ( 8 Rs./unit) | 0.00 | 1.60 |
| 9. | Labour charges @ 25 Rs./h/man (Rs./h) | 25.00 | 50.00 |
| **B** | **Total variable cost (7+8+9), Rs./h** | 25.20 | 64.60 |
| **C** | **Cost of processing (A+B), Rs./h** | 25.84 | 106.20 |
| 10. | Capacity of machine/*Chakki* (kg/h) | 1.80 | 21 .00 |
| 11. | **For 1 kg *Chironji* nut** | = 14.35 | = 5.06 |

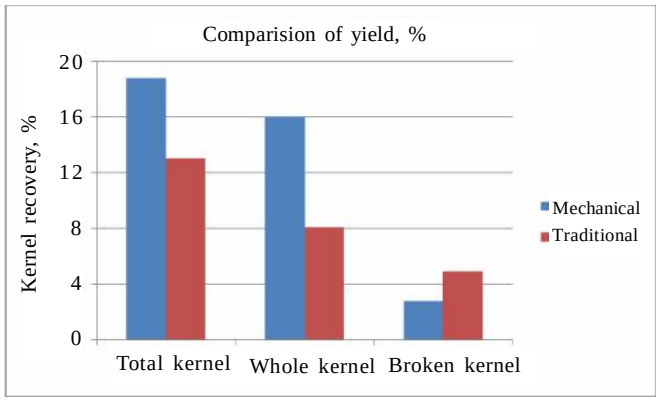


**Fig. 2 : Comparison between both methods**

kernel recovery with number of passes in tradition and mechanical method of *Chironji* decortications is presented in Fig. 1. Mechanical method gave slightly higher total recovery and also higher whole kernel. However, there was gradual decreased in the total kernel recovery with the number of passes increased.

On the other hand the labour requirement per unit decortications of *Chironji* was very less in case of mechanical method. In mechanical decortications process it possible to decorticated 150-200 kg of raw *Chironji* nuts whereas only 10-15 kg of nuts is possible by the traditional practice.

In traditional method for processing of 15 kg of nut requires 1 man-day for one day. Hence, 1 kg of *Chironji* nut decortications costs Rs. 14.35. Processing by mechanical method using *Chironji* decorticator machine for decorticating nut and two man-labours were required. Capacity of this machine was 1.5 to 2 quintal per day and 2 man-days are required. In this methods the total cost of processing operation for 1 kg of *Chironji* nut was calculated Rs. 5.06 per h and its 3 times less as compared to traditional practice. The details of cost of processing are given in Table 2.

## Conclusion:

The results were shows that the traditional method is very tedious and takes long time. The decorticating of *Chironji* nut by small stone *Chakki* (*Jatta*) involves much of the drudgery. On the other hand the total kernel recovery and whole kernel recovery percentage by this method is very less. It was possible to introduce mechanization of the process by replacing on small stone *Chakki* with *Chironji* decorticator machine, which increase the output capacity per man-day by more than 10 times and it also save Rs. 9.30 per kg for decortications of nuts. In this method the total kernel recovery and whole kernel was higher as compared to traditional method. However, innovative approach in the direction of mechanization can further reduce the cost of processing/ production such as automatic feeding system use in the place of manual feeding.

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