# SUB SECTOR STUDY OF CASHEW NUT IN MEGHALAYA

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Institute of Livelihood Research and Training

IBDLP MEGHALAYA

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# Executive Summary

Indian Cashew industry that provides employment to around 0.05 million people both directly and indirectly is export oriented and hence called dollar earning crop of the country. However, Cashew cultivation and processing in Meghalaya still remains in infancy. Production and productivity of cashew plants are low as majority of the plantation are not developed from clones of high yielding varieties and cultivators are not adopting orchard management practices. Most of the cashew orchards have become senile and due to poor canopy management and are infested with pest and diseases. Cashew Plantation in Garo Hills mainly the result of efforts to abate. Jhum Cultivation by Soil Conservation Department is a traditional crop and mainly grown as perennial horticultural crop. Cashew nut is being taken up extensively in Garo Hills. The area under Cashew Plantation was 6785 ha during 2005-06 and the production was 11207 tons. Cashew nut plantation in South Garo was 3426 ha during 2008-09 and the production was 3348 MT, the average being 977 Kg/Ha. Cashew nut processing industry located in West and South Garo Hills have not been very useful in improving the income of the growers and thereby the standard of living.

In view of this, cashew sub sector study was carried out in Selsella and Betasing Community Development Block, West Garo Hills; Gasuapara Community Development Block, South Garo Hills District during April-May 2014. At growers, traders processing unit level, information has been collected through present questionnaire, one to one interview and Focus Group Discussion.

**Issues and challenges on Cashew cultivation:**

- Soil erosion is a concern as terracing is not practiced hence soil erosion and leaching of plant nutrients are generally very common in cashew orchards of West and South Garo Hills.
- There is no rejuvenation of senile cashew orchard that takes place, which leads to some cashew plants dying.
- Plant protection measures against Tea Mosquito Bug (*Helopeltis Antonii*) and Cashew stem and root borer have not been initiated.

- There is a wide knowledge gap among cashew growers on the canopy management issues which effects their productivity.

**Issues and Challenges on Cashew Processing:**

- The Cashew processing industries do not use improved packaging and hence, this has an impact on the quality of cashew.
- Low cost cashew industry have not been established at the growers level, which is an important concern.
- At present procurement of raw nuts is done mostly based on personal experience and floating or cutting results forms criteria to fix up the price.

**Recommendations:**

Based on the findings the following recommendations were generated for action.

- Increase Agricultural Extension Services to cashew growers to meet the challenges of disease and pest and exploit private participation
- Inter cropping or mixed cropping during initial years of formative stage of cashew needs to be practiced as intercrops help to check soil erosion and utilizes soil water and solar energy.
- Re-organize, re-establish farmers interest group and promotion of farmer's federation
- Increase level of awareness of farmers regarding importance of cashew and other horticulture as profitable business activity through orientation and skill training.
- Organize exposure visit of farmers to cashew growing areas of Karnataka, Goa and train them in low cost processing.
- Investment in storage facilities and sensitization on quality control of processed cashew in processing units
- Establishment of market and trade information centres at district and State level

- There is a need to develop standards for raw cashew nut and have good storage management for raw cashew nut at producer level and envisage enhancing farmer processor interaction on storage aspect.
- Strengthening of Agricultural Finance credit for establishment of high density cashew orchards and low cost cashew processing industry for small cashew growers as the present credit system does not cover cashew growers.

# 1. Overview of the subsector

Cashew is grown in a wide variety of soils and more so in poorer soils under marginal condition of management as it is a hardy crop. Genetic diversity in cashew in our country is limited. This is because the cashew grown in any part of the country is basically from the same limited stock material introduced by the Portuguese in the 16th century.

## 1.1. National context

Cashew has been one of the most important dollars earning horticultural crop of our country. India was the first country to initiate and exploit the international trade of cashew kernels in the beginning of the 21st century and currently India has become the largest exporter of cashew kernels. Cashew, one of the most important commercial crops in India, produced 5.20 lakh tonnes of raw nuts from an area of 6.834 ha. This plantation crop is being grown in different states like Kerala, Karnataka, Maharashtra, Goa, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal and North Eastern States. In respect of productivity, the average productivity centres around 900 kg/ha with maximum of 1470 kg/ha in Maharashtra and minimum productivity of 540 kg/ha in Goa. The raw material wealth is a positive aspect for promoting processing industry. The importance of cashew (*Anacardium occidentale* L.) for the Indian economy has been due to its role as an earner of foreign exchange and also to its employment generating capacity in the processing sector. Cashew processing in India started as a small cottage industry and has developed into a highly organised labour intensive industry. However, in North Eastern India cultivation and processing is still at infancy level.

## 1.2. Meghalaya's Production Scenario

Vast area available in the hills of West and South Garo Hills presently being utilized for shifting cultivation provide an ample scope for area expansion of this plantation crop in the districts of Meghalaya. During 2009-10, West Garo Hills recorded a total production of 10468 MT with an average production of 2380 Kg per Ha while in South Garo Hills production was recorded as 3348 MT with a yield of 977 Kg per Ha (NABARD, 2013).

## 1.3. Production

Cashew plantation in West and South Garo Hills is done across the undulating terrain without proper soil conservation measures. Very isolated efforts are made by farmers of West Garo Hills under Selsella Development Block for area expansion through planting recommended variety of cashew. The average area of cashew orchard per family is 1 acre. 5% farmers in the West Garo Hills were found to undertake intercropping with pineapples. Most of the farmers practice occasional weeding and inter-culture operation; neither do they perform pest and disease control action nor do they perform manuring and irrigation. Most of the cashew orchards were found to be infested with weed and intensity of the infestation remains at low to moderate level. However, in no case chemical weed control is practiced. Tea Mosquito and stem borer are the major pests in the area.

## 1.4. Products

Farmers from South Garo Hills sell their cashew nut after sun drying for 1-2 days separating the Apple from the Cashew nut. However, West Garo Hills' farmers sell cashew nut without sun drying. Farmers get a farm gate price of INR 20-30 per Kg and on an average a farmer sells around 1-2 Quintal per year. On an average, sun dried cashew nut fetches INR 10.00per Kg higher than raw cashew.

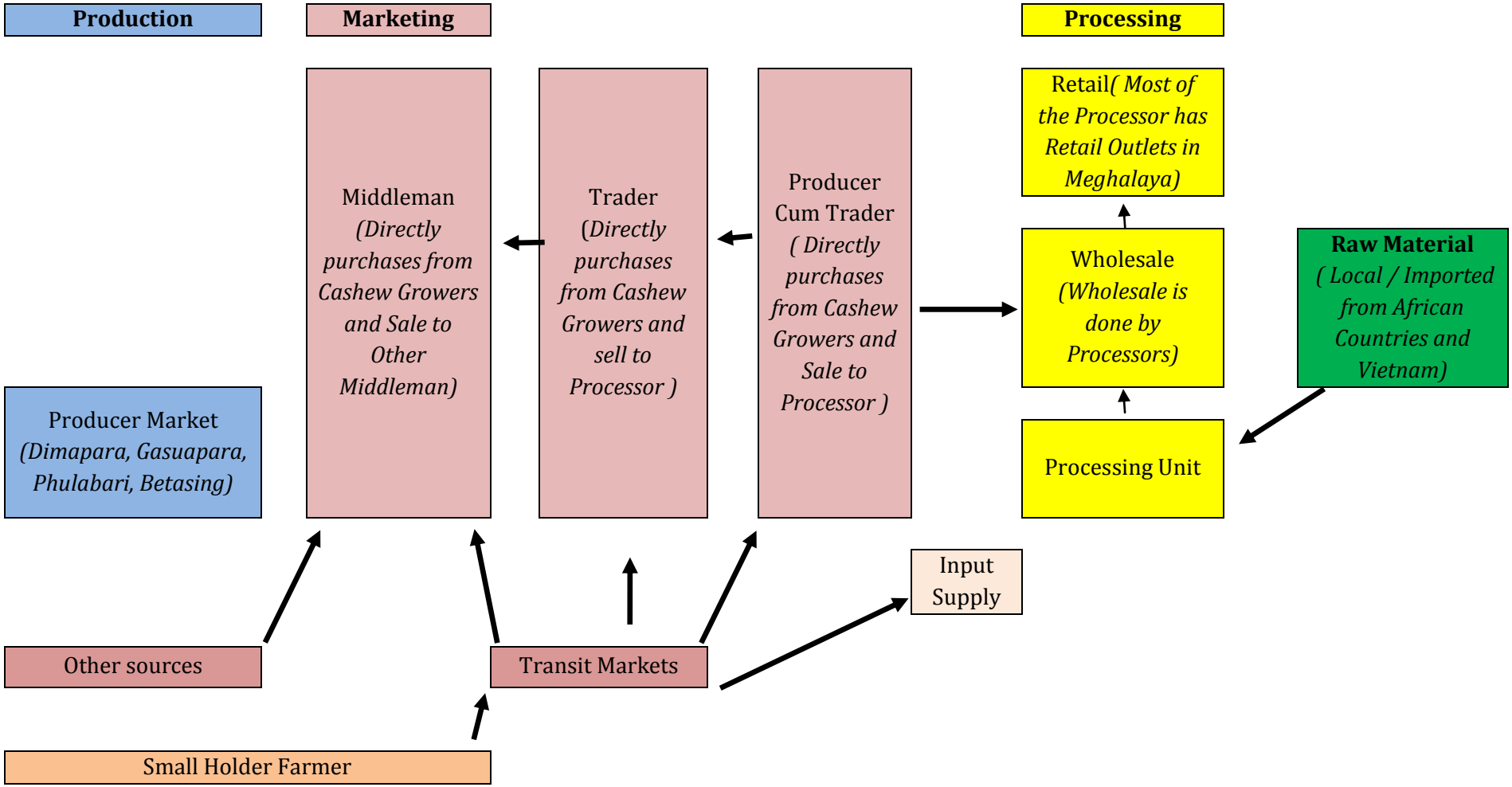
## 1.5. Market

Farmers sell cashew nut to middlemen who in turn sell it to the factory. These middlemen come from Dopagre, Doldoma, Phulbari and Betasing area of South and West Garo Hills and Mancachar, Assam. These middlemen put the Raw Material in the ordinary gunny bag and send to processing plant without pre-processing.

## 1.6. Employment

Farmers earn minimal cash from their cashew orchards and its production. Most of the farmer sale cashew weekly to the middleman or local traders and cannot sustain his/her living depending solely on the cashew orchard. On an average a farm family can sustain 1-2 months per year from income accrued from cashew orchard.

## 1.7. Subsector map



## 1.8. Economics at primary producer level

Pricing trend of cashew in West and South Garo Hills indicated that per kg of raw cashew nut fetches INR 20-30/Kg at farmers' level; however net profit at farmer's level after labour charges for plucking, removal of apple from the shell and drying comes around INR15-20 /Kg which is less than national average of INR35-40 /Kg. (See *Annexure 1* for the full economics of cashew production).

# 2. Preproduction stage – Inputs and process

## 2.1. Inputs

### *2.1.1. Variety*

Old orchards of South and West Garo hills have local varieties which have a low yield. The recommended varieties of cashew nut for Meghalaya are VRI 1, VRI 2, VRI 3, VRI 4, VRI (CW) H1, Vengurla 4, Vengurla 7 and BPP – 8 (H2/16). Most of farmers in Meghalaya have newly planted Vengurla-4 and Ullal-3 varieties of cashew nut from Goa and Karnataka through Govt. Sponsored schemes.

A National Group meeting on Cashew was convened in 1988 to finalise production strategy of different plantation crops. This group had suggested cultivation of several varieties of cashew in different states based on the varietal performance in different regions and their availability. However, no such recommendations were made for North East regions and Meghalaya in particular.

### *2.1.2. Sources of Planting Material*

Presently, most of the farmers do not get quality planting material due non availability of nursery in the adjoining areas. Planting materials were imported from Karnataka and Orissa for Government Sponsored programmes. However, a nursery located in adjoining area of Selsella Block called Aidoba in Assam partially fulfils the need of farmers of West Garo Hills.

### *2.1.3. Soil Management*

In general the crop has received minimum attention by the farmers. The crop is mostly raised in poor soil which requires proper management to enrich fertility level. In the case of lands owing to frequent exposure to weather conditions, particularly heavy rainfall, the top soil is almost completely eroded and the subsoil with poor nutrient reserve is exposed in elevated areas (observed mostly in South Garo Hills). If the crop is planted in such soils, the yield per tree is generally poor; terracing with catch pit followed by mulching is not followed. By and large, farmers from West and South Garo

Hills region do not practice soil conservation management because of lack of knowledge and skill involved on terracing.

### *2.1.4. Cost of the inputs*

The cost of planting material in West Garo Hills is INR 20- 25/ saplings including transportation. Farmers contribute the labour of digging pits and filling the pits with mixture of top soil and compost. However, farmers do not apply FYM (Farm Yard Manure) and fertilizer. Out of total area, hardly 1% receives proper management and crop is applied with fertilizer. Remaining area of the cashew is grown under natural systems and is indirectly growing under organic system. This could be a major strength for Cashew of Meghalaya as organically grown cashew fetches premium price.

### *2.1.5. Finance*

For a unit size of 1 acre with a spacing of 7m X 7m, with 82 plants the cost of cultivation stands at INR 46,800 which, as a loan, can be repaid over a span of 10 years. During the FGD, farmers from both South and West Garo Hills indicated that such financial assistance were the need of the hour.

## 2.2. Constraints at the pre-production stage

- ***Non availability of quality planting material within reach of farmer***

  Due to the kind of rough and hilly terrain in almost all the blocks in Meghalaya, it becomes very difficult for the farmer to access good quality material for Cashew plantation. Moreover, the quality of cashew saplings that is available to them is not good and hence, becomes a barrier for good quality and quantity production.

- ***Inadequate nursery of cashew in West and South Garo Hills***

  It has been seen that the nurseries for cashew in the West and South Garo hills among the other blocks of Meghalaya, is inadequate to meet the demands for the product. The number of nurseries itself is alarmingly low and hence, acts as one of the major constraints in cashew production.

- ***Existing agricultural extension services are not readily accessible to the farmers***

  There are some agricultural extension services that are available for cashew production in the pre-production stage. However, these existing services are not readily accessible by the farmer. This is again due to the undulating terrain and the far reaches of the cashew farms.

- ***Limited skills and knowledge of improved agricultural technologies resulting in low production***

  There has been quite a lot of advanced in agricultural technologies for cashew production and processing. However, the farmers and processing of Meghalaya have not been exposed to the same. This lack of knowledge and skills acts a constraint, causing low production of cashew in Meghalaya.

# 3. Production Stage – Activities and technology

Production is predominantly done by smallholder farmers in small acreages of 2-4 acre and a maximum of 5 acre (average: 1 acre/ 0.4 ha). Less than 5% farmers interviewed undertake canopy management in West Garo Hills. With proper canopy management, senile cashew orchards of South and West Garo Hills can become productive.

## 3.1. Agronomic Practices

Most of the farmers do not have knowledge on land preparation, manuring, irrigation, drainage. In addition to this, operations such as weeding, mulching, cover cropping, pruning, high density planting and intercropping. However, a few farmers have newly planted cashew in the pits of 60 cm X 60 cm X 60 cm (lbd) are opened at 7 to 8 metre distance either following square or triangular method and small channel above the pits have been opened to divert water to the sides during rainy season in lands with a slope. Unfortunately, the canopy is neither parallel to the ground nor vertically semi-circular because of lack of adequate after care.

## 3.2. Inter-cropping

Selection of intercrop is to be determined with short and long term perspectives, for immediate returns, and fuel trees for sustained income on a long term basis. Pineapple when grown as intercrop in the interspaces available between two rows of cashew plants enhances immediate returns. Both main and intercrop can be planted simultaneously. Less than 5% farmers interviewed undertake intercropping or mixed cropping in West Garo Hills. Farmers do not have the knowledge on methods to plough the interspaces after the receipt of rain and raise either pulses or minor millets till the trees reach bearing age. However, only about 10% farmers undertake turmeric cultivation as intercrop along with cashew nut in West and South Garo Hills.

## 3.3. Training and Pruning

Farmers do not have the knowledge of developing the trunk to a height of 1 m by removing low lying branches. Less than 5% farmers from South Garo Hills revealed that during 1$^{st}$ and 2$^{nd}$ years of planting flower panicles are to be removed to encourage

vegetative growth and frame formation. Only 10% of the farmers remove dried twigs and branches but not every year.

## 3.4. Management of Insect and pest

Farmers have shown apathy towards management of insect pests. There is an urgent need to control stem and root borer attack. The infestation is usually noticed during February- May as evidenced by egg laying during these months Mechanical removal of grubs and pupae from infested trees and phyto-sanitation by cutting the and burning infested trees are suggested measures. Whenever, new plantations are planted with grafts, swabbing on trunk up to one metre height and onto exposed roots using carbayl or lindane (0.2%) or painting a mixture of coal tar and kerosene (1:2) during March - April and November-December may be followed. Existing healthy trees can also be treated similarly. The newly planted grafts should be trained to have branching at a height of 0.75 to 1.00 m from ground level for better inspection and management operations. Besides, tea mosquito bug is also one of the most serious foliage and fruit pest of Cashew in this region which may be controlled using carbaryl (0.1%) and monocrotophos (0, 05%) is a suggested measure.

| | |
|---|---|
| First spray | Monocrotophos 36 EC (0.05%) - at flushing stage |
| Second spray | Carbayl (0.01%) - at flowering stage. |
| Third spray(if pest persists) | Carbaryl (0.1%) - at fruit set stage |

## 3.5. Constraints at the production stage

During FGD carried out by the study team, it was found that farmers of West and South Garo Hills did not maintain any proper spacing while planting cashew nut in their old orchards. Cashew plantation is done across the undulating terrain but they do not practice soil and water conservation measures; manuring and fertilization. Male members of the family are usually involved in weeding. 5% farmers in the area undertake intercropping with pineapples. However, most of these farmers practice occasional weeding and inter-culture operation; they do not undertake pest and disease control or manuring or irrigation. Most of the cashew orchards were found to get

infested with weed and intensity of the infestation remains at low to moderate level. However, in no cases chemical weed control is practiced.

- ***Low fertility of the soil***

  Due to undulating terrain and the hilly nature of land in Meghalaya, it has been reported that constant run-off that is the major cause for low fertility in the soil. The top soil is continuously eroded leading to poor quality of soil in almost all the blocks of Meghalaya. The soils of Meghalaya are derived from gneissic (*a high grade metamorphic rock*) complex parent materials; they are dark brown to dark reddish-brown in color, varying in depth from 50-200 cm. The texture of soils varies from loamy to fine loamy. Meghalaya soils are rich in organic carbon, which is a measure of nitrogen supplying potential of the soil, deficient in available phosphorous and medium to low in available potassium. The reaction of the soils varies from acidic (pH 5.0 to 6.0) to strongly acidic (pH 4.5 to 5.0). Most of the soils occurring on higher altitudes under high rainfall belt are strongly acidic due to intense leaching. Base saturation of these soils is less than 35 %. These soils are not suitable for intensive crop production. There is not much difference in fertility classes of the soils of the State. Four soils fertility classes, namely, High Low Medium (HLM), High Medium (HMM), Medium Low (MML), and Medium Low Medium (MLM) have been established from the soil test data so far compiled in the Soil Testing Laboratory of the State.

- ***The problems in the cashew nurseries***

  There is a less plant population per unit area in the nurseries where cashew is grown. Apart from this, there are inadequate clonal nurseries of cashew in West and South Garo Hills as mentioned in the previous section as well.

- ***Limited reliable and knowledgeable rural input suppliers for genuine inputs***

  There is limited reliable knowledge for the farmers for the kind of inputs to use for cashew production. Along with this, the poor harvesting practices are attributed to ignorance that reduces the quality of output as well as price bargaining power of farmers and ultimately their incomes.

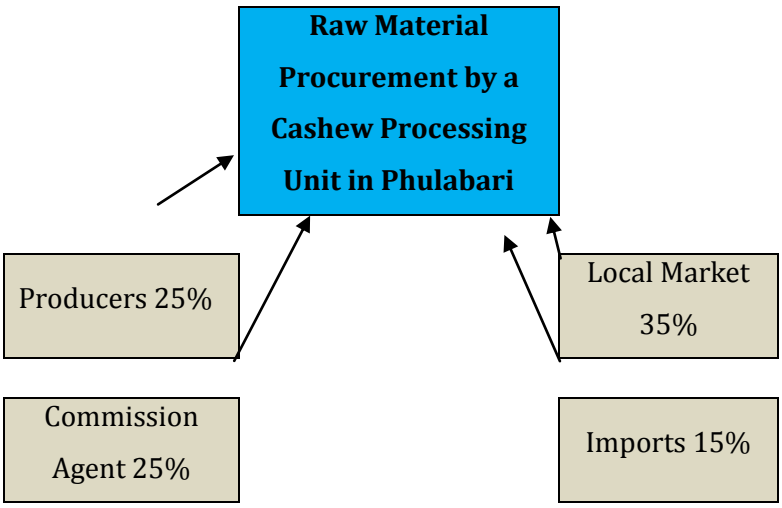
# 4. Post Production Stage – Raw Nut Procurement & Storage, Marketing and Value Addition

## 4.1. Raw Nut Procurement and Storage

### *4.1.1. Raw Material Procurement*

Cashew nut is a seasonal crop, harvesting of nuts in Meghalaya starts from May to June/ July. A good harvest alone does not ensure that growers shall receive economic benefit. In absence of aggregates and collective sale farmers do not obtain remunerative price. However in places like Dimapara and Gasuapara, very limited scale of collective sale of raw cashew nut takes places. It has been found that the processors obtain raw material in four ways.

- Directly from producers
- Direct purchase from local market
- Through commission agents
- Through imports




In order to run the factory through the year, the processing units in West Garo Hills under the study were found to import raw nut during off season from West and East Africa and Vietnam. In processing units normally visual test and floating test are conducted to assess the maturity of the kernels. In West and South Garo Hills ,

transactions are dominated by transit markets, lack of trust and opportunism, with very few contracts or long-term business relationships. This situation breeds speculation and opportunism, leading to distortions and loss of interest on the part of the producers.

### *4.1.2. Storage practices*

As cashew apples are not used for making pickle and jam in Meghalaya; growers simply discard the cashew apples after mature nuts naturally fall from the tree. They collect cashew by handpicking, and sell to markets but do not wash mature nuts prior to sun drying . Farmers from South Garo Hills separate cashew undertake sun drying for 2-3 days and separate kernels from the apple. However, they lack any mechanism to assess percentage of moisture in the sun dried raw material (Optimum being 8%). Most of the farmers store sun dried material in gunny bags for a few days prior to sale the product to the nearest market or to the middleman. They have a poor price discovery mechanism and have to negotiate in the hands of middlemen. In some cases, middleman come to village and price negotiations take place in the village. Presently there is no visible interaction that exists between the farmers and processors on storage management and other aspects of farm production aspects.

### *4.1.3. Access to storage practices: Presently farmers do not have any access to storage practices.*

## 4.2. Grading at Processor level

In Garo Hills, Cashew nuts are graded in 3 different grades *viz. 8J, 6J, and 4J*. Greater the size of kernel higher is the grade. However, some other inferior quality grade like ***2 Pcs (Pieces cs), 4 Pcs*** *and* ***Baby pieces*** *and* ***Gura*** are also obtained. Based on the grade, cashew price is determined. Whole sale price is around 10% less than the retail price. Following are the whole sale and retail price of processed cashew nut at in Tura during May 2014. (*Annexure 9* has the detailed process for testing the size of the kernels)

| Sl. No | Size Grade | Whole sale Price (INR) | Retail Price (INR) |
|---|---|---|---|
| 1 | 8J | 580.00 | 620.00 |
| 2 | 6J | 520.00 | 580.00 |
| 3 | 4J | 480.00 | 520.00 |

## 4.3. Local Value addition

Graded cashew nuts are packed in 9Kg Tin container and 500g Polypropylene container. ***Baby pieces*** *and* ***Gura*** obtained from the processing factory goes to local confectionary units.

## 4.4. Marketing

### *4.4.1. Market Access for the products*

90% of the processed Cashew nuts weighing 9.00 Kg are wrapped in a polypropylene sheet and sealed in a tin container and are transported to Assam. The shelf life of the processed cashew varies between 1 and 2 month. However, 1 kg and 500g packaging is also being done by processing factories in West Garo Hills.

Presently farmers do not have access to market information of raw cashew nut. This is because there is no established channel for getting information. Owing to the absence of such communication channels, Processors and middleman determine the price of raw cashew nut. In case of processed cashew nut, processors from West Garo Hills determine the price of finished cashew nuts of different grade. This is being calculated based on the cost of raw material; cost associated with processing and labours. Cashew processing industry engages women labour for size grading and polishing, the cost of labour is the main determinant in fixing whole sale and retail price of cashew nut in West Garo Hills.

### *4.4.2. Market Regulation*

Cashew nut processing plants in West Garo Hills have obtained Trade licenses from Garo Autonomous Council located in Tura. Pollution Control Board and other regulatory agencies play a very minimal role.

### *4.4.3. Market information*

Access and use of market information by farming community is very poor in West and South Garo Hills. Government and other agencies have not been able play supportive role in providing access of market information to farmers.

## 4.5. Value Addition

### *4.5.1. Value Added Products*

On a small scale, cashew nuts are processed by roasting nuts in a perforated pan. When nuts are roasted, Cashew Nut Shell Liquid (CNSL) from the shell leaks out and just gets burnt. The nuts processed by this method are usually contaminated with CNSL. Moreover, CNSL the important by-product cannot be recovered. Roasted nuts are shelled and kernels are removed. The quality of these kernels is poor.

One of the major concerns is that moisture content of the cashew nuts needs to be adjusted to 16%. This is very essential for releasing CNSL from the shell during roasting. Further, humidification of cashew nuts makes cashew kernels more rubbery which prevents breakage of kernels during roasting. The moisture content should not be increased too much nor should temperature not rise above 30°C. Such mechanism should be put in place so that tannins of the peel dissolve in water and p1p- penetrate into kernel. No other value added products in West and South Garo Hills except cashew nut are produced presently.

The entire process of post-production of Cashew is detailed in ***Annexure 10.***

## 4.6. Problems in Cashew Processing Industries

- **Procuring quality raw nut:** At present procurement of raw nuts is done mostly based on personal experience and floating or cutting results forms criteria to fix up the price. Moisture content of raw nut has strong bearing on quality of final product and fixing up the price. Therefore, raw nut moisture content along with prescribed quality standards have to be followed while fixing up the price
- **Enhancing shelf life of raw cashew nuts:** Fluctuating temperature is deleterious during storage due to condensation of moisture in the godowns at certain pockets and consequent microbial growth. Relative humidity plays a key role in safe storage of raw nuts as the nuts absorb or desorb moisture to maintain equilibrium with atmospheric relative humidity. Therefore equilibrium moisture content of raw nuts has to be determined. Presently such measures are not adopted by cashew processors in Meghalaya.

- **Increasing white kernel recovery:** In drum roasting the different operating parameters have to be optimized for various nuts origin in order to improve the whole kernel outturn.

- **Drudgery of women labourers in shelling process:** In order to minimize the drudgery of labours operating shelling unit and to avoid the effect of CNSL effect on the hands of the operator improved cashew shelling unit has to be developed. Presently no standard operating procedures are adopted at processing units in Meghalaya.

- **Phyto-sanitary Measures**: Cleanliness of processing units has to be given utmost importance. Authorities issuing license for cashew processing industries have to be very critical in this direction.

- **Export Market needs exploration**: Cashew processing industries need to explore export market and accordingly packaging and quality improvement need to be undertaken. The tin container needs to be hermetically sealed by infusing carbon dioxide. Besides, MVM (Moulded Vacuum Packing) to be initiated using nitrogen flushing which will remove oxidative rancidity.

- **Low cost cashew industry**: This need to be set up at growers level who has minimum 100 plants. Instead of selling raw cashew nut to middleman in the market at lower price , groups of farmers will be able process their raw nuts and finally process cashew kernel which has better demand in the market and in this way value addition of their product will nearly be double.

- **Storage of Cashew:** As both farmer and processor need to store raw cashew nut for long period prior to processing, it is required to develop standards for raw cashew nut and have good storage management for raw cashew nut at producer level and envisage enhancing farmer processor interaction on storage aspect. The study team did not find any such interaction between the groups on farm production aspects. As there is no standard storage system (SSS) and techniques are not known to farmers, quality of raw cashew nut becomes inferior and creates marketing problem.

- **Developing effective technology and entrepreneurship possibilities**: For Cashew Shell Nut Liquid (CSNL) and extraction of Cardol and Cadanol which is used for base paints, water proof materials effective technology needs to be developed. Production of bio-polymer degrading enzymes from cashew shell using need to be explored. Enzymes like pectinase, cellulose and lipase are industrially important and can be synthesized from cashew shell liquid. Such new initiatives may be taken up through entrepreneurs.

## 4.7. Possible Interventions at the post production stage

- Cashew processing industries need to explore export market and accordingly packaging and quality improvement need to be undertaken.
- Owing to high relative rancidity, the tin container needs to be hermetically sealed by infusing carbon dioxide. Besides, Moulded Vacuum Packing to be initiated using nitrogen flushing which will remove oxidative rancidity.
- Low cost cashew industry needs to be set up at grower's level that has minimum 80-100 plants. Instead of selling raw cashew nut to middleman in the market at lower price, groups of farmers ( Farmer' Interest Group) will be able process their raw nuts and finally process cashew kernel which has better demand in the market and in this way value addition of their product will nearly be double.
- As both farmer and processor need to store raw cashew nut for long period prior to processing, it is required to develop standards for raw cashew nut and have good storage management for raw cashew nut at producer level and envisage enhancing farmer processor interaction on storage aspect. The study team did not find any such interaction between the groups on farm production aspects. As there is no Standard Storage System (SSS) and techniques are not known to farmers, quality of raw cashew nut becomes inferior and creates marketing problem.
- Developing effective technology for Cashew Shell Nut Liquid (CSNL) and extraction of Cardol and Cadanol which is used for base paints, water proof materials.

- Production of bio-polymer degrading enzymes from cashew shell need to be explored. Enzymes like pectinase, cellulose and lipase are industrially important and can be synthesized from cashew shell liquid. Such new initiatives may be incubated through entrepreneurs.

# 5. Institutional Support mechanisms

## 5.1. Infrastructure

Cashew farmers do not have infrastructure for primary value addition i.e. drying and size grading. Presently these practices are carried out in yard with uncovered roof. A drying and size grading yard of 1000 sq feet would cost around INR 2.0 Lakh.

## 5.2. Input supply

There are no clonal nursery of cashew nut either in South and West Garo Hills. Presently seedlings are imported from Karnataka and Goa. The nursery located in Aidoba, Assam cannot fulfil the demand of the farmers. An informal estimate for South Garo Hills shows that demand of V-4, Jhargram variety Cashew seedlings is 1.56 Lakhs per annum.

## 5.3. Technology Transfer and capacity building

### *5.3.1. Training and technical assistance situation in the district*

There is an urgent need to undertake capacity building of cashew farmers on Agronomic Practices, Soil and water conservation measures, disease and pest management of cashew orchard. Besides, technical backstopping is required on low cost cashew industry for small cashew growers who have minimum 80-100 plants. Such low cost cashew industry shall help small cashew growers having 80-100 plants as instead of selling raw nuts to middleman in the market at lower price, group of farmers will be able to process their nuts and finally process cashew kernels. For such low cost cashew industry boiler can be gas, electricity or firewood and the cost of establishing would be around INR 6 Lakh.

## 5.4. Constraints in institutional support

It is high time to develop an institutional framework for supporting ailing cashew sector in West and South Garo Hills involving pre-production, production, processing and marketing. An Institutional Analysis and Development approach would be required to explore how community attributes such as socio-economic and cultural characteristics, rules and physical and material condition determine the outcome of such institutional design. Among all the stages of production and processing of Cashew, only production is

controlled by local people. Institutions are to be formed through active participation of the community and perform important functions of preproduction to production stage. In absence of proper support system, cashew growers have shifted interest to Rubber Plantation.

# 6. Constraints and Opportunities

- ***Production and Farm Management :***

  It has been observed that there is a continuous problem of disease and pest infestation of Cashew in South and West Garo Hills. There is inadequate knowledge of best agronomic practices as well that causes less yield of cashew. Another concern is the small acreage for growing cashew average being only 0.4 ha in comparison to other cashew growing states which is significantly higher than Meghalaya. The senile orchards are the cause for this low yield. Apart from these constraints, weak organization of farmers unable to undertake group marketing and low literacy and weak management of farmers groups are other causes for the low production of cashew.

- ***Marketing***

  There is a small volume of the cash crop on an average which is the cause for stiff competition between cashew and rubber growers in Meghalaya. This causes major issues in marketing.

- ***Processing***

  There is a low efficiency of processing units located in Phulbari in the West Garo Hills. Apart from this, common issues to the processing of cashew include lack modern knowledge on processing among workers in the processing plants and lack of equipment and facilities along with processing skills among small holders farmers.

- ***Finance***

  It has been reported that there is a limited accessibility of financial services for small scale farmers. This limited financing mechanism is seen for large scale investment in Processing of Cashew and production of CNSL and other by product as well. Lastly, there is a limited financing opportunity for contact farming which is a constraint for the quantity of cashew production in Meghalaya.

# 7. Constraints of cashew growers

## 7.1. Constraints

- **Poor transport networks:** limited communication infrastructure increase transaction costs for bulking affecting profit margins and the prices given to farmers by traders. Poor storage facilities reduces the quality and undermines faster bulking and consolidation of surplus in the supply chain
- **Lack of valid and reliable market information:** Traders rely on telephonic conversions with ***wholesalers***. Such information is often inaccurate, not targeted, not update and usually has no information about exports.
- **Limited business skills and competences**: The key areas are: knowledge of premiums price available for better quality; regional/international quality standards; knowledge of improved ***packaging*** options; current international prices and markets, sources of finance, and knowledge of better/improved technologies for use. The others which were also severely in short supply were: knowledge of value-adding and (further) processing opportunities and business planning.
- **Limited knowledge by traders about market requirements**/specifications has resulted in the ***mixing*** of crops from different locations and grades, which further reduces quality.
- **Limited knowledge on technology options:** by processors has resulted in a slow rate of ***technology*** adoption which in turn has limited processing efficiency and the production of new and improved products.
- **Inadequate enforcement of quality:** Inadequate enforcement of quality standards, weights and measure and lack of premium prices has undermined crop quality improvements in the supply chain.
- **Extortion threats:** Some believe that cashew processors have to pay a heavy tax to the extortion threats posed by militant groups. This is one of the reasons for not expanding the business to higher volume.

# 8. Recommendations

After the interviews and the FGDs conducted with the farmers and exploring the constraints in Cashew production, the following recommendations have been outlined based on the issues and challenges discussed in the previous sections. These have been divided in to three sections, so that at the various stages of the cashew production, recommended changes can be brought about.

## 8.1. Inputs and Preproduction stage

- It has been seen that the kind of cashew varieties that are used by the farmers are low. Hence, there is a need for **promoting high yielding cashew varieties** like VRI 1, VRI 2, VRI 3, VRI 4, VRI (CW) H1, Vengurla 4, Vengurla 7 and BPP – 8 (H2/16) among growers.
- There is an urgent need for evaluation of selections from germplasm and hybrid progenies for varietal evaluation trials so that varieties can be released for better performance in Garo Hills.
- To reduce the soil erosion and to conserve soil quality, the following **soil conservation measures** can be taken up to improve the soil fertility including Filling of natural gullies, Contour bunding and Terracing and Growing cover crop.
- As discussed there are no nurseries that are available to the cashew growers. Hence, it is very important to **establish cashew nursery in West and South Garo Hills** so that quality planting material can be made available to growers.
- As vegetative-propagated clonal progenies are true-to-type of the mother plant, give relatively more uniform yields and come to fruiting earlier than the seedling progenies needs, they need to be promoted to ensure better yield.
- Scientific studies are required to develop varieties with desirable characters such as bold nut, cluster bearing habit, compact canopy, high shelling percentage, high proportion of bisexual flowers etc.

## 8.2. Production stage

- To combat stem and root borer attack, **adoption of an integrated approach** including regular checking for infestation, mechanical extraction of grubs from stem and root region, as well as phyto-sanitation by removing severely infested trees, along with chemical control is quite obligatory

- **Promote high density cashew plantation** in Garo Hills with 4m×4m spacing for first 11 years, then subsequently 8m×5.6m×5.6m by removing alternate tree after 11 years of planting. Rejuvenation of senile cashew orchard should be immediately initiated by cashew growers.

- **Terracing with catch pits followed by mulching** to be initiated as soil erosion and leaching of plant nutrients are generally very common in cashew orchards of West and South Garo Hills.

- **Plant protection measures** against Tea Mosquito Bug (*Helopeltis antonii*) and Cashew stem and root borer to be initiated at growers' level by spraying monocrotophos @ 0.05% (1.5ml/l) at the time of new vegetative flush followed by 0.1%( 2g/l) at flowering stage followed by another spray of carbaryl at the same rate at the time of fruit setting. (For details on plant protection measures, refer *Annexure 8*).

- **Canopy management** in productive orchard to be initiated. Training and Pruning are highly essential practices in cashew cultivation. Pruning is to be done in 2-3 years depending upon the dead wood and age of the plants (*Annexure 6* has detailed process of Canopy Management).

- **Inter cropping or mixed cropping** during initial years of formative stage of cashew needs to be practiced as intercrops help to check soil erosion and utilizes soil water and solar energy. Suggested intercrops are Pineapple, Black pepper, Ginger, Turmeric etc. (See *Annexure 2* for details of using Pineapple as an intercrop with Cashew and annexure 7 for suggested intercrops)

## 8.3. Post Production stage

- At present procurement of raw nuts is done mostly based on personal experience and floating or cutting results forms a criteria to fix up the price. Moisture content of raw nut has strong bearing on quality of final product and fixing up the price. Therefore, **raw nut moisture content along with prescribed quality standards** has to be followed while fixing up the price.

- The ware house for raw nuts has to be given particular care to maintain the nuts at safer moisture level by controlling the environment of the ware house. **Control can be achieved through good ventilation** and usage of new fumigated bags is an effective measure against insect infestation. There should be free space between two stacks in a row for sufficient aeration.

- In drum roasting operating parameters have to be optimized for various nuts in order to improve the whole kernel outturn. Provision of maintaining uniform circulation of hot air at constant temperature throughout process in tunnel drier by providing thermostatic control.

- In manual peeling the production capacity is very much lower. Therefore, the **mechanical means to peel** the testa automatically has to be tried. Cooperative processing units may be promoted for processing and marketing.

- Cashew processing industries need to improve packaging and quality of processed cashew kernel. As presently, packaging is done in tin container or HDPE packet, due to humidity shelf life is 2-3 months. **Moulded Vacuum packing shall enhance shelf life of the processed kernels**.

- Instead of selling raw cashew nut to middleman in the market at lower price , groups of farmers will be able process their raw nuts and finally process cashew carnel which has better demand in the market and in this way value addition of their product will nearly be double.

- As both farmer and processor need to store raw cashew nut for long period prior to processing, it is required to **develop standards for raw cashew nut** and have

good storage management for raw cashew nut at producer level and envisage enhancing farmer processor interaction on storage aspect.

- **Developing effective technology for Cashew Shell Nut Liquid** (CSNL) and extraction of Cardol and Cadanol which is used for base paints, water proof materials
- Production of bio-polymer degrading enzymes from cashew shell using need to be explored.

## 8.4. Institutional support

For making cashew to be a commercially viable for growers and processors following institutional support may be considered

- **Strengthening village councils** and other local institutions to ensure optimal resource management of cashew orchard through soil and water conservation.
- **Set up infrastructure facilities** which would help facilitate rural, urban, national and international market access for producers by strengthening market linkage cum value addition units at strategically identified key locations in the West and South Garo Hills. **Producers meet, trade fairs,** and so on will enhance market linkages as presently the processors are selling to a few market outlets of Guwahati, Siliguri and Shillong who in turn is controlling the price.
- **Organize producers and processors** meet and trade fairs on cashew at District and State Level.
- **Credit support to be extended to Cashew farmers** who do not have infrastructure for primary value addition.
- **Development and promotion of sustainable cashew farming** especially organic and natural farming.
- **Initiate online information centres to provide local market information** to local producers and suppliers as well as those at National and International Level.

# 9. Viable Business Solution

During the study, several issues of like farmers apathy towards management of insects and pests; lack of business skill and competence of the cashew processors; poor adoption of technology options leading to limited processing efficiency have been noted. Considering the above, few viable solutions were generated in the fields which later have been enriched with secondary information.

- **Promotion of Cashew Nursery in South and West Garo Hills**, Meghalaya and ensuring availability of quality planting material to farmers could be one of the ways to ensure better production of cashew.
- **Developing customised capacity building support program** on basic agronomy, disease control, pest management and primary processing would also help increase the quantity of cashew.
- **Institutional strengthening of Farmers Group** and associations can also be a way forward.
- **Training of Micro and Small Cashew Processors** in processing, entrepreneurship development and business management.
- **Developing and effective Market Information** and estimation of Demand about farmer's clusters and communication and knowledge management strategy for rural business. Financing for high density cashew plantation and low cost cashew industry with gas or electricity operated boiler.

# 10. Recommendation

In order to revamp cashew industry in Meghalaya, the need of the hour is to undertake capacity building of cashew farmers on agronomic practices, soil and water conservation measures, disease and pest management of senile orchard and high density plantation with pineapple intercrop and enhance the efficiency of the processing units. However, based on the study following recommendations are generated for action.

- **Re-organize and re-establish Farmers Interest Group and promote federation***:* Government of Meghalaya to encourage and support the formation of farmer groups and cooperatives as an important strategy for improving cashew marketing and facilitated in terms of finance and human capital to promote cooperatives.

- **Improve road network and other communication systems:** Increase investment in road construction and maintenance in order to increase accessibility of farmers to marketing centre all year round. Allocation of funds to maintain the feeder roads in their localities and resources to maintain the roads.

- **Increased investment in storage facilities and ware house:** Government of Meghalaya to focus and encourage farmers to upgrade their storage facilities and promote establishment of community storage facilities.

- **Increase Agricultural Extension Services:** Government of Meghalaya to consider proposals for increasing enterprises promotion in cashew cultivation and processing by facilitating the extension services.

- **Establish market and trade information centre:** Establish market and trade information centre in West Garo Hills and strengthened the centers financially through increased budgetary allocation to enable them collect, store and disseminate market information. Government of Meghalaya should establish an effective agricultural marketing information system so as to boost both domestic and export marketing.

- **Establish credit linkage:** Government of Meghalaya may establish commodity specific credit financing schemes in order to mitigate the financial constraints arising out of the existing financing systems – which are currently dominated by private money lenders.

# 11. Conclusion

The study observes that cashew production in India has been increasing which means the area under cultivation has increased over the years. Due to its high demand in the international markets, it is export oriented and hence is called a dollar earning crop of the country making it an important cash crop. Particularly the north-east regions, Tripura, Meghalaya, Assam and Manipur have a somewhat vibrant cashew production. However, in Meghalaya cashew cultivation has not become an important commercial crop due to the production of cashew fluctuating from year to year due to factors including changing weather and lack of upkeeping of cashew orchards. Cashew nut is extensively grown in West and South Garo Hills. However the bulk of the produce is sold outside the state in the form of raw product, calling for processing of Cashew to take place in the state itself.

There have been some strategic efforts by the Government of Meghalaya and more attention has been given towards agricultural diversification and productivity enhancement in the recent past but is unfortunately scanty. The worth and the potential of Cashew in the state has been recognized by the Government of Meghalaya. Other stakeholders like the directorate of Horticulture are exploring new avenues for boosting up cashew nut cultivation under different on-going schemes with a view to boost cashew production in the state. However, these efforts have been done at an individual and small-scale level. There is a need for concerted and joint efforts from these various departments and stakeholders to work together for ensuring that the maximum potential of cashew is reached in the state of Meghalaya. There is a need for a determined policy shift to structure development interventions in this area where the small-scale and large-scale farmers can play a crucial role. Inputs, structures and processes that augment the production of cashew in Meghalaya need to be considered as an important development intervention.

Among many constraints, some major strategic constraints include limited skills and knowledge of improved agricultural technologies resulting in a very slow rate of technology adoption, high post-harvest losses, poor quality products and generally low production levels. As seen in Garo Hills, the transactions are dominated by spot markets, lack of trust and opportunism, with very few contracts or long-term business relationships. Apart from these, technical constraints like soil erosion and leaching of plant nutrients is common and no efforts are being extended to prevent soil erosion, for example. There is a wide knowledge gap between and amongst cashew growers on technological enhancements and changes made in the production of cashew at the larger scale, along with lack of awareness on plant protection measures.

Thus, the study has aimed to bring out some major recommendations to ensure that cashew production for small farmers as well as large scale production is enhanced. These include suggestions to the government of Meghalaya to consider like encouraging and supporting the formation of farmer groups and cooperatives and increasing investment in road construction. Since availability of credit for the farmers is low, the Government of Meghalaya should establish commodity specific credit financing schemes.

Considering that such recommendations, explored in the report, are taken up seriously and they are implemented, there can be a change in the number of farmers keen on taking up cashew farming. Finally, if some measures are taken by the stakeholders, it is quite likely that Meghalaya will become an important hub in Cashew nut production not only in the region but in the country.

# Annexure-1: Economics of Cashew Plantation

| Item of works | High density* 4 m x 4m | Normal density** 8 m x 8m |
|---|---|---|
| Jungle clearance and Weeding | 3130 | 6950 |
| Opening pits, filling with top soil and planting cashew grafts | 580 | 145 |
| Cost of planting material | 1250 | 312 |
| Terracing | 945 | 480 |
| Removal of side shoots | 70 | 56 |
| Cost of fertilizers and pant protection chemicals | 24367 | 9687 |
| Application of fertilizers | 5025 | 3750 |
| Spraying Chemicals | 1847 | 1312 |
| Pruning overlapping branches | 550 | - |
| Thinning out trees and stacking wood | 2720 | - |
| Picking nuts | 1800 | 1246 |
| Total cost of production | 42283 | 24093 |

* 4m x 4m for the first 11yrs and 8m x 5.7m x 5.7m after that (625 trees /ha for first 11yrs and 312 trees/ha after that)

** 8m x 8m (156 trees/ha)

| Returns and Net profit (Rs) | High density | Normal density |
|---|---|---|
| Total fuel wood produced (tonne) | 36.84 | 0.0 |
| Income from fuel wood | 16720 | 270 |
| Cumulative cashew yield (tonne/ha) | 4.944 | 2.275 |
| Income from nuts sold in different years | 1,02,617 | 50,024 |
| Total income | 1,19,337 | 50,249 |
| Net profit as on 12th year | 70,054 | 26,201 |

(Source: NRCC, 2001)

## Annexure-2: Pineapple cultivation as intercrop in one hectare cashew garden for the first 7 years (NRCC, 2007)

| | |
|---|---|
| Spacing for cashew (Main crop) | 7.5 m x 7.5 m (175 plants/ha) |
| Variety | M 10/4 |
| Spacing for pineapple (Intercrop) | 2 rows in each trench of 3600 m length, 1 m width and 0.5 m depth. Distance between two rows of pineapple is 60 cm and between two plants in a row is 40 cm. Three such trenches are opened at 90 cm distance between two rows of cashew |
| Variety | Kew |

| **Field Operation** | **Man days** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1st Year** | **2nd Year** | **3rd Year** | **4th Year** | **5th Year** | **6th Year** | **7th Year** | **Total** |
| Opening trenches of 0.5 m width, 0.5 m depth and 3600 m length totalling 1800 cubic metres of soil to be dug out. | 150 | - | - | 75 | - | - | - | 225 |
| Planting pineapple suckers in the trench after mixing organic manure, rock phosphate and mulching | 39 | - | - | 39 | - | - | - | 78 |
| Weeding | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 84 |
| Fertiliser application and earthing up | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 90 |

| **Field Operation** | **Man days** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1st Year** | **2nd Year** | **3rd Year** | **4th Year** | **5th Year** | **6th Year** | **7th Year** | **Total** |
| Covering the fruits with dry grass and tying crown leaves to protect from sun scorch and from crow and rodent damage | - | 15 | 10 | 10 | 10 | 10 | 10 | 65 |
| Harvesting of fruits | - | 15 | 8 | 8 | 8 | 8 | 8 | 55 |
| **Total mandays** | **213** | **55** | **43** | **157** | **43** | **43** | **43** | **597** |
| **@ Rs. 60/manday** | **12780** | **3300** | **2580** | **9420** | **2580** | **2580** | **2580** | **35820** |
| **Input (Rs.)** | | | | | | | | |
| Cost of pineapple suckers for 15624 suckers @ Rs. 0.50/sucker | 7812 | - | - | - | - | - | - | 782 |
| **Cost of organic manure** | | | | | | | | |
| Cow dung or compost for 9000 kg @ Rs. 0.50/kg @2.5 kg/metre length of 3600 m length trench | 4500 | - | - | 4500 | - | - | - | 9000 |
| **Cost of fertilizers** | | | | | | | | |
| Urea (@26.4 g/plant) for 410 kg @ Rs. 3.66/kg | 1500 | 1575 | 1654 | 1737 | 1824 | 1915 | 2010 | 12215 |
| Rock phosphate (@20 g/plant) for 312 kg @ Rs. 2.20/kg | 686 | 720 | 756 | 794 | 834 | 876 | 920 | 5586 |

| **Field Operation** | **Man days** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1st Year** | **2nd Year** | **3rd Year** | **4th Year** | **5th Year** | **6th Year** | **7th Year** | **Total** |
| Muriate of potash @ 19.2 g/plant for 300 kg @Rs. 3.70/kg | 1110 | 1166 | 1224 | 1285 | 1349 | 1416 | 1486 | 9036 |
| **Total cost of input (Rs.)** | **15608** | **3461** | **3634** | **8316** | **4007** | **4207** | **4416** | **43649** |
| **Total cost of cultivation (Rs.)** | **28388** | **6761** | **6214** | **17736** | **6587** | **6787** | **6996** | **79469** |
| Yield expected from pineapple as inter crop (kg/ha) | - | 10000 | 4500 | - | 8000 | 4500 | 3500 | 30500 |
| Extra pineapple suckers produced | - | - | 4600 | - | - | - | - | 4600 |
| Cost of pine apple @ Rs. 6/kg and Rs. 0.50/ pineapple sucker | - | 60000 | 27000 & 2300 | - | 48000 | 27000 | 21000 | 185300 |
| **Net profit** | **-28388** | **53239** | **23086** | **-17736** | **41413** | **20213** | **14004** | **105831** |

## Annexure-3: Addresses of a few firms manufacturing machinery required for cashew processing industry

Royal Industries

No 21, Rathinam Garden

Saidapet(west)

Madras 600 015

Apnaa Indusries

M 2, Industrial Estate

Guindy, Madras 600 032

Abhay Engineers

Kamath's Industrial Estate

Hoige Bazar

Mangalore 575 001

Vinayaka Engg. Works

Plot No 254, 8th A Road

Industrial Area

Bakampadi, Mangalore 575 011

Royal Metal works

Kondivilla Lane

J B Nagar Post

Andheri, Bombay 400 059

## Annexure-4: List of farmers present during Focus Group Discussion carried out by the study team in South and West Garo Hills, Meghalaya

**District: South Garo Hills, Meghalaya**

**Area: Gasuapara Community Development Block**

**Date: 29/04/2014**

**Place: Gandugre Village**

1. **Name of Key Informant** : Claris Sangma
2. Roiju Sangma
3. Moinu Sangma
4. Annas Sangma
5. Nokhang D sangma
6. Leena Sangma
7. Bhudit Sangama
8. Jeenu Sangma
9. Gensing Marak

**Place: Kasigre Village**

1. **Name of Key Informant** : Chaongtop Momin
2. Albert Sangma
3. Marthan Momin
4. Mendar Sangma
5. Gibison Sangma

**District: West Garo Hills, Meghalaya**

**Area: Betasing Community Development Block**

**Date: 06/04/2014**

**Place: Asangre Village**

1. **Name of Key Informant** : Mansing Sangma

2. Piush R Sangma
3. Kremithson Momin
4. Arbitsone Sangma
5. Anjelela Marak
6. Miathlina Marak
7. Krinis Marak

# Annexure-5: Suggested Agronomic Practices

**1. Land preparation and sowing cover crop seeds:**

With the onset of monsoon the land must be cleared of all bushy growth and noxious weeds. Soon after the receipt of pre-monsoon showers the stumps of bushy growth should be uprooted and the noxious weeds are also uprooted when the soil is soft with moisture. Soon after that with the onset of actual monsoon season the cover crop seeds should be sown @ 7.5 kg seeds per hectare on the contour bunds if the land is with a slope and also in the interspaces of the rows of main crop proposed to be planted. The seeds are sown by loosening top soil enriched with farm yard manure.

The pits of 60 cm x 60 cm x 60 cm (lbd) are opened at 7 to 8 metre distance either following square or triangular method. Hedge row system of planting can also be adopted ( the distance between rows 10m and between plants within row 5m). The size of pits is upto 1m x 1m x 1m in soils with hard pan or hard laterite substratum. Opening the pits along the contour line is preferred in areas with a slope. The pits have to be filled with mixture of top soil, compost (5 kg) or poultry manure (2 kg) and rock phosphate (200 g). A small channel above the pit is opened to divert water to the sides during rainy season in slopy lands. The run off water should not accumulate in the pit which causes water stagnation during rainy season.

**2. Planting:**

Planting is done preferably during the first week of June with the onset of monsoon. The soil in the centre of the filled up pit is scooped out. The polythene bag containing graft covering the root and soil is removed carefully and the graft with ball of earth intact is separated. The graft is placed gently in the centre of the pit where soil was scooped out and covered with soil and pressed gently. The graft is planted in such a away that the graft union is above the soil level. Sprouts below the graft union on the root stock are removed with the help off sharp knife. Plastic ribbon covering the union is removed if not done already. Later mulch is provided at the base around the plant to prevent soil disturbance during rainy season and also to suppress weed growth and conserve moisture in the soil. The plant is then staked by erecting. 1 m sticks and loosely tied with coir or plastic string.

**3. After care:**

Sprouts emerging from the rootstock are removed at regular intervals as and when seen. The graft should be allowed to grow by maintaining single stem upto 0.75 to 1 m height by removing sprouts or side shoots not only below the graft union (stock portion) but also above it (only side

shoots on the scion portion are removed allowing apical bud to grow). Staking the plant in the second year also by replacing the spoiled and weak support fixed in the first year with strong stick is necessary. When the plant grows to a height of 0.75 to 1 m with single stem, the graft is likely to lodge due to wind blow and hence it has to be staked in the second year also with a strong support. The flower panicles emerging later in the season need to be removed during the first two years of growth of the graft to boost up proper vegetative growth and thereby achieving proper height and good canopy. The plants are allowed to flower and fruit from third year onwards. Weak and criss- cross branches are to be removed leaving 4 to 5 strong ones. The canopy of the plant should be round parallel to the ground and vertically semicircular. Jettisoning branches on one side only when noticed should be pruned for providing round and compact shape to the plant (open umbrella shape).

Root distribution of a 10 year old cashew trees revealed that more than 90 per cent of the cashew roots are within 2 m radius and maximum depth up to which roots extended was 9.5 m. But more than 90 per cent of the cashew roots are found within 1m depth. The cultural operations should then be restricted to 1 m depth and 2m radius around the trunk of the tree, so that whatever nutrients applied can go to the root zone. Cashew is commonly grown on land with a slope in west and east coasts. Soil erosion and leaching of plant nutrients are generally expected in such situations. To avoid soil erosion terracing and catch pit opening are essential.

**4. Terracing and opening catch pit :**

In the second and third year, terrace of 1.8 m radius around the trunk of the plant is to be formed in areas with a slope by cutting the soil across the slope and spreading below. A catch pit across the slope at the periphery end of terrace is to be provided for withholding water during pre-monsoon and post monsoon shower in areas with a slope. A small channel connecting the catch pit-sidewise is to be provided to drain out excess water during rainy season.

**5. Manuring :**

- Application of 10-15 Kg FYM or compost per plant every year.
- The recommended dose of fertilizer by National Research Centre for Cashew is 150 g N, 125G P2 O5 and 125 g K2 o per plant per year It is advisable to use straight fertilizer instead of complex fertilizer

**Recommended dose of fertilizer are as follows**

| Years of Planting | Dose (g/plant) | | |
|---|---|---|---|
| | Urea | Rock Phosphate | Muriate of Potash |
| 1st Year | 330 | 125 | 40 |
| 2nd Year | 660 | 250 | 80 |
| 3rd Year | 990 | 375 | 120 |
| 4th Year | 1320 | 500 | 160 |
| 5th Year | 1650 | 625 | 200 |

## 6. Irrigation and drainage:

Cashew being a hardy crop with extensive root system can absorb soil moisture from deeper layers and in general the crop is not irrigated. However, in initial stage cashew may require irrigation in summer especially in sandy soils. The experimental results showed that with irrigation cashew yield can be increased to 1.5 to 2 times. For a grown up tree i.e., four years onwards irrigating @ 200 litres per tree once in fifteen days from January to March is beneficial. Drip irrigation right from planting up to seven years @ 60-80 litres per tree once in four days was also found equally beneficial. Care must be taken to see that plants are irrigated only after flowering. Depending upon varietal character irrigation should be started one or two weeks after flowering. Hence, wherever irrigation facilities are available, the crop can be irrigated to get more yield and profit. Cashew cannot withstand water stagnation, flooding or impeded drainage. Adequate drainage should be provided wherever there is possibility of water stagnation.

## 7. Weeding:

Weeds may compete for nutrients, moisture and also for light with cashew plants. Keeping the cashew orchards free of weeds is one of the important aspects of management. The first round of weeding may be done before heavy rains and fertilizer application (June) and the second weeding may be taken up during fertilizer application which falls normally in the month of August-September. Weeds have to be slashed or uprooted before seed setting in weeds so that multiplication of weeds is reduced considerably. In the initial two to three years of the establishment of graft in the main field, weeds are to be removed 2 m around the plant. The weeds prevailing in the remaining interspaces are to be slashed twice annually.

## 8. Mulching:

Mulching the cashew plantations with organic matter prevents weed growth, reduce surface evaporation, during summer regulates the soil temperature, improves the soil fertility and also

prevents soil erosion. Therefore, green matters obtained during weeding may be utilized for mulching the plantations at the base of the respective trees.

**9. Pruning:**

Cashew is sun loving tropical tree and does not tolerate excess shade. Providing uniform sunlight to each and every part of the canopy therefore assumes major importance to increase the production. Though regular pruning is not advisable for cashew owing to its exuding gum resins from the cut ends, whenever the trees and branches are overcrowded the excess branches may be removed for facilitating uniform and maximum interception of sunlight by the crop canopy.

# Annexure-6: Suggested Canopy Management

Training and pruning are essential management practices in Cashew

**Training:**

- Training is done in the initial years
- During 1st and 2nd years of planting flower panicles are to removed
- Stacking should be provided
- The lower branches are gradually removed with the help of secateurs during initial 4-5 years of planting
- Branches are evenly spaced by pruning unwanted criss cross branches
- The mature plants are detropped at 3-4 m height and a semi globular canopy to be maintained

**Pruning:**

- Water sprout, crown suckers, dead branches/ twigs are removed
- About 60% of leader shoots ( 1-2 years old laterals) are to be pruned by pruning back at two third lengths
- Pruning at least in 2-3 years is necessary depending on amount of dead wood and age of plant

## Annexure-7: Suggested Inter crop

- Pineapple  can be grown in between cashew trenches of 1m width and 0.5m depth for 7 years from planting
- Black pepper can be grown allowing them to trail in the stems and braches for 6 years
- Ginger can be raised in the initial 3-4 years of cashew plantation
- Turmeric can be taken up for 7 years from planting

## Annexure-8: Suggested Plant Protection

- Tea Mosquito Bug (Helopeltis antonii) is to be controlled by sparying monocrotophos and carbaryl at different times. Monocrotophos @0.05% ( 1.5ml/l) is to be given at the time of new vegetative growth followed by carbaryl @ 0.1% 92g/l) at flowering stage. This should be followed by 3rd spray of carbaryl at the time of fruit setting at the same rate.
- To save plants from the grub of Cashew Stem and Root borer attack, infested part is to be chiselled out to find the grub hidden in tunnels and then physical removal is to be done with prophylactic swabbing of carbaryl 1.0% soluation. Examination of roots and collar region is most essential to detect insect infestation.

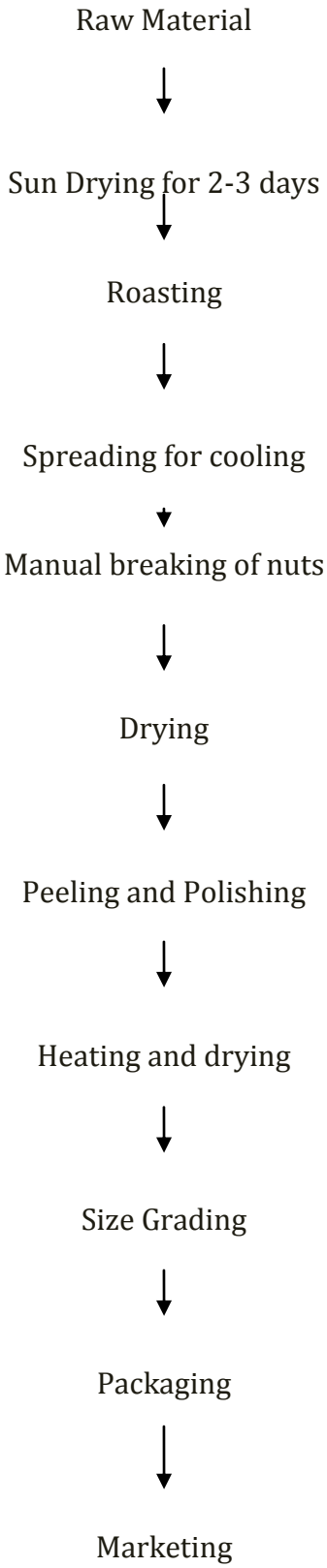
## Annexure-9: Test for assessing maturity of kernels

While procuring the nuts, normally 3 tests are conducted by the processors, they are;

| | | | |
|---|---|---|---|
| i) | Visual test | : | Size and color of the nuts to check the maturity |
| ii) | Floating test | : | About 5kg of sample is put in a vessel containing water. After continuous stirring floaters are collected and counted. Mostly immature nuts, due to its lower density than water, improperly filled nuts and deteriorated nuts floats. Based on the percentage of floaters the raw nut price is fixed. |
| iii) | Cutting test | : | Raw cashew nut sample of 5 kg is collected from different bags and mixed together. 1 kg raw nut is taken from the bulk and cut open using hand cutting tool. Based on the kernel appearance ie., white, shriveled dotted or rejects, the percentage of good kernel is calculated. This also forms a basis for fixing the price. |

## Annexure-10: Flow chart for Cashew Processing

**Flow chart for Cashew Processing:**



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