



Agri-Business Management Opportunities and Challenges

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CONTENTS

Sl. No.	Title and Author Name	Page No.
1	Internal factors affecting the successful growth and survival of small and Micro Agri-Business firms in Kenya Grace Gathoni Kimaru, Paul Maina Mwangi and Alice Wangui Gichuki	1-5
2	Wine making as agribusiness in Karnataka – new market for entrepreneurs Ashwini Balakrishna S Kumar and A. P. Achar	6-11
3	Impact of soil and crop management farmer field schools on farming systems and productivity among smallholders in north rift, Kenya David K. Bunyatta, Christopher A. Onyango and Joash K. Kibett	12-20
4	Retaining youth in agriculture- an opportunity for transforming agribusiness sector Madalitso Zelda Chidumu	21-22
5	Increasing access to dairy information through radio dairy extension Njuguna D.M., Mwenze P. Awino J.	23-26
6	ARSHAK MITRA CENTRES Caring Farmer- "Farm to Fork" George James and Rakhi C M,	27-32
7	Agriculture sector gender, HIV/AIDS strategy (2012-2017) implementation plan Ian Madalitso Saini	33-35
8	Labor and Agribusiness in India - the inseparable union Joe Correa and A.P. Achar	36-39
9	Kisan Credit Card- A tool in Agricultural Finance Lokesh, Dr. Ishwara and Vishal Samartha	40-42
10	Soil quality and land suitability mapping for alternative development scenarios in the mara ecosystem: a tool for land use planning. Zachary Gichuru Mainuri, Edward M. Muya, Peter O. Owenga and Joseph.K.Ngetich	43-49
11	Entrepreneurship driven post harvest processing and value addition technologies of coconut M.R.Manikantan, M.Arivalagan, A.C.Mathew, K.B.Hebbar, T.Arumuganathan, K.Madhavan And S.J.Don Bosco	50-54
12	Agribusiness management a stepping stone towards a better standard of living Nelson Marwin Fernandes and Vishnu U. Pujari	55-59
13	Issues and challenges of women in agribusiness: a study with special reference to betel leaf sellers Preethi Keerthi Dsouza	60-63

ENTREPRENEURSHIP DRIVEN POST HARVEST PROCESSING AND VALUE ADDITION TECHNOLOGIES OF COCONUT

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ABSTRACT: The coconut palm exerts a profound influence on the rural economy and provides sustenance to more than 10 million people in India. The problems of decline in the prices of coconut and its products due to local as well as international competition, acute shortage of skilled manpower necessitated the need for development of broad based entrepreneurship driven processing technologies for the sustainable growth of the industry. The processing and related activities can mitigate the seasonal price variation and generate income and employment opportunities for over two million people in India. Hence, there exists a huge scope for coconut based agri-business in India. At CPCRI, equipments such as copra dryer using different energy sources, coconut splitting device, coconut deshelling machine, snowball tendernut machine, coconut grating machine, tender coconut punch and cutter, power and pedal operated slicing machine (for coconut, potato, banana and tapioca), coconut testa remover, coconut pulverizer, blanching unit for coconut, coconut chips dryer (Electrical and agricultural waste fired), coconut flaking machine, manual and hydro-pneumatic coconut milk expellers, single and double screw milk expellers, virgin coconut oil cooker (LPG/steam/agricultural waste fired), fermentation tank and chamber for virgin coconut oil production have been developed for integrating various unit operations in coconut processing and thereby completing the value chain in coconut. The technologies for the production of copra, snowball tender nut, sweet and medicated coconut chips with different flavors, coconut grits and desiccated coconut for chutney and different food formulations, hot and fermentation process virgin coconut oil, virgin coconut oil meal based extrudates, confectionery and bakery products have also been developed.

Keywords: Coconut, Postharvest, Processing, Entrepreneurship, VCO, Chips

INTRODUCTION

Coconut is the only tropical crop commercially cultivated extensively in about 93 countries with an area of 11.98 million hectares and production of 58.42 million MT. Widely acclaimed as Kalpavriksha or Tree of Heaven, it provides food security and livelihood opportunities to 20 million people around globe and 10 million people in India through cultivation, processing, marketing and trade related activities and thus it exerts profound influence in rural economy. The coconut-based economy can expect a revival from the negative impact of liberalised imports only when the profitability of coconut farming is delinked from the price behavior of coconut oil. This is possible to achieve through efficient utilization of the land under coconut cultivation and post harvest value addition activities. As compared to the tardy growth recorded by the country in the processing sector, most of the coconut growing countries are making profit from the production and exports of diverse coconut products. Exploiting the potentials of this crop by enabling production of value added products will help to get the farmers sustainable income. The processing and related activities can mitigate the seasonal price variation and generate income and employment opportunities for over two million peoples in India. Hence, there exists a huge scope for coconut based agri-business in India. Although possibilities are wide it is prudent for us to concentrate on selected products, which could compete price- wise and quality- wise both in the domestic and export markets. This paper deals with the various entrepreneurship driven post harvest and value addition technologies of coconut.

PRODUCTS DERIVED FROM FRESH KERNEL OF MATURED COCONUT

The fresh kernel of ripe coconut constitutes an essential ingredient in the recipes of diverse food preparations in the households as well as in food industries of different countries. In the fresh kernel processing industries, shelling and removal of testa are the common labour intensive unit operations. Central Plantation Crops Research Institute (CPCRI), a nodal coconut research institute has developed coconut desheller and testa remover.

The batch type coconut de-shelling machine having a capacity of 400 half cups per batch is to separate partially dried shell and copra and efficiency is 92%. The optimum speed of the de-shelling machine is 10 RPM and the time taken for de-shelling was 4 minutes per batch. Estimated cost of de-shelling machine was worked

out to be Rs. 50,000/-. CPCRI has also developed desheller of 150 nuts/h capacity for fresh coconuts.

The testa remover consists of a circular wheel covered with an emery cloth or water paper. This friction wheel is rotated using an electric motor. Coconut kernel is pressed to the surface of the rotating friction wheel either by hand or using a fork. Removed testa is collected at the bottom. The emery cloth/ water paper needs to be replaced periodically when the surface gets smoothened. One person can remove testa of about 75 coconuts per hour. Fabrication cost of the machine is Rs.25,000/-. 25% of the time and labor can be saved by this machine.

Desiccated coconut

Desiccated coconut is the white kernel of the coconut, comminuted and desiccated to a moisture content of less than 3%. CPCRI has developed coconut grater, pulverizer and dryer for making desiccated coconut. It is a very important commercial product having demand all over the world in the confectionary and in other food industries, as one of the main subsidiary ingredients of fillings for chocolate, candies, etc. It is also used as decoration for cakes, biscuits, ice cream and toasted for short eats.



Coconut
deshellers

Coconut
desheller

Coconut
testa
remover

Coconut
grater

Coconut
pulverizer

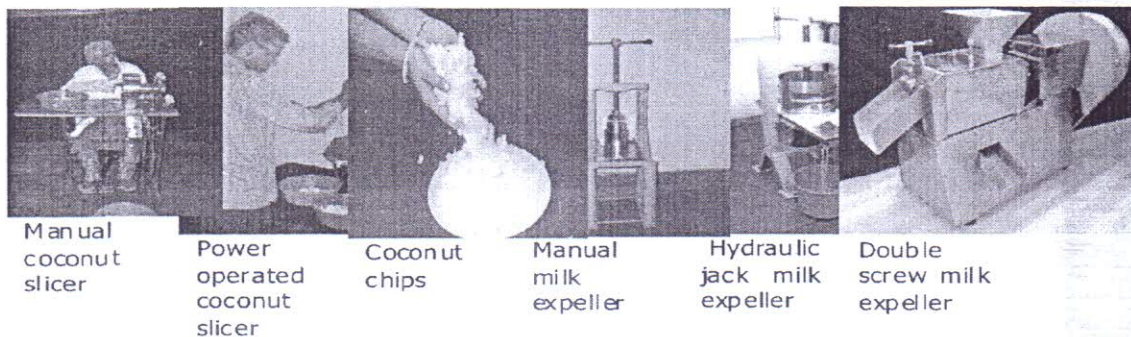
Dryer

Coconut chips

Preparation of coconut chips is a simple technology and the process includes paring, slicing, osmotic dehydration and drying. Coconut chips can be prepared by drying the partially dehydrated coconut kernel by osmotic mediums like sugar syrup or salt solution. It is in crispy ready-to-eat form and can be packaged and marketed in laminated aluminium pouches, which will have shelf life of 6 months. Coconut chips with different flavour can be prepared by adding the required flavour essence in the osmotic medium. Chips can be fortified by adding carrot juice/beetroot juice in the osmotic solution. The machines required for chips making are shell remover, paring machine, slicer, osmotic dehydration tank and dryer. CPCRI has developed both manual and power operated coconut and multi crop slicing machine for making coconut chips. The capacity of the power operated machine is 60 nuts/h and the approximate cost is Rs.50,000/-. The capacity of the manual operated machine is 25 nuts/h and the approximate cost is Rs.15,000/-.

Coconut milk

Coconut milk is an emulsion of coconut oil in water obtained by pressing the gratings of the fresh. A comparison of the coconut milk with cow's milk has shown that coconut milk is richer in fat, poorer in protein and sugar content. Apart from household culinary uses, coconut milk is utilised as a substitute for dairy milk as evaporated and sweet condensed milk and in the preparation of white soft cheese, yoghurt and many other foodstuffs. Sensing the importance of coconut milk, CPCRI has developed 1000 nuts/h capacity double screw milk expeller for large scale enterprises and 5 lit capacity & 15 lit capacity (with hydraulic jack) manual milk expellers for small and medium level enterprises. The cost of the above expellers are Rs.2.5 lakhs, Rs.15,000/- and Rs.35,000/- respectively.



Manual coconut slicer

Power operated coconut slicer

Coconut chips

Manual milk expeller

Hydraulic jack milk expeller

Double screw milk expeller

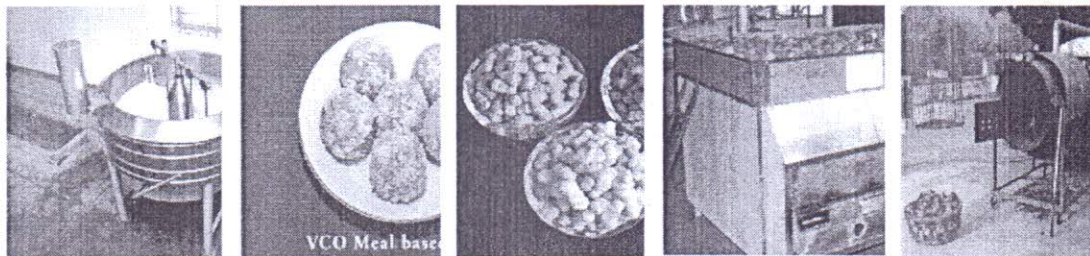
Virgin coconut oil (VCO)

VCO is the oil obtained from fresh, mature endosperm (kernel-meat) of the coconut by mechanical or natural means, with or without use of heat, no chemical refining, bleaching or deodorizing and maintains the natural aroma and nutrients. It is called "virgin" because the oil obtained is pure, raw and pristine. It is the purest form of coconut oil, crystal clear, contains natural vitamin E and with very low free fatty acid content (0.1 %). It has a fresh coconut aroma ranging from mild to intense depending on extraction process.

The different methods involved in VCO production are Hot-processing, Natural fermentation, Centrifugation and Extraction from dried grating (EDG). The choice of the technology to be adopted depends to a great extent on the scale of operation, the degree of mechanization, the amount of investment available and the market demand. The process for VCO by fermentation and hot processing was standardized by CPCRI. The machineries required for this such as grating/pulverizing machine, coconut milk extractor, fermentation tank and VCO cooker (LPG, Steam and Agricultural waste fired) were developed by CPCRI and are commercialized. Ten entrepreneurs had adopted CPCRI VCO technology till now.

Edible coconut flour

After expelling the milk, the protein rich residue is dried and powdered to obtain a product called coconut flour. The flour contains 7-8% protein, 3-5% moisture and 17% oil. It can be used as an ingredient in weight control foods because of its high fibre content. The protein contained in the flour is identical to that contained in the original fresh kernel. The dried coconut residue is passed through a special type of screw press under a specified expeller setting to reduce oil content of the residue. The defatted flakes are dried to reduce its moisture content to 2.5 to 3.0 per cent. These flakes can also be utilized in different food formulations such as extrusion, baking and confectionery. They can also be used for enriching the nutritional values of wheat flour, rice flour etc. Technologies are available now to prepare VCO meal based compressed bar, porridge, laddoo, halwa, and noodles. These products can be prepared from the by-products obtained while preparing the coconut chips and virgin coconut oil.



VCO cooker

VCO meal based laddoo

VCO meal based extrudates

Shell fired copra dryer

Green house copra dryer

PROCESS FOR THE PRODUCTION OF COPRA

The dried coconut endosperm is called copra. The copra and the oil are the principal products of coconut palm. With oil content of 65-70 percent, copra is the richest source of fat. The essential requirement of copra drying is to bring down the moisture content of the wet fresh kernel from 45-55 percent to 5-6 percent. There are two types of copra – edible copra and milling copra. Edible copra is available in two forms – ball copra and cup copra. Converting coconut into copra can yield 15% more income and copra to coconut oil can fetch another 10% income to the farmer. Edible copra is utilized in sweet snacks preparations and as an ingredient in the processed foods.

The conversion of fully matured coconuts into copra for milling purpose is the most common processing activity in the major coconut producing countries. Drying is an important post-harvest operation in the production of copra for the extraction of good quality oil. To obtain good quality white copra, particularly during rainy season, a suitable dryer using indirect heating is essential. The existing direct type kiln dryers are not desirable as the product becomes inferior in quality due to smoking and improper drying. To overcome these problems, shell fired copra drier and green house driers were developed by CPCRI and are being used.

PRODUCTS OF TENDER COCONUT

Tender coconut water has a great potential as a health drink both in Indian and International market. Though the artificial soft drinks once tended to reduce the importance of tender coconut water, the propaganda in favour of tender coconut water by the Government, the Coconut Development Board and the proponents of naturopathy has now paved the way for its increased consumption.

Snow ball tender coconut

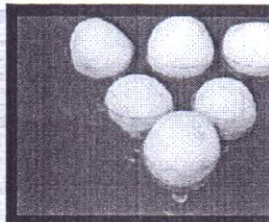
The soft tender kernel or solid endosperm of tender coconut is a delicious dessert and contains good amount of nutrients. The tender coconut kernel is good for convalescing patients. The traditional method of its extraction is difficult and time consuming. Thus the kernel of the tender coconut is sometimes eaten or else thrown away. Coconut of 8 month maturity is more suitable for making snow ball tender coconut. Before scooping out the globular tender kernel with water, a groove is made in the shell by using a machine developed exclusively for this. By inserting the scooping tool, specially made for this purpose, in between the tender kernel and shell and then by rotation of the nut, the snow ball is scooped out from the shell. It is nutritive and used as drink and snacks at the same time. Since the snow ball tender nut can be individually packed and refrigerated under hygienic conditions, the shelf-life of this product is prolonged and therefore this ready-to-serve product is found to become popular.

Tender coconut punch and cutter

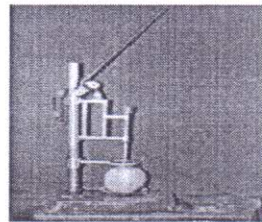
The main factors deterring the large scale adoption of 'tender coconut parlour' is the absence of simple tools for the easy extraction of tender coconut water. After drinking the tender coconut water, some people like to eat the soft meat. Considerable practice is necessary before acquiring the skill for cutting it open with least number of cuts and also for avoiding injury. Because of the risk involved, only a few people learn this craft. In view of this, a simple stainless steel device has been developed by CPCRI, Kasaragod for making a small hole in the coconut and a cutter to cut open into two halves. The cost of the tender nut punch and cutter is Rs.15, 000.



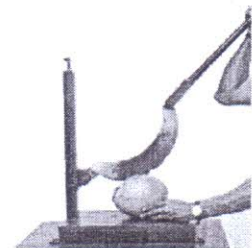
Snow tender machine



ball nut Show tender nut ball nut



Tender nut punch



Tender nut cutter

COCONUT SAP (NEERA) AND ITS VALUE ADDED PRODUCTS

Kalparasa (coconut inflorescence sap or neera) extracted from coconut spadix is a healthy nutritious drink, rich in carbohydrates, minerals, proteins, vitamins; antioxidants etc. In the traditional method, the sap is collected in internally lime coated earthen pots or bamboo sacs to avoid fermentation. Lime, preservatives or anti fermentation chemicals however were not completely successful to prevent the sap deterioration. It could be preserved as fresh and unfermented only when it is collected under cold condition as in the simple 'ice-box technology' developed at CPCRI (Patented). This technique consists of an adopter to connect to the cut end of inflorescence, a connecting pipe and a collection container housed in an ice-box with ice cubicles. It can be stored fresh for any length of time under refrigerated condition. Coconut produces 12 to 14 spadices per year, even if 6 spadices are tapped and the rest are allowed to produce nuts, 600 litres of sap and nuts can be produced without much reduction.

Coconut sugar, jaggery and honey are obtained by boiling unfermented sap in moderate heat to evaporate the water at 115°C. Faintly thick heated syrup is cooled to get coconut honey or syrup. Still thicker consistency of the syrup is poured to moulds of either coconut leaf or steel to obtain jaggery. Coconut sugar can be prepared by further heating of thick syrup with continuous stirring. At particular stage the liquid will change into solid form and it is immediately cooled. When it is cooling, it is stirred continuously to break the lumps. The sugar obtained is sieved to get uniform particle size and to produce quality product. Unlike cane sugar which supplies only calories, coconut sugar supplies calories and nutrients. It has high mineral content and is a rich source of potassium, magnesium, zinc and iron. Adoption of CPCRI technology for the collection of fresh, hygienic and unfermented sap and its sale in roadside kiosks showed very encouraging results for its promotion as ready to serve drink. Promotion of this technology will help to revive the economy of the coconut sector.

CONCLUSION

Every part of the coconut palm is beneficial to mankind and hence it is aptly described as "Kalpa Vriksha". The Agro Processing Centre established in 2005 at CPCRI has been effectively utilized to impart hands on training to entrepreneurs availing technologies of VCO, coconut chips, coconut neera and jaggery, copra production and snow ball tender nut through institute technology management unit as part of commercialization initiatives. In view of effective transfer of technology initiatives, the demand for CPCRI technologies has been very high among the farming community and other clientele. Research and extension activities were fine tuned considering the demand of the stakeholders. CPCRI developed coconut processing equipments and value addition technologies have been transferred to several entrepreneurs, self help groups and NGOs. CPCRI has developed several models of technology transfer through producer/farmer/women groups so as to increase their access to necessary technical and management skills associated with specific enterprises, as well as to gain market access for coconut based high value processed products.

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