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Value addition in horticultural crops

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Abstract
Value added refers to the additional value created with a product to extend its shelf life in marketing. Value- addition in agricultural products is the process done on the various farm products to reap the benefits of providing a processed form of the raw commodity. It is also a process of increasing the economic value and consumer appeal of a commodity. Value added products has the potential to create community economic development opportunities. The exponential increase of world's population and the trend towards the utilization of eco-friendly and viable agricultural by products creates a steady platform for the continuation of innovation.

Keywords: Value addition, agriculture, banana, turmeric, chilli, coconut

Introduction
Value addition is the "Process of changing or transforming a product from its original state to a more valuable state". The benefits of value-added products include providing better nutrition to children and mothers; greater income for producers; access to new markets; and new processes to improve packaging and storage to reduce waste and ensure greater food safety. Value addition in agriculture is needed for the profitability of the farmers, to empower the farmers and weaker sections of the society, to provide safe, quality and branded food to the consumers, to reduce post- harvest losses, reduction in import and increasing exports, encourage the growth of subsidiary industries.
Value added product can be any product that has been the subject of additional actions or combined with additional products to increase the overall value of the product value added products are an important aspect of the agricultural sector.
Value addition in agriculture is needed for the profitability of the farmers, to empower the farmers and weaker sections of the society to provide safe, quality and branded food to the consumers to reduce post-harvest losses, reduction in import and increasing exports, encourage the growth and subsidiary industry.

Value addition of different Products
Banana
Banana is globally ranked fourth, next to rice, wheat, and maize in terms of the gross value of production. It is a major staple food crop for millions of people as well as provides income through local and international trade.
Developed countries 40-50% of the annual agricultural produce is converted into value added commodities. However, in India it is less than 2% annually. India is one of the largest producer of banana in the world with a production of approximately 29,725 thousand tons from an area of 803 thousand hectare (Anon, 2014). Banana was cultivated in wet lands, dry lands and garden lands of Tamil Nadu, while cultivation in dry lands and garden lands was popular in Tiruchirapalli District because of the availability of both irrigation and drainage facilities (Tamilarasan, 1987) [2]. The areas where banana is grown throughout the country and also in the foreign countries, he estimated that the kathali variety is cultivated in half of the banana cultivable areas in Tamil Nadu, Assam and Travancore (Hayeer, 1990) [3]. Among fruits banana accounted for the highest production and they contributed 31% of the total production, there had been a phenomenal increase in the production and productivity of banana (Chadha, 1990) [4]. Unlike other varieties Nendran is a multi-purpose fruit, when unripe, the fruits are used for making chips. Production of chips is an agro-based industry with Nendran as raw material. Chips are also used for export purposes. Nendran can be consumed raw after steaming or roasting on fire when ripe or half ripe.

From nendran flesh a special powder is made and this is used for making tablets which are said to cure stomach ulcer. (Nagarajan, 1993) [5].

Bananas can be processed into different value-added products to enhance their shelf life and market value. Processing is recognized as a way of preserving the fruit. The ripe banana can be utilized in a multitude of ways in the human diet, from simply being peeled and eaten out of hand to being sliced and served in fruit cups and salads, sandwiches, custards, and gelatins. Thousands of value- added products can be made from bananas.

Banana cake

Banana cake is a cake prepared by using banana as a main ingredient and other typical cake ingredients. It can also serve with cream cheese icing, chocolate icing or just plain unfrosted. The cake was slight brownish yellow in color, texture is light, pillowy soft and taste is very sweet. The banana cake can be wrapped in plastic or in an airtight container and store it for upto 4 days.

Table 1: Materials and equipment's used

Banana	Microwave Oven	Baking powder
Bowl	Aluminum foil plate	Aluminum foil paper
Sugar	Vanilla essence	Wheat flour

Procedure for banana cake

- Wheat flour, baking soda, vanilla essence was added in a selected bowl.
- Banana and sugar were added in the bowl and mashed properly in the selected bowl.
- Now the prepared batter was poured into the aluminum foil plate.
- The foil plate was covered with aluminum paper and kept inside the microwave oven.
- The oven was pre heated at 180 C for 10 minutes and baked at 180 C for 25-30 minutes.
- The cake was taken from the oven when it is baked and waited till it cools down to room temperature.
- Now, the delicious banana cake is ready to serve.

Fig 1: Pouring the batter into the plate

Fig 2: Baking inside oven

Fig 3: Banana cake

Banana cookies

Banana cookie is a baked food product that is typically small, flat and sweet made from flour with higher amount of fat and sugar. The cookies are whitish yellow in color, texture is crumbly, soft and taste is very sweet. The cookies are small at around 5 cm and flat. Banana cookies can be stored at room temperature two to three weeks. These cookies are very tasty and highly nutritious.

Table 2: Materials and equipment used

Banana	Wheat flour	Microwave oven
Cardamom	Roller	Vanilla essence
Baking soda	Sugar	Bowl

Procedure for banana cookies

- Wheat flour, baking soda, vanilla essence, and cardamom powder were added in a selected bowl and mixed properly.
- Banana and sugar were added into the bowl and mashed properly in the selected bowl to form a dough.
- Once the dough is ready, it was rolled in a small circle shape with the help of roller.
- The rolled circle shaped dough was placed in a cookie tray and kept inside the microwave oven.
- The oven was pre heated at 180 C for 10 minutes and baked at 180 C for 25-30 minutes.
- The cookies were taken from the oven when it is baked and waited till it cools down to room temperature.
- Now, the tasty banana cookies are ready to consume.

Fig 4: Prepared circle shaped dough

Fig 5: Baking inside the oven

Fig 6: Banana cookies

Banana Ice cream

Banana ice cream is a soft, sweet frozen food made with dairy products and other ingredients. Ice creams are full of vitamins and nutrients also can be a part of a healthy diet. The ice cream was canary yellow in color, texture is soft, creamy and taste is very sweet. The shelf life of ice cream is upto two months for an unopened tub, inside a refrigerator.

Table 3: Materials and equipments used

Banana	Refrigerator	Milk
Milk maid	Milk cream	Beater
Bowl	Sugar	Ice cream scoop

Procedure for banana ice cream

- Milk, milk maid, milk cream and sugar were added in a selected bowl and stirred properly.
- Mashed banana was added to this creamy liquid and again it was stirred properly.
- The creamy liquid containing bowl was kept inside the refrigerator and freezed it at -18 C for 4-5 hrs.
- After 5 hrs, the bowl was taken out from the refrigerator and the sweetest banana ice cream is ready.

Fig 7: Stirring

Fig 8: Creamy liquid kept inside the refrigerator

Fig 9: Banana Ice cream

Turmeric

Turmeric, a plant in the ginger family, is native to Southeast Asia and is grown commercially in that region, primarily in India. Its rhizome (underground stem) is used as a culinary spice and traditional medicine. Historically, turmeric was used in Ayurveda and other traditional Indian medical systems, as well as Eastern Asian medical systems such as traditional Chinese medicine. In India, it was traditionally used for disorders of the skin, upper respiratory tract, joints, and digestive system.

The substitution of non-degradable synthetic plastics with edible or biodegradable films made from biopolymers originating from agricultural sources is latest innovation in packaging materials. Currently, exploration of flour from agricultural sources as a new source is attempted for the preparation of biodegradable films with improved properties. The turmeric spent rich in starch fraction can be used as a functional ingredient in food industries and in the preparation of biofilms for packaging (Maniglia *et al.*, 2015). The growing awareness of health globally has led to demand of

organically produced seed spices as they are free from chemical residues and health hazards. India has been exporting seed spices and its value-added items to 70 countries in the world and is earning a foreign exchange of more than Rs. 362 crore annually. Though, contribution towards export is only 10% of the total spices exported, but there is tremendous scope to enhance it to twice if value added products of seed spices are also exported from India. (S.K. Malhotra, 2015) [8]. Spices are high value and export-oriented commodity crops, which play an important role in agricultural economy of the country. India is the principal source for supply of spices in the global market, though there are number of other countries *viz*. Indonesia, Malaysia, Pakistan, Australia, Spain, Egypt, Tanzania, etc., producing and exporting to the international market. Spices contributed 1.24 per cent of India's total export earnings. (R.K. Yadav *et al*., 2004). Ginger prefers warm, humid climate with well-drained soils like sandy or clay loam, red loam or laterite loam for its successful growth. In North East region ginger is grown as rainfed crop while in other parts of the country it is grown both as rainfed and irrigated crop. It is an exhaustive crop by nature and, therefore, not advised to grow in the same field year after year. (Gosh, 1984). Among all spices, ginger is the main cash crop supporting the livelihood and improving the economic level of many ginger growers of north eastern region. Ginger is grown in almost all the states of the region but the leading states are Meghalaya, Mizoram, Arunachal Pradesh and Sikkim (Govind *et al*., 1998).

Turmeric neem oil

The key therapeutic ingredients of neem, turmeric, and coconut oil are combined in this neem and turmeric skin oil. Coconut oil has antibacterial and antifungal properties, is a demulcent, and is beneficial for stress and sleeplessness. Turmeric is the most effective anti-poison medication. The rhizome is the component that is used.

Ingredients

Turmeric: 300g
Coconut oil
Neem Leaves

Procedure for turmeric neem oil

- Chop the turmeric into small slices in a way that it can be easily put into the grinder for grinding.
- In this experiment I have took the natural stone grinder for the process of grinding(Aattukallu). Now place the slices in the stone grinder together with the neem leaves and grind it for a period till the turmeric and the neem leaves put together becomes a paste.
- Now add some coconut oil in a pan and let it heat till it reaches a favorable temperature.
- Now add the mixture of coconut and neem into the oil and prepare until the turmeric and the neem leaves comes out dry.
- Now extract the oil from the pan and pour it into a container for further use.
- Turmeric oil has many uses in the field of medicine and food. There are many methods of extracting essential oils from plants. However, every traditional method has limitation regarding the heat transfer, time or quality of the oil obtained. In this study, the combination of microwave extraction and response surface methodology are used to extract turmeric oil and optimize the factors that influence the extraction process.

Fig 10: Ingredients

Fig 11: Boiling the ingredients with oil

Fig 12: Turmeric neem oil

Turmeric Face Cream

Dark spots, acne scars, pigmentation, dullness, and sunburn can all be treated with this homemade turmeric cream. This cream acts to minimize the appearance of wrinkles, fine lines, and dull skin, as well as other signs of ageing. It aids in the treatment of skin infections, inflammation, blemishes, and other skin conditions. The cream is thick in consistency and is can be easily applied on the skin.

Ingredients

- teaspoon of honey
- teaspoons of corn starch
- 1/4 teaspoon of turmeric powder
- How to make and use this turmeric face pack:

Procedure for turmeric face cream

- Mix cornstarch, turmeric and honey to make a smooth paste.
- For dry skin, add oil to the mixture. For oily skin, add lemon juice and yogurt to create a creamy mixture. Apply the mask to your face and neck.

- Leave it for 15-20 minutes. Use a warm wet cloth to remove the mask
- Turmeric has anti-inflammatory and antioxidant properties. These features may give the skin a lustrous sheen. Turmeric can also help your skin look younger by bringing out its natural glow.
- To test if turmeric has any beneficial effects on your skin, try a turmeric face mask at home. Small amounts of Greek yoghurt, honey, and turmeric can be mixed together and applied on the face. Leave the mask on for 15 minutes before rinsing it off with water.

Fig 13: Ingredients

Fig 14: Mixing corn starch with honey

Fig 15: Turmeric face cream

Turmeric Chutney

The turmeric chutney is produced in a way that the resultant product comes out in a thick consistancy. It has a very low shelf life and cannot be stored for a long period of time. It is best used with South Indian dishes like dosa and idli. The result of this product lets us know turmeric can be used as a great cooking ingredient together with its immense medicinal uses.

Ingredients

- Raw Turmeric 1 Kg
- Mustard Oil 250 ml
- Salt According to taste
- Red Chilli Powder 1 tsp
- Jaggery 250 gm
- Vinegar 50ml
- Grinded coconut

Procedure for turmeric chutney

- Wash turmeric rhizomes and peel them
- Cut into small pieces and Boil for 10 minutes
- Grind in a mixer
- Heat oil in a pan and add paste of turmeric rhizomes along with spices
- Add vinegar and jaggery and cook till it gets thickened
- Store in a glass Jar

Fig 16: Ingredients

Fig 17: Blended with mixer

Fig 18: Turmeric chutney

Chilli

Chili is one of the most important commercial crops of India. It is grown almost throughout the country. There are more than 400 different varieties of chilies found all over the world. It is also called as hot pepper, cayenne pepper, sweet pepper, bell pepper, etc. Its botanical name is *Capsicum annuum.* The world' shortest chili "Naga Molokai" is cultivated in hilly terrain of Assam in a small town Tempura, India. Different varieties are grown for vegetables, spices, condiments, sauces and pickles. Chili occupies an important place in Indian diet. It is an indispensable item in the kitchen, as it is consumed daily as a condiment in one form or the other. Among the spices consumed per head, dried chili fruits constitute a major share.

Due to high pungency and aroma of the king chilli, it has an enormous scope both in international and domestic market. It has been reported that production of king chilli increases every year in north-eastern India (Meetei *et al*., 2016) [9]**.** Huge quantity of green chilli has been found to be wasted in the field due to the lack of proper processing and preservation technology. After harvesting of king chilli is very challenging due to its perish-ability; it is subject to quick worsening of shelf life during storage, transportation, and marketing (Chitravathi *et al*., 2015) [10]. Chilli is grown for its pungent fruits which are used both as green and ripe to impart pungency and flavor to the food. Pungency, one of the important attributes of Capsicum species is due to the presence of alkaloid 'capsaicin' in the fruit. It is used primarily in the flavoring of pickles, meats, barbecue sauces, ketchup, cheese, snack food, dips, chilli cake, salads, and sausages (Pugalendhi *et al*., 2010) [11]**.** "Extracts of chilli are used in the production of ginger beer and other beverages. Capsaicin, chilli oil, powder and oleoresin are used to impart pungency. Capsaicin has many medicinal properties, especially as an anti-cancerous agent (Nayaki, 2004) [12]. Freshness is a prime requirement of green chilli consumed in India. However, freshness loss and reduced shelf life occur because most supermarkets and retailers handle chilli improperly without optimal packaging and storage and quality can be improved and shelf life extended for fresh king chilli by modified atmosphere packaging MAP (Azlin *et al*., 2014) [13]. Currently, chilies are used throughout the world as a spice and also in the making of beverages and medicines. If some varieties of chilies are famous for red color because of the pigment 'capsanthin,' others are known for being pungency attributed to 'capsaicin.' India is the only country which is rich in many varieties with different quality factors.

Chillies are rich in vitamins, especially in vitamin A and C. They are also packed with potassium, magnesium and iron. Chilies have long been used for pain relief as they are known to inhibit pain messengers, extracts of chili peppers are used for alleviating the pain of arthritis, headaches, burns and neuralgia. It is also claimed that they have the power to boost immune system and lower cholesterol. They are also helpful in getting rid of parasites of gut.

Chilli sauce

The chilli sauce was tangy and spicy in taste, reddish orange in color. It was preserved by using vinegar. It used as spreading over sandwiches, wraps, burgers and more. Opened chilli sauce will generally stay at best quality for about 1 month.

Table 4: Material used

Chilli	Oil	Sugar
Tomato	Vinegar	Garlic
Onion	Salt	Mixer

Procedure for chilli sauce

- Firstly added oil in the pan. after oil gets heated added tomato.
- Added chilli, onion, garlic, salt, sugar
- Fried in low flame for 10 mins
- Allowed to cool down completely
- Added in mixer and grinded into thick paste.
- Stored in air tight container

Fig 19: Adding in blender

Fig 20: Adding vinegar

Fig 21: Chilli sauce

Green chilli pickle

The prepared chilli pickle was spicy and loaded with flavor and chilli was costed with masala's. It was preserved by using oil. It used as condiments in Indian cuisine.

Table 5: Material and method

Green chilli	Fenugreek	Oil
Jeera	Coriander	Hing
Mustard	Salt	Vinegar

Procedure for Green chilli pickle

- Firstly, removed the pedicel of chilli and cutted into pieces.
- Further in a pan dry roasted jeera, corriander and fenugreek, mustard seeds.
- Dry roasted on low flame for a minute.
- Cooled completely and blended in mixer to slightly coarse powder.
- Transferred the masala powder onto the chilli.
- Mixed well making sure everything is combined well.
- Heated oil.once oil was hot added pinch of hing.
- Allowed the oil to cool completely and poured over chilli.
- Mixed well to combine all the ingredients
- Stored in air tight container.

Fig 22: Roasting

Fig 23: Grinding

Fig 24: Chilli pickle

Green chilli chutney

The green pickle was hot and spicy, texture was thick paste. Vinegar was added for good shelf life and slight tangy. It's used to provide balance to an array of dishes like raits, sandwich, roti, noodles etc.

Table 6: Material and methods

Green chilli	Tumeric
Garlic	Salt & Jeera
Oil	Vinegar

Procedure for Green chilli chutney

Procedure

- Heated the pan with oil and fried chill till they wilt off fully.
- Added garlic, jeera, tumeric
- Cooled completely.
- Added the chilli, salt, vinegar to the blender.
- Blended everything well to a coarse green chilli chutney.
- Added vinegar in it.
- Stored it in an air tight glass jar.

Fig 25: Frying in oil

Fig 26: Adding in blender

Fig 27: Chilli chutney

Coconut

The coconut tree (*Cocos nucifera*) is a member of the palm tree family (Arecaceae) and the only living species of the genus *Cocos*. The term "coconut" (or the archaic "cocoanut") can refer to the whole coconut palm, the seed, or the fruit, which botanically is a drupe, not a nut. The name comes from the old Portuguese word *coco*, meaning "head" or "skull", after the three indentations on the coconut shell that resemble facial features. They are ubiquitous in coastal tropical regions and are a cultural icon of the tropics.

For hundreds of years, the coconut has been a great source of veracity. It provides food, drink, clothing and shelter as well as income from its products. It plays a significant role in the agrarian economy of India. Apart from the importance of copra and coconut oil which is widely used in manufacture of soaps, hair oil, cosmetics and other industrial products, its husk is a source of fibre which supports a sizable coir industry. The tender nt supplies coconut water, a popular thrist quencher of health and hygienic value.

Coconut is the important commercial crop which can be value added in different ways like furniture, different edible products, handicrafts and so on. Apart from that it is the main source in rural areas and industries as fuel. The more research and commercialization will provide additional income to farmers or the producers (Mithra, 2013) [14]. The products made from coconut which increased its value gives more benefits. (Sharma, 2021) [15]. The product made from coconut oil can be used as lubricant and it can be used as alternative. (Mannekote, 2016) [16]. The alcohol and palm sugar made from the influence of coconut which has lot of health benefits and their value addition methods (Hebber, 2020) [17]. The downstream processing plays the major role in producing different products from extraction, concentration and drying. These things can be done in proper packaging and export to non-producing countries and increase the income. (Naik, 2015) [18].

Coconut is a crop of small and marginal farmers since 98% of about five million coconut holdings in the country are less than two hectares. In the west coast of India, the palm is an essential component in the homestead system of farming. While there is a concentration of coconut plantations in the coastal region of the country, it is also grown in the hinterlands where the agro climatic requirements of coconut cultivation are met.

Coconut Milk

The main use of coconut milk in cooking is to make curries - comforting and fragrant stews of fish, meat, or vegetables

Materials Required

- Coconut
- Sugar
- Cardamom

Procedure of Coconut Milk

- I took 1cup of coconut and blend it
- Extracted the juice
- Now I boiled and add jaggery and cardamom
- Now it is ready to serve

Fig 28: Blending the coconut kernels and extracting.

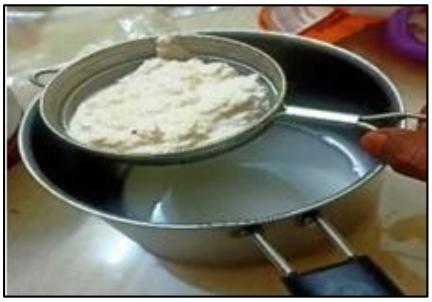

Fig 29: Extracting the Filtrate

Fig 30: Adding the required amount of jaggery, and it is ready to serve

Observation

Coconut milk was prepared using coconut blend. It took me 1 hour to complete. Coconut milk was white color and looks like milk in texture, the taste is sweet and coconut flavored. This can be stored for up to 5 days in a container in refrigerator.

Coconut Burfi

This is a famous sweet served in Tamil Nadu and Kerala mostly.

Materials Required

- Coconut
- Sugar
- Cardamom
- Ghee

Procedure of coconut burfi

- I took 1cup of coconut and fried it in ghee
- Added 1 cup of sugar and cardamom

- Now I let sugar melt
- Now I poured it into plate and cut it
- Cooled it and ready to serve

Fig 31: Sauteing the shredded coconut on a non-stick pan.

Fig 32: Adding sugar to the coconut-ghee mixture

Fig 33: Transferring the gelatinous mixture onto a plate, letting it dry and served.

Observation

Coconut burfi was prepared using coconut. It took me 2 hours to complete. Coconut burfi was hard, crispy, and brown color in texture, the taste is sweet and coconut flavoured. This can be stored for 7-10 days in a container without any moisture content in it.

Coconut Cake

The famous South Indian coconut cake is used as bakery item as snack and its immensely flavorful when eaten for tea-time and goes well with other drinks in the evening.

Material Required

- Flour
- Sugar
- Oil
- Milk Coconut
- Baking soda
- Baking powder
- Salt

Procedure of Product Preparation:

- I took 1 cup of flour and add ¾ cup sugar and 1 teaspoon of baking powder
- I added the dedicated coconut and a pinch of salt
- I added melted butter or coconut oil ½ cup
- And also added ½ cup milk
- Now gently I mixed until combined
- Transferred the batter to cake tray
- baked the cake
- Now the cake is ready

Fig 34: Mixing the ingredients

Fig 35: Transferred the cake batter onto the baking bowl

Fig 36: Baked end- product and the cake turned out well

Observation

Coconut cake was prepared using coconut. It took me 3 hours to complete. Coconut cake was soft and spongy in texture, the taste is sweet and coconut flavoured. This can be stored for 3-4 days in fridge.

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