Value addition and economics of Arecanut processing plant – A study from North-Eastern India

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ABSTRACT

The study analyzes the economic aspects of value addition of green arecanut harvests based on primary data collected from 28 processing plants of Dhubri and Goalpara districts of Assam. Both PRA and Survey methods were adopted to collect information. The study reveals that most of the processing plants were run by the owners of the land either as sole processor or in partnership. About 60.71% of plants remain under single ownership. The processing activity is done in two phases *viz.*, early season from Mid-November to Mid-April for the preparation of Tipni, Rota and Sagar grades by using half matured or premature nuts and late season starting from Mid-April to Mid-June to produce Maza, Fali and Mala grades by using fully ripen nuts. The net profit earned from per qunital (output) processing of Tipni with fumigation is ₹5043.16 followed by Tipni without fumigation (₹3826.28) with a benefit-cost ratio of 1.34:1 and 1.24:1, respectively while the net return per quintal fetched from preparation of Maza is ₹1750 followed by Mala (₹1050.00) and Fali (₹772.50) with the B/C ratio of 1.64:1, 1.31:1 and 1.24:1, respectively. The average net return of a standard processing plant with an average capacity of business with 575 qtls is ₹3,16,999.91 of which 62.40% contribution comes from early season processing and rest 37.60% from late season processing activity. Average annual employment generation of such plant found 778.5 mandays of which 36.87% is female. For establishing the said plant initial average fixed investment is ₹67,885.00. The processing of arecanut may be regarded as an income and employment generating enterprise that provides synergy between farm and non-farm sector of rural livelihood domain.

Key words: *Areca catechu*, processing grades, tipni, maza, employment generation.

INTRODUCTION

Arecanut (*Areca catechu* L.), a tropical crop, is popularly known as betel nut, as its common usage in the country is for mastication with betel leaves. Arecanut is cultivated in different climatic and soil conditions, particularly in India, Bangladesh, Sri Lanka, Malaysia, Indonesia, Philippines and Myanmar (Jose and Jayasekhar., 8). Arecanut production in India is the largest in the world, as per FAO statistics for 2013, accounting for 49.74% of its world output and is exported to many countries. At present, India has attained self-sufficiency with regard to arecanut production. Arecanut provides income and livelihood security to more than three crore people in India (Kammardi., 9). Major portion of the arecanut production is exported to countries like Singapore, Kenya, Saudi Arabia and United Kingdom in various forms. The annual compound growth rate of consumption (5%) is more than that of production (4.2%) hinting at the demand – supply gap. India exported 1750 tonnes of arecanut and its products to more than 40 countries during 2009-10 also imported 40,000 tonnes of arecanut valuing ₹100 crores at ₹25,000 per ton (2009-10) (Kammardi., 9). Within India, as of 2013-14, Karnataka produces

62.69% of the crop followed by Kerala (13.77) and Assam; all three states together account for 88.59% of its production. The other major states where arecanut is also grown are Meghalaya, West Bengal, Mizoram, Tamil Nadu and Tripura. From an area of 0.70 lakh hectares Assam produces 0.68 lakh tonnes (Anonymous, 1) arecanut.

Arecanut is an important commercial plantation crops in the state of Assam. It also called as "Betel nut" or "Supari". Arecanut kernel obtained from the fruit is chewed both as raw nut and in processed form. Fully ripe arecanut is generally used by the consumers of Assam, Kerala and Northern parts of West Bengal. The processed green arecanut in different forms is favoured in Rajasthan, Karnataka and Tamil Nadu.

Processing of arecanut in Assam is a traditional occupation. Grading is not usually done by growers, the wholesalers, however, grade the produce but not on any scientific basis. Grading is done on the basis of size, colour and quality of fruit (Bhalerao and Singh, 2). The important factors affecting the quality of arecanut are colour, tenderness, gleam, shape, weight etc (Kolur *et al.,* 10). Danti and Suresha (5) recently proposed a technique for classification of arecanut based on texture features. Investment requirement or establishment of arecanut processing at farm level stood ₹59,481 of which 66% was the cost of building

construction (Chinnappa, 4). One of the common indicators of economic analysis suggested by Gittinger (7) and was applied by Das (6), Bhalerao and Singh (3) and others to test the economic worthiness of the investment in arecanut is the Benefit-Cost Ratio (BCR). Arecanut processing is an important operation to make it available to the consumers in various processed forms. Therefore, it is important task to know the different processing stages and the cost involved in each stage. In Assam the main processed products of arecanut are Maza, Fali, Mala, Tipni, Rota and Sagar. The total cost of value addition of one qtl of green arecanut in cooperative unit was ₹15,217 and in private units it was ₹15,290 and net profit earned by processing unit from marketing of one qtl finished product was ₹4783 in co-operative unit and ₹4218 for private unit (Kolur *et al.,* 10).

Processing units of arecanut generated employment facilities in the rural areas particularly for employment in female and minor labours (age below 18 years) during their leisure time. On an average, each acre of arecanut employs around 250 human labour days for cultivation and another 200 human days for processing annually (Mallikarjunaiah and Prakash., 11). The problems associated with the arecanut processing are numerous, like non-availability of the required quality of the green arecanut, low returns from different processing grade, improper marketing facilities, lack of availability of institutional finance etc. The present study has explored the cross section of different processing units according to their volume of business, investment required in general, the cost and return aspects of different grades of processed output in particular. The employment generation opportunity of the said enterprise has also been analyzed duly.

MATERIALS AND METHODS

The investigation is based on primary data collected from 28 processing plants from Dhubri and Goalpara districts Assam. Both Participatory Rural Appraisal (PRA) and Survey methods were followed to collect information on different aspects of processing plants.

Out of 28 processing plants surveyed from two developmental blocks, are distributed over 8 clusters where each cluster possesses 2 to 5 plants (Table 1). The inter unit distance within the same cluster is 0.50 km where cluster to cluster distance ranges from 10 – 50 km. The clusters are developed within contiguous villages having due favour of raw material, labour supply and market access. Though the representation of study area is obtained from two developmental blocks, little difference is found with regard to structure, distribution and operation of plants. Hence, the present study area was taken

Table 1. Distribution of Arecanut processing plants in the study areas.

Name of the blocks	Name of the business cluster (GPs)	No. of processing plants
Agamoni	Agamoni	4
	Baterhat	4
	Halakura	2
	Shernagar	3
	Sub-total	13
Bilasipara	Bilasipara	5
	Baghmari	4
	Gopigaon	4
	Hatipota	2
	Sub-total	15
	Total	28

under unique domain devoiding any stratification. However, the selection of blocks was done based on due concentration of business activities to get adequate information on processing.

A structured survey schedule was used for collecting different information from the respondents. Simple tabular method is used for interpreting the results. The primary data is related to Financial Year 2015 – 2016. The data were analyzed with the help of simple statistical tools like average, percentage, benefit-cost ratio etc. Annualized depreciation of implements, machinery and farm buildings are estimated by the Straight Line Method appended below

Annualized depreciation = (Purchase value – Junk Value at the Life end)/ Economic life in years

RESULTS AND DISCUSSION

The duration of processing season (November to Mid-June) and the market arrival of green arecanut along with percentile distribution is presented in Table 2. The activity starts from month of November only and continues upto Mid-June depending upon availability of arecanuts. The less hardened nut gives better quality processed product but the quantity yield needs to be sacrificed. The over hardened nut gives more quantity yield but need to compromise with quality grade. The volume of business reaches highest in the month of February and March (37.89%) and declines in the month of April (8.79%) and May to Mid-June (7.69%). The reason is that, month of February and March are the peak harvesting season of premature green arecanut used for production of Tipni, Rota and Sagar grades. During April to Mid-June, availability of the fully ripen nuts is maximum, used for preparation of Maza, Fali and Mala grades

Table 2. Distribution of market arrival of green arecanut for sample processing unit in a season.

Sl. No.	Months	Agomoni Block		Bilasipara Block		Overall	
		Amount (Qtl)	% share	Amount (Qtl)	% share	Amount (Qtl)	% share
1	November	355	14.36	365	14.40	720	14.38
2	December	368	14.88	392	15.47	760	15.18
3	January	395	15.97	410	16.18	805	16.08
4	February	480	19.41	485	19.14	965	19.27
5	March	470	19.01	462	18.23	932	18.61
6	April	215	8.69	225	8.88	440	8.79
7	May to June	190	7.68	195	7.70	385	7.69
Total		2473	100.00	2534	100.00	5007	100.00

which are normally processed through traditional method. The average volume of business is slightly higher in Bilasipara block compared to Agomoni block.

Table 3 represents the classification of arecanut processing plants in the study areas on the basis of number of oven possessed by plant owner. The capacity of processing unit is measured by number of oven it possess locally known as 'chulli', made of clay soil and iron rod. The volume of business operated by the processing units depend not only on the availability of green arecanut but also the number of oven operated by processing unit for boiling of green arecanut. The boiling activity is usually under taken twice in a week matching with the availability and the supply of nut and it continued for the whole day. One oven can boil upto 4.8 qtl of green nut in a day. The single oven plants are generally managed under individual capacity with low business strength. The number of oven may be taken as an indicator of plant size. We can say that unit with less than 3 chulli indicating small size, while those having 3-6 and more than 6 numbers of chulli, may be called medium and large unit respectively. The result shows that out of 28 processing plants in the study area 60.71%, 28.57% and 10.71% of the owners of the processing plants come under small, medium and large groups respectively. It is observed that large plants are available only in Bilasipara block proclaiming commercial gesture of the area. The reason may be that of adequate local supply of green arecanut to the processing plants, supplemented by adequacy of local labour.

The ownership pattern of processing units in the said study is delineated in Table 4. Plants or units are operative both under single proprietorship and multimember partnership. From the analysis of the ownership it has been found that 60.71% of processing plants run under single ownership, 21.43% under 2–3 member partnership and 17.86% under more than 3 member partnership. One of the primary impediments of establishing processing plant is possession of an open yard required for sun drying

Table 3. Classification of Arecanut processing plants, according to number of oven (locally called as Unan or Chulli) in the study areas.

Name of the blocks	Name of the business cluster (GPs)	No. of processing plants	No. of Chulli (Oven)		
			< 3	3 – 6	> 6
Agamoni	Agamoni	4	3	1	–
	Baterhat	4	2	2	–
	Halakura	1	1	–	–
	Shernagar	4	3	1	–
Bilasipara	Bilasipara	5	3	2	-
	Baghmari	4	1	2	1
	Gopigaon	4	2	1	1
	Hatipota	2	1	-	1
Total		28 (100)	17 (60.71)	8 (28.57)	3 (10.71)

*Figures in the parentheses indicate percentage of respective totals.

Table 4. Ownership pattern of arecanut processing units in the study areas.

Name of the blocks	Name of the business cluster (GPs)	No. of Processing plants	Single		Partnership			
					2 - 3		3 >	
			O	L	O	L	O	L
Agamoni	Agamoni	4	2	2	–	–	–	–
	Baterhat	4	2	–	1	1	–	–
	Halakura	1	1	–	–	–	–	–
	Shernagar	4	3	–	1	–	–	–
Bilasipara	Bilasipara	5	3	–	–	–	2	–
	Baghmari	4	2	–	1	–	1	–
	Gopigaon	4	2	-	-	-	2	
	Hatipota	2	-	-	2	-	-	
Total		28 (100)	15 (53.57)	2 (7.14)	5 (17.86)	1 (3.57)	5 (17.86)	–

O = Owned land; L = Leased land.

of decorticated nuts after boiling. The face value of such yard adjacent to market fringe is quite high. Hence, the entrepreneur having such land enjoy added opportunity to establish a processing unit either by his own or through augmenting working partnership with any other landless one. Sometimes such land may also be given for lease use either to a single person or to a group of entrepreneurs. Hence there exists four types of arrangement, single owner plant with own yard, single owner plant with leased in yard, multi owner partnership plant where land owner as a partner and multi owner partnership plant with leased in yard. Out of 28 processing plants 15 are established by single owner on his own yard, 10 by

partnership with land owner and rest 3 upon leased in land only. The said results conclude that availability of processing yard with self-ownership of the proprietor plays the key role behind the establishment and prosperity of such processing unit.

Table 5 explains the average estimate of investment for establishment of standard arecanut processing plants having 4 ovens. The estimate has been prepared for a 4 oven plant exclusive of lease value of land and interest on fixed capital. The working capacity of a standard processing unit is 18 packet green arecanut (each packet 80 kg in net weight) per processing cycle and average 32 cycles in early season (November to April). The input items

Table 5. Analysis of establishment cost for a standard arecanut processing unit in the study area.

Sl. No.	Item of costs (Fixed)	Economic life/years*	Qty/ kg/p	Rate (₹)	Cost (₹)	%
1	Preparation of oven	4 – 5	4	900	3600.00	5.30
2	Building (Brick floor with tin shed) for one	10-12	1	-	44000.00	64.82
3	Vessels made of copper / Aluminum locally known as 'Deski'	4-5	2	3000	6000.00	8.84
4	Ladles (String implements)	3-4	3	90	270.00	0.40
5	Knives (Locally known as 'Zhati')	7-10	4	165	660.00	0.97
6	Sarasi (For pressing Tipni grade)	3-4	8	40	320.00	0.47
7	Plastic wrappers	2-3	3	45	135.00	0.20
8	Gunny bag	2-3	18	25	450.00	0.66
9	Gas chamber for fumigation (made of bamboo & plastic)	2-3	1	-	3600.00	5.30
10	Tarpaulin (18l × 10l)	4 -5	2	1200	2400.00	3.54
11	Hand tube-well (with plastic pipe)	4-5	1	-	1950.00	2.87
12	Van for carrying Arecanut	5-6	2 p	-	4500.00	6.63
	Total	-	-	-	67885.00	100.00

*As reported by the owners of the processing unit.

required for establishing the unit are preparation of oven (made of clay and iron rod), processing yard *i.e.* brick floor with metal shed (partly shaded and rest open floor), vessel used for boiling made of copper or aluminium ladle for stirring (made of wood), knives (locally called Zati used for decortications), processing fork (used for Tipni grade), polythene wrapper, gunny bag, gas chamber (made of bamboo and plastic used for fumigation), tarpaulin, hand tube well (for water supply) and carrying van (for carrying the goods ready to use as and when required). The table gives an average static review of respective costs based on 2015-16 market prices; however the same may change marginally from place to place according to local adjustment. Over time costs may increase but the quantity of inputs remain same. At 2015-16 market prices, the estimated establishment cost comes at ₹67,885.00 of which 64.82% expenditure is made for construction of building *i.e.* brick floor with metal shed, durable for 10-12 years. The above finding is also analogous to the study of Chinnappa (4). It is to note that on an average upto 3 years no new investment as a fixed cost is to be needed except minor repairing. About 10.68% of total investment has been allocated for purchase of boiling equipment such as two Deski (large vessel), three ladles, four knives, and eight Sarasi for pressing for Tipni grade. Another major item of investment is tarpaulin worth ₹1200 per piece constituting 3.54% of the total cost, used for sun-drying arecanut and its durability is about 5 years.

Information explained through Table 6 provides clarity about the possible product mix of a standard processing plant. From the operational point of view the whole processing season needs to be observed in two phases *viz.* early and late. The former exists between Mid-Novembers to Mid-April and relates with harvested premature fruits those processed likely through pre-boiling before sun drying. The commercial grades obtained in this period are Tipni with fumigation, Tipni without fumigation, Rota, Sagar and Others (Paniwala, Gunglee, Chur, Maradana etc). It is revealed from the table that 78.26% raw material (green arecanuts) of total volume of business is processed in this period drawing prime focus of the enterprise. The dry sunny weather with moderate temperature prevailing during winter period in the said zone plays a key role for conduction of the whole process. As a seasonal average 11.50 kg. of dry processed product may be obtained from 100 kg of partially matured green fruits and accordingly a standard processing plant could produce 51.75 qtls dry processed items using 450 qtls green nut over the period of six months. The productivity is less during early months because of high moisture content with premature fruits.

The late season activity is undertaken between Mid-April to Mid-June and deals with fully matured or ripen nuts only. The fruits are dried under scorching summer sun light, prevails during this period to produce Fali and Mala grades. From 100 kg of ripen nut, 14 to 15 kg of dry processed product can be obtained. Over ripen fruits obtained at the last part of harvesting season is preferably chosen for producing Maza grade through partial fermentation. This activity

Table 6. Business summary of a standard processing unit.

Season	Fruit Type	Grades produced	Volume of green fruit	Volume of processed product
Early season (Mid-November to Mid-April)	Immature	Tipni with Fumigation	225 qtl	25.875 qtl
		Tipni without Fumigation	81 qtl	9.135 qtl
		Rota	67.5 qtl	7.7625 qtl
		Sagar	54 qtl	6.210 qtl
		Others	22.5 qtl	2.5875 qtl
Sub-total =			450 qtl	51.75 qtl
Late season (Mid-April to Mid-June)	Fully matured or ripen	Maza	10 qtl or 250 pan	250 pan
		Fali	59 qtl	8.85 qtl
		Mala	56 qtl	6.72 qtl
				1.12 qtl
Sub-total =			125 qtl	-
Grand Total =			575 qtl	-

1 qtl green arecanut (immatured) = 11.50 kg dry (processed arecanut), In case of Fali 1 qtl green arecanut (fully matured or ripen) = 15 kg dry processed arecanut, and for Mala one qtl green arecanut = 14 kg dry processed arecanut of which 12 kg of high quality and 2 kg of low quality

Table 6.1. Calculation of fixed cost of a standard processing unit in a season.

Sl. No.	Particulars	Total cost (₹)
1	Annualized depreciation on oven	600.00
2	Annualized depreciation on building	2666.67
3	Annualized depreciation on equipments	1239.67
4	Annualized depreciation on gas chamber	1050.00
5	Annualized depreciation on hand tube-well	290.00
6	Annualized depreciation on van	550.00
7	Annualized depreciation on tarpaulin	440.00
Total fixed cost =		6836.34

is matched with onset of monsoon rain required for recharging of sub-surface soil moisture where the fruits are to be kept buried for partial fermentation for a specified period of 90 days. The late season processing activities are traditional and may be regarded compensatory as a whole. Such activities are optionally chosen to provide job to attached labourer, recovery of fixed cost as well as to keep the unit active.

The economics (cost and return analysis) of a standard processing unit is delineated through Table 6.1, Table 6.2 Table 6.3 and Table 6.4. Table 6.1 explains the annualized depreciation value of capital equipments of the processing plants to be regarded as fixed cost component for the said output.

Table 6.2. Analysis of cost associated with processing of green arecanut to produce Tipni, Rota, Sagar and other grades during early season (Mid November to Mid April).

Sl. No.	Item of costs	Man days/ amount/ number	Rate (₹)	Total cost (₹)	Cost (₹) of processing of different grades				
					Tipni with Fumg.	Tipni without Fumg.	Rota	Sagar	Others
1	Procurement of green arecanut								
	Raw materials (450 qtls)	450 q	1520/q	684000.00	342000.00	123120.00	102600.00	82080.00	34200.00
	Labour for collection	45 MD	200/MD	9000.00	4500.00	1620.00	1350.00	1080.00	450.00
2	Staking (labour)	12 MD	200/MD	2400.00	1200.00	432.00	360.00	288.00	120.00
3	Boiling								
	Chemicals (kg)	3 Kg	170/Kg	510.00	255.00	91.80	76.50	61.20	25.50
	Fuel (Firewood & others)	15 q	320/q	4800.00	2400.00	864.00	720.00	576.00	240.00
	Labour	25 MD	200/MD	5000.00	2500.00	900.00	750.00	600.00	250.00
4	De-husking (labour)	100 MD	200/day	20000.00	10000.00	3600.00	3000.00	2400.00	1000.00
5	Labour for Preparation & Pressing of Tipni	90 MD	200/day	18000.00	12600.00	5400.00	–	–	–
6	Gas Chamber treatment								
	Sulphur	50 Kg	112/Kg	5600.00	2800.00	–	1120.00	1008.00	672.00
	Labour	40 MD	250/day	10000.00	6000.00	–	2000.00	1500.00	500.00
7	Sun drying								
	Bamboo dhara (Mat)	85 pcs	60/pc	5100	2550	918	765	612	255
	Labour	205 MD	200/day	41000	20500	7380	6150	4920	2050
8	Packing and grading								
	Bamboo basket	45 pcs	44/pc	1980	990	356.4	297	237.6	99
	Labour	48 MD	250/day	12000	6000	2160	1800	1440	600
9	Marketing (labour for loading)	18 MD	200/day	3600	1800	648	540	432	180
	Total variable costs for 450q of green Arecanut (₹)			822990.00	416095.00	147490.20	121528.50	97234.80	40641.50
	Fixed cost (₹) vide Table 6.1			6836.34	3418.17	1230.54	1025.45	820.36	341.82
	Total cost (₹) (TVC+TFC)			829826.34	419513.17	148720.74	122553.95	98055.16	40983.32
	Quantity of processed product (qtl)			51.75	25.875	9.315	7.7625	6.210	2.5875
	Average Total cost per qtl (processed product)			16035.29	16213.07	15965.73	15787.95	15789.88	15838.96

Fixed cost is fully considered for early season activity only, TVC = Total Variable Cost, TFC = Total Fixed Cost.
The other grades obtained as off quality named paniwala, maradana, chur, tukary, gunglee etc.

Table 6.3. Analysis of variable cost to associated with processing of ripen arecanut to produce Maza, Fali and Mala grade in 2ⁿᵈ phase of the season (Mid-April to Mid-June).

Item of costs	Maza			Fali			Mala		
	Qty /MD	Rate (₹)	Cost (₹)	Qty/MD	Rate (₹)	Cost (₹)	Qty/MD	Rate (₹)	Cost (₹)
Procurement									
Green Arecanut	200 pan	105/pan	21000.00	20 pan	105/pan	2100.00	20 pan	105/pan	2100.00
b. Labour for collection	0.80 MD	200/day	160.00	0.08 MD	200/day	16.00	0.08 MD	200/day	16.00
For Fermentation of maza									
Labour for digging of hole	1 MD	200/day	200.00	–	–	–	-	-	-
b. Plastic for covering	0.5 kg	160/kg	80.00	–	–	–	-	-	-
c. Turmeric dust for colour	0.5 kg	120/kg	60.00	–	–	–	-	-	-
d. De-holing	0.5 MD	200/day	100.0	–	–	–	-	-	-
Framing of garland of fruit				20 pan	4.50/ pan	90.00			
Sundrying									
Labour	–	–	–	0.8 MD	200/day	160.00	0.8 MD	200/day	160.00
Bamboo dhara for drying (mat)	–	–	–	2 piece	60/p*	120.00	2 nos	60/p*	120.00
De-husking (labour)	–	–	–	0.4 MD	200/day	80.00	0.4 MD	200/day	80.00
Packing									
Gunny bag	5 Nos.	48/bag	240.00	2 nos.	48/bag	96.00	2 nos.	48/bag	96.00
Labour requirement	0.8 MD	200/MD	160.00	0.05 MD	200/MD	10.00	0.05 MD	200/MD	10.00
Total cost (TC)	–	–	22000.00	–	–	2672.00	-	-	2582.00
TC/q, (TC/pan for Maza)	–	–	110.00	–	–	3340.00	-	-	3227.50

*The average volume of business of sampling processing unit for the grades of Maza, Fali and Mala = 125 qtl in a season
1 pan = 80 nos. of maza arecanut, 1 qtl. raw arecanut = 25 Pan

It is pertinent to note that all such capital inputs are basically used during early activities of the season and thus said cost component be accounted with for the preparation of processed products *viz.* Tipni, Rota, Sagar etc grades only. The processed products (grades) obtained during late phase of the production season hardly demand any use benefit out of such capital inputs.

The Table 6.2 explores the activity wise variable cost requirement to run a processing unit from Mid-October to Mid-April to produce 51.75 qtls of dry (processed) arecanut from 450 qtls of green immature fruit. There are nine different activities related with processing *viz.* procurement of green nut, staking, boiling, de-husking, pressing for preparation of Tipni grades, gas treatment, sun-drying, packing cum sorting and finally marketing. From the study, it is revealed that the apportioning of business (450 qtls) in a season amongst the above grades accounts as 50% for Tipni with fumigation, 18% for Tipni without fumigation, 15% for Rota, 12% for Sagar and the rest 5% for other grades. Here other grade includes

Paniwala, Maradana, Chur, Tukari, Gunglee etc. It is to be noted here that other grades *viz.* Paniwala and Gunglee are produced in option only and also based on specific demand come from the consumers while Maradona, Chur and Tukari are basically by-products of the processing operations. The preparation of Tipni grades starts from Mid-November and is continued upto Mid–February in Assam because production of this grade needed immature nut (30% to 45% mature) while the preparation of Rota needs half matured nuts and its period of operations is March to Mid-April. For Sagar and Chur grade, the period of operation generally starts from Mid-November and continued to Mid-April because these two grades are also produced from immature arecanut.

It is observed from the Table 6.2 that the major operational costs are the cost of raw material and labour cost accounting around 83.11% and 12.52% respectively. The overall average variable cost for processing of one qtl green arecanut to processed items for preparation of Tipni, Rota, Sagar and other grades stands ₹15,903.19 which is about 99.18% of

Table 6.4. Return analysis of a standard processing unit of arecanut in a season.

Grades	Quantity		Market price		Return (₹)		Gross return (₹)	Total cost (₹)	B:C ratio	Net return (₹)	Net return (₹/q)
	Main product (qtl)	By-product (bag)	Main product (₹/qtl)	By-product (₹/bag)	Main product	By-product					
Tipni with Fumg.	25.875	78	21000	85	543375.00	6630.00	550005.00	419513.17	1.31	130491.83	5043.16
Tipni without Fumg.	9.315	32	19500	85	181642.50	2720.00	184362.50	148720.74	1.24	35641.76	3826.28
Rota	7.7625	29	18000	85	139725.00	2465.00	142190.00	122553.95	1.16	19636.05	2529.60
Sagar	6.210	23	17000	85	105570.00	1955.00	107525.00	98055.16	1.10	9469.84	1524.93
Others	2.5875	10	16500	85	42693.75	850.00	43543.75	40983.32	1.06	2560.43	989.54
Sub-Total	-	-	-	-	1013006.25 (98.58)	14620.00 (1.42)	1027626.25 (100.00)	829826.34	1.24	197799.91	-
Maza	250 pan = 10 qtl	-	180 /pan	-	45000.00	-	45000.00	27500.00	1.64	17500.00	1750.00
Fali	8.85	236	27000	85	238950.00	20060.00	259010.00	197060.00	1.31	61950.00	1050.00
Mala	6.72 (high quality)	224	26500	85	178080.00	19040.00	224000.00	180740.00	1.24	43260.00	772.50
	1.12 (low quality)		24000		26880.00						
Sub-Total	-	-	-	-	488910.00 (92.59)	39100.00 (7.41)	528010.00 (100.00)	405300.00	1.30	122710.00	-
Grand Total	-	-	-	-	1501916.25 (96.77)	53720.00 (3.23)	1552126.25 (100.00)	1235126.34	1.26	316999.91	-

*Figures in the parentheses indicate percentage of respective totals.

total cost. The result is also analogous to the study of Kolur *et al* (10) for the above grades. The average fixed cost per qtl for processing of the above individual grades slightly differs as all activities are not required for such specific grades.

From the assessment of variable cost (Table 6.3) for the preparation of Maza, Fali and Mala in second phase or late season, it is observed that there are six different types of activities *viz.*, procurement, fermentation, framing of garland, sundrying, de-husking and packing. But all the activities are not required to produce above said grades. The activities like fermentation and framing of garland are exclusively needed for Maza and Mala preparation respectively while sun-drying activity is not required for Maza preparation. The average volume of business for the said above grades in a season is 125 qtls, out of which 8.00% goes for the preparation of Maza grade, 47.20% for Fali grades and 44.8% for Mala grade. The productions of different grades partially vary with respect to the demand for same well as supply of the raw material as mentioned earlier. The above grades are produced in non-chemical way and production continues between Mid-April to Mid-June. The average cost of preparing one unit (80 nos) of Maza is ₹110.00 while for Fali and Mala grades, the average cost of preparation per qtl are ₹3340.00 and ₹3227.00, respectively.

The return analysis of a standard processing plant is evaluated and presented through Table 6.4. The said analysis is done in two section based on two phases of seasonal processing activity *viz.* early season processing by using green or immature nuts to produce Tipni, Rota, Sagar and other grades and late season processing by using fully matured or ripen nut for preparation of Maza, Fali and Mala grades. The return analysis reveals that the gross return constitutes two parts – major contribution from marketing of main product *i.e.* processed product and a very negligible income from the selling of by-product *i.e.* the husk of arecanut fruits). The overall contribution to gross return from selling of main processed grades accounts 96.77% and rest 3.23% from selling of by product. In early season activity the gross return subsequently net return per qtl of dry processed nuts are the highest for Tipni with fumigation grade (₹5,50,005.00 and ₹5043.16, respectively) with benefit-cost ratio of 1.31:1 followed by Tipni without fumigation grade (₹1,84,362.50 and ₹3826.28 respectively) with benefit-cost ratio of 1.31:1 and Rota (₹1,42,190.00 and ₹1524.93.00, respectively). The above findings are also comparable to the study of Kolur *et al* (10). In late season processing activity the gross return and net return per qtl are highest for Maza grade (₹45,000.00 and ₹1750.00, respectively)

with benefit cost ratio of 1.64:1 followed by Fali (₹2,59,010.00 and ₹1750.00, respectively) and Mala (₹2,24,000.00 and ₹7,72,500.00, respectively). It is important to note that although the net return per qtl is higher for Tipni grades but the benefit-cost ratio is highest for Maza grade preparation. This may be due to the fact that processing cost of later is negligible. One of the major findings is that the total net income of the entrepreneur from the early season processing activity is ₹1,97,799.91 with an average benefit–cost ratio of 1.24:1 and from late season activity it is ₹1,22,710.00 with benefit-cost ratio of 1.30:1. Accordingly, an entrepreneur can earn a net income to the tune of ₹3,16,999.91 over the whole season for the total volume of business of 575 qtls of green arecanut.

The employment opportunity of arecanut processing unit has been explained in Table 7. There is an operational sequence of the process and for each step some sorts of specialization is also required. The sequence is composed of a set of activities namely, collection of green fruit, staking in peal, boiling of green fruit, decortications of boiled green fruit (de-husking), preparation of low height bamboo roof for sun-drying of green nut, pressing of half dried nut for Tipni grade, fumigation of dried nut, packaging of products and also disposal for the market. Most of the activities are performed by hired casual labour with ongoing market wage rate. For decortications of boiled green fruit and pressing of half dried nut for 'Tipni' grade, local female labour and their grown up minors (age below 18 years) are generally engaged on contract basis. For decortications job, the unit is one basket full fruit containing around 15 kg of green fruit and a standard skilled women labour can decorticate 30 – 35 basket in a day. The minor can also decorticate 17 – 20 baskets in a day along with their elders. The quantitative requirement of labour input for running a four oven processing unit having a standard operational turnover of average 575 qtl green fruit for average nine months processing season has been delineated in the said table. From the given data it is observed that the unit can generate 778.50 mandays over the season of which 41.10% goes for sun-drying, 20.53% for dehusking of fruits, 11.56% for pressing for 'Tipni' and 7.39% for collection of green arecanut 9.57 packaging, grading and marketing and rest 9.89% for boiling of green fruits, fumigation staking purpose. On the basis of different grades of processed nuts out of total employment (mandays) generation 74.89% contributed from preparation of Tipni, Rota, Sagar and other grades, 12.64% from Fali grade preparation, 11.94% from Mala grade and 0.51% coming from Maza processing. Regarding gender distribution of labour, 49.84% for

Table 7. Employment generation in a standard processing unit in a season.

Sl. No.	Name of the activities	Employment (no. of mandays) for processing of different grades					Division of labour		
		TRSO* (450q)	Maza	Fali (59q)	Mala (56q)	Total labour (MD)	Male	Female	Minor
1	Collection of raw materials	45	1	5.9	5.6	57.5 [7.39]	57.5	-	-
2	Staking	12	-	-	-	12 [1.54]	12	-	-
3	Boiling	25				25 [3.21]	9	16	-
4	De-husking	100	-	29.5	28	157.5 [20.23]	-	96	123
5	Preparation and pressing of Tipni	90	-	-	-	90 [11.56]	-	48	84
6	Gas chamber treatment	40	-	-	-	40 [5.14]	40	-	-
7	Sun drying	205		59	56	320 [41.10]	216	104	-
8	Digging of hole & de-holing	-	2	-	-	2 [0.26]	2	-	-
9	Packaging & grading	48	1	4	3.5	56.5 [7.26]	33.5	23	-
10	Marketing	18	-	-	-	18 [2.31]	18	-	-
	Total Labour (Mandays)	583 (74.89)	4 (0.51)	98.4 (12.64)	93.10 (11.94)	778.50 [100.00]	388 (49.84)	287 (36.87)	207 (13.29*)

*Figures in the parentheses indicate percentage of respective totals.
Figures in the third bracket indicate percentage of respective totals.
*Average volume of business 575 qtls per unit processing plant per annum
TRSO* = Tipnis, Rota, Sagar & Others grades, MD = Mandays,
*The percentage of minor labour is calculated in respect of work efficiency as 1 male labour = 1 female labour = 2 minor labour (age below 18 years)

male (man), 36.87% for female and 13.29% goes for grown up minor. Males are engaged in collection of green fruits, staking, preparation of bamboo roof and marketing while female and minor reserve their dominance upon dehusking and preparation for 'Tipni'. Other works are shared by male and female in complementary mode. The remarkable observation of the said information states that the given enterprise provides a holistic support to the job starved society of the area to sustain upon family income rather than individual.

CONCLUSION

The emergence of agribusiness of arecanut processing is backed by the availability of green nut produced in homestead orchards in Assam. The seasonal processing activities continue from November to June with a peak concentration during February and March. The size of business of a processing plant is directly related with number of oven it possesses. More than 60% of processing plants have only less than 3 oven in the study area and about two third of plants are on single ownership and the rest are under partnership. The estimated costing of establishment of a standard processing unit having four ovens is ₹67,885.00 at 2015-16 prices. The entire processing activity is done in two phases- one in early season (Mid-November to Mid-

April) by using premature nut to produce Tipni, Rota and Sagar grades and another in late season (Mid-April to Mid-June) to produce Maza, Fali and Mala by using fully ripen arecanuts. It is studied that the volume of business of a standard processing unit in early season are 450 qtls and in late season it is 125 qtls and on an average, one qtl of premature nut gives 11.5 kg dry processed products of different grades but it is 14 kg to 15 kg for ripen arecanut (for Fali and Mala grades). The major operational costs are the cost of raw material and labour cost accounting 83.11% and 12.52%, respectively. Although the average total cost (₹16,035.29) for preparation of Tipni, Rota, Sagar and other grades is more or less same but net return per qtl from marketing of above grades is different *viz.* ₹5043.16 for Tipni with fumigation, ₹3826.28 for Tipni without fumigation, ₹2529.60 for Rota, ₹1524.93 for Sagar grade and for other grades it is ₹989.54. In late season, out of three grade of processed nut (Maza, Fali and Mala), the highest business of volume contributed from Mala grade followed by Fali but the net profit per qtl stands ₹1750 for Mala and ₹1050.00 for Fali with a benefit-cost ratio 1.64:1 and 1.31, respectively. An entrepreneur can earn a net income to the tune of ₹3,16,999.91 with overall B:C of 1.26:1 in a whole season of which 62.40% is contributed from early season processing activity with B:C of 1.30:1 and

rest from late season processing activity with B:C of 1.30.:1. The study reveals that a standard processing plant can generate 778.5 mandays for various activities of which 49.84%, 36.87% and 13.29% done by male, female and minors respectively. An analytical review of the study indicates that agribusiness through processing of green arecanut opens up a vista of forward linkage opportunity both in employment and income, ensuring complementary synergy between farm and non-farm sector of rural livelihood domain.

Notes

1. Maza: The matured ripen arecanuts are put into a soil chamber (underground pit / hole). Plastic or bamboo mat locally called dhara are wrapped around the pit so that the soil cannot come in direct touch with nuts and then covered with polythene for retting for minimum of 90 days to make the arecanut soft and also to create a smell. After 90 days the partly fermented arecanuts are recovered and named as Maza supari and packed for marketing without decortication.
2. Fali: The matured fully ripen arecanut is just cut into two pieces in length and sun dried. After drying husking is done for packing.
3. Mala: The fully ripen arecanuts is stitched with plastic twine and then sundried for a period of 90 days. The husking is done thereafter.
4. Tipni: First, green arecanut along with husk is boiled for half an hour. After subsequent dehusking the nuts to be boiled for another half an hour. Now, the boiled arecanut is to be sundried for 4-5 days. In between the soft arecanut is pressed to give button like shape called Tipni.
5. Rota: Single boiled nuts are dehusked and dried gradually to turn into deep red colour (Red Rota). In second method, green arecanut fruits are partially boiled for half an hour then dehusked and put into 2nd boiling with one chemical, locally called 'hydro' for another half an hour. The product colour will be white while dried and is called White Rota
6. Chur: Broken, off size, small particles of dried nuts obtained at the time of processing Tipni.
7. Maradana: During the preparation of Tipni, some low grade off quality products of light black colour is obtained due to processing failure and is called Maradana.

REFERENCES

1. Anonymous. 2009. Indian Horticulture Data Base, NHB, Gurugram, Haryana, India.

2. Bhalerao, M.M. and Singh, R.K. 1982. A study of marketing of Arecanut in Jalpaiguri district of West Bengal. In: Arecanut Research and Development, Ed: Sharma, Bhat and Radhakrishnan. Central Plantation Crops Research Institute, Kasaragod. pp. 205-206.

3. Bhalerao, M. M. and Singh, R .K. 1985. Profitability of Arecanut cultivation in Jalpaiguri Area of West Bengal - A Sample Study, In: *Arecanut Research and Development*, Kshama Bhat and C.P. Radhakrishnan Nair (eds.), CPCRI, Kasaragod, pp. 217-19.

4. Chinnappa, B. 2000. Economics of farm level processing of Arecanut. *Agric. Mktg.* **43**: 17-19.

5. Danti, A. and Suresha, M. 2012. Texture Based Decision Tree Classification for Arecanut. International CUBE conference on IT-Engineering-Management-Telecom. pp. 113-117. Anonymous, 2009, Indian Horticulture Data Base.

6. Das, P. K. 1985. Cost of Production and Cost-Benefit Analysis of Smallholder Plantation Crops. Technical Bulletin No. 12, CPCRI, Kasaragod, 1985, pp. 1-8.

7. Gittinger, J. P. 1984. Economic Analysis of Agricultural Projects, EDI Series in Economic Development, *World Bank*. pp. 299-363.

8. Jose, C. T. and Jayasekhar 2008. Growth trends in area, production and productivity of Arecanut in India. *Agric. Situation in India*, **65**: 135-40.

9. Kammardi, T. N. P. 2012. Arecanut economy at the cross roads - Report of Special Scheme on Cost of Cultivation of Arecanut in Karnataka (GOI), Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru.

10. Kolur, A. S., Murthy, C., Mahajanashetti, S. B. and Venugopal, C. K. 2012. Value addition and marketing efficiency in Arecanut processing units. *Karnataka J. Agric. Sci*. **25**: 77-81.

11. Mallikarjunaiah, K. G. and Prakash, T. N. 1988. Processing and Marketing of Arecanut in Shimoga District. Research Report submitted to Director of Research, University of Agricultural Sciences, Bangalore.