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RESEARCH ARTICLE

CASHEWNUT: A DOLLAR EARNING CROP OF WASTE LANDS AND AN INDISPENSABLE SEED IN EVERY FAMILY CONSIDERING ITS' NUTRITIONAL ADVANCEMENT AS WELL AS UNIQUE & CATCHY TASTE

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ABSTRACT

Cashew (*Anacardium occidentale* L.) a native of Brazil has acclimatized and adapted well to Indian climate and praised the world over for its delicious and nutritious kernels. Being introduced by the Portuguese sailors to the Malabar coast during 16th century it has travelled a long way to earn the status of "a Dollar earning crop" from a mere "Crop of waste lands". Cashew is a tropical, evergreen, perennial tree with a darkish-green leathery foliage, spreading branches and very irregular crown. The flowers are borne in a panicle that consists of three types of flowers name hermaphrodite (bisexual), male and sterile flowers. Actual fruit is the nut and apple is rather a pseudo fruit which is nothing but a swollen receptacle. The colour and shape of the apple varies with cultivars ranging from yellow, greenish yellow to red. Apple weighs about ten times more than that of nut and the nut weight usually ranges from 3 to 15 g. Cashew being tropical crop can tolerate higher temperatures but is highly sensitive to frost. The optimum temperature range for successful cultivation is about 20 to 30degreesCelsius. The annual precipitation of 100cm to 200 cm is ideal for cashew. Coincidence of flowering with high rain fall or excess humidity leads to incidence of pests and diseases. Though cashew is not Cashew, a perennial tree well known as "poor man's crop" is a source of highly priced cashew nuts. India being the leading producer, consumer and second largest exporter of cashew in the world, has a prime position in cashew trade in the world market. But the productivity level of Indian cashew is far less than that of its close competitors viz., Vietnam, Nigeria, Cote de "Ivoire, Philippines etc. The cashew processing sector in India is one of the largest in the world and has given huge employment to rural people especially the women folk. Some of the cashews processing industries in India are still under unorganized sector. Increasing demand for the nuts has necessitated the increased production. The cashew industry plays a vital role in the economies of many producing countries, providing employment opportunities and income generation opportunities by contributing to rural development. This global industry not only supports livelihoods but also fosters economic growth, generating export revenues in cashew-producing regions. These impacts are significantly improves the socioeconomic conditions for millions, particularly women in rural communities.

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INTRODUCTION

India is a global leader in cashew production, with states like Maharashtra, Andhra Pradesh, and Orissa playing pivotal roles. These regions benefit from favorable climates and longstanding farming traditions, making cashew cultivation an essential industry supporting the livelihoods of many farmers across the country. Cashew is the common name of a tropical evergreen tree *Anacardium occidentale*, in the family Anacardiaceae. It is native to South America and is the source of the cashew nut and the cashew apple, an accessory fruit. The tree can grow as tall as 46 feet, but the dwarf cultivars, growing up to 20 ft, prove more profitable, with earlier maturity and greater yields. The cashew nut is edible and is eaten on its own as a snack, used in recipes, or processed into cashew cheese or cashew butter.

The nut is often simply called a 'cashew'. The cashew apple is a light reddish to yellow fruit, whose pulp and juice can be processed into a sweet, astringentfruit drink or fermented and distilled into liquor. In 2023, 3.9 million tons of cashew nuts were harvested globally, led by the Ivory Coast and India. In addition to the nut and fruit, the shell yields derivatives used in lubricants, waterproofing, and paints.One of the most important cash crops introduced to India in 16th century by Portuguese. In India, Cashew was initially introduced in Goa and further expanded to other states. As a resilient and drought resistant tree that is adaptable to poor soil conditions, it offers environmental benefits in the fight to combat deforestation and soil erosion hence it is known as Gold Mine of Waste Land.In 2022, India ranks second globally in the export of Cashew Nuts Fresh/Dried Shelled holding an 8.72% market share, also India is the world's second-largest importer

of Cashew Nuts Fresh/Dried In Shell. There is an ever-increasing demand for cashew kernel both in international market and in the domestic market. The industry faces challenges such as reliance on imported raw cashew nuts to meet demand. Government initiatives under MIDH and RKVY aim to boost production through expanded cultivation and high-yield variety adoption across traditional and non-traditional states.Cashew as a marketable commodity, has a very important role to play in the liberalized Indian economy. With export earnings of Rs. 12,320 million in 1995-96, cashew ranked as one of the top agricultural export commodities. From the farmers' as well as from the exporters' point of view, the current emphasis that cashew is receiving as a horticultural crop from the research and development front, is a welcome sign. At present, India has a processing capacity of nearly seven hundred thousand metric tons and to meet the raw nut demand, the country depends partially on imports from several African, and in recent years, from south-east Asian countries. This has considerable drain on the country's foreign exchange reserves and there is an urgent need to increase local production to substitute imported raw material in order to derive the maximum benefits from a strong processing and marketing capability developed over the years by the Indian cashew industry.

History:-Research work on cashew was initiated on a relatively small scale in early 1950's resulting in the development of several production techniques. These efforts were further strengthened when the national research mandate was delegated to the Central plantation Crops Research Institute (CPCRI), Kasaragod, in 1970 which spearheaded the All India Coordinated Spices and Cashew improvement Project from 1971. These research activities received further impetus with the implementation of a World Bank aided multi-State Cashew Project in the States of Andhra Pradesh, Kerala, Karnataka and Orissa from 1982-86. A National Research Center for Cashew was established at Puttur to increase the production and productivity of cashew with the mission-mode approach in 1986.The cashew development component of the combined All India Coordinated Spices and Cashew Improvement Project was de-linked and an independent National Cashew Research project was initiated with the newly established National Research Center (NRC) for the crop at the same time. There are 8 research centers and one sub-center at present, located in 8 cashew growing States in the country. This can be considered as a milestone in cashew development with firmly established linkages with the Directorate of Cashew nut Development Corporation and other extension agencies which assisted in the transfer of newly developed production technologies.

Distribution:-The species is native to tropical South America and later was distributed around the world in the 1500s by Portuguese explorers. Portuguese colonists in Brazil began exporting cashew nuts as early as the 1550s.The Portuguese took it to Goabetween 1560 and 1565. From there, it spread throughout Southeast Asia and eventually Africa. India's Cashew Nuts production has increased from 779 thousand tonnes in 2021-22 to 810 thousand tonnes in 2022-23 registering a growth rate of 4 per cent. Cultivation of cashew in India is confined mainly to the peninsular areas. It is grown in Kerala, Karnataka, Goa and Maharashtra, along the west coast of the country and in Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the east coast of the country. To a limited extent it is being cultivated in Chhattisgarh, Northeastern States (Assam, Manipur, Tripura, Meghalaya and Nagaland) and on Andaman and Nicobar Islands. The cashew tree native to Brazil, has transcended its origins to become a major global crop, cultivated across more than 30 countries in Asia, Africa, and Latin America.

Scientific classification

Kingdom: Plantae
Clade:Tracheophytes
Clade:Angiosperms
Clade:Eudicots
Clade:Rosids
Order:Sapindales
Family:Anacardiaceae
Genus:Anacardium
Species:occidentale
Binomial name: *Anacardium occidentale*

Plant description: -The cashew tree is a low spreading, evergreen tree with a very prominent tap root. The leaves are alternative, simple, glabrous, obovate, round and pinnately veined. The inflorescence is an indeterminate panicle of polygamomonoecious type i.e. flowers are either bisexual or staminate but both occur intermixed in the same inflorescence. On the same tree, the perfect flowers are larger in size than the staminate. Pollination is carried out by flies, bees and ants as well as by wind. The fleshy peduncle, the 'cashew apple', is juicy and sweet when ripe. The apple varies in size, colour, juice content and taste. It is rich source of vitamin c and sugar. The cashew fruit is a kidney shaped drupaceous nut, greenish grey in colour. The nuts vary in size, shape, weight (3-20g) and shelling % (15 –30%).The true fruit of the cashew tree is a kidney-shaped or boxing glove-shaped drupe that grows at the end of the cashew apple. The drupe first develops on the tree and then the pedicel expands to become the cashew apple.The drupe becomes the true fruit, a single shell-encased seed, which is often considered a nut in the culinary sense. The seed is surrounded by a double-shell that contains an allergenic phenolic resin, anacardic acid - which is a potent skin irritant chemically related to the better-known and also toxic allergenic oil urushiol, which is found in the related poison ivy and lacquer tree.

Cashewnut tree

Uses of cashewnut

- Extensively taken as nutritional snacks
- Cashew nuts are used in preparation of cashew butter
- Cashew cheese and have high demand in food product industries.
- The shell of cashew seed is also used in a variety of applications like paints, waterproofing, arms production and more.
- The pulp of cashew apple that grows in yellow and reddish color is processed and used for producing fruit drinks and sweets.
- Culinary uses for cashew seeds in snacking and cooking are similar to those for all tree seeds called nuts.
- Cashews are commonly used in Indian cuisine, whole for garnishing sweets or curries, or ground into a paste that forms a base of sauces for curries (e.g., korma), or some sweets (e.g., kaju barfi).
- It is also used in powdered form in the preparation of several Indian sweets and desserts.
- In Goan cuisine, both roasted and raw kernels of Goa Kaju are used whole for making curries and sweets.
- Cashews are also used in Thai and Chinese cuisines, generally in whole form. In the Philippines, cashew is a known product of Antipolo and is eaten with suman.
- In Indonesia, roasted and salted cashews are eaten.
- To meet the manufacturing demands for cashew milk, a plant milk alternative to dairy milk.

- In Mozambique, bolo polana is a cake prepared using powdered cashews and mashed potatoes as the main ingredients.
- Discarded cashew nuts are unfit for human consumption and the residues of oil extraction from cashew kernels can be fed to livestock.
- Animals can also eat the leaves of cashew trees.
- In Cambodia, the bark gives a yellow dye
- The timber is used in boat-making, and for house-boards
- The wood makes excellent charcoal.
- The shells yield black oil used as a preservative and water-proofing agent in varnishes, cement, and as a lubricant or timber seal.
- Timber is used to manufacture furniture, boats, packing crates, and charcoal.
- Its juice turns black on exposure to air, providing an indelible ink.
- Cashew apple pulp and juice can be fermented and distilled into liquor.
- The shell oil was used as a preservative for boats and nets and to protect wood from termites.
- The outer surface of the nut is used of fire wood which is bought by the hotels and industries. The inner nut is marketed and used by the bakeries for preparing various types of sweets and it is used for tasty consumable products.

Nutritional value of cashew nut: -Cashews has sweet and mild flavor with source of protein, rich in healthy fats, including mono-unsaturated and poly-unsaturated as well as several minerals including copper, magnesium, zinc, and iron which makes body health. Cashews use as dairy alternatives, such as cashew milk, cashew-based cheeses, and cashew cream in the world and specifically the popular with many vegans and vegetarians. The importance of cashew is the largest component among all is fat and it is mono-saturated, which brings enormous health benefits for humans.

Cashews, raw-Nutritional value per 100 g
Energy-553 kcal
Carbohydrates-30.19 g
Starch-23.49 g
Sugars-lactose-5.91 g, 0.00 g
Dietary fiber-3.3 g
Fat-43.85 g
Saturated-7.783 g
Monounsaturated-23.797 g
Polyunsaturated-7.845 g
Protein-18.22 g
ShowVitamins and minerals
Other constituentsQuantity
Water5.20 g

Link to USDA Database entry

Cashew fuits

Cashew nuts

Cultivation procedures

Varieties: -There are many varieties available for commercial cashew plantation in India. Here are some cashew varieties developed by and/or suitable for different states in India-

- **Tamil Nadu** – Virudhachalam-1,-2, -3, VRI 4
- **Kerala** – Amrutha (H-1597)/ Akshaya (H-7-6)/ Anagha (H-8-1)
- **Andhra Pradesh** – BPP-1/ BPP-2/ BPP-3
- **Maharashtra** – Vengurla-1/ Vengurla-2/ Vengurla-3
- **Karnataka** – Ullal-1/ Ullal-2/ Ullal-3
- **Goa** – Goa-1
- **West Bengal** – Jhargram-1

Soil-Cashew can do well when grown in deep, sandy loam well-drained soil, even though they can be grown in poor soils too. Sandy red soil, coastal sandy soils, and laterite soils are great for cashew plantation. Cultivators should be careful about flooding or water stagnation in the field which damages plant growth. Also, the pH level of soil should be up to 8.0 at the maximum level. Pure sandy soil enriched with minerals can also be chosen for growing cashew.

Climate-Areas with annual rainfall of 100-200 cm and temperature ranging between 20 to 30°C are best for cashew nut cultivation. For best results it needs a well-defined dry weather condition for a minimum of 4 months while heavy rainfall with erratic climate is not favourable for it. Excess temperature above 36° C especially during flowering and fruiting period could affect adversely to maintain fruit standard.

Propagation

Air Layering-Propagation through air layering could be successful even though cashew plantations raised through the process are quite vulnerable to drought and under such condition; the chance of survival rate is low.

Grafting-For epicotyl grafting, lively seedlings with stones need to be uprooted from the nursery bed at an early stage and they should be beheaded keeping a height of 8-10 cm. By giving a downward parallel cut of 4-6 cm deep in the middle of the decapitated stalk will produce a fissure in the stem. After that, the wedged scion should be inserted into the fissure of the rootstock in a way so that when combined, the rootstock and scion matches perfectly with each other. Take a polythene strip of 100-120 mm gauge thickness and bind the graft joint quite firmly.

Nursing young plants:-The following management techniques are important in nursing young grafted plants. (1)Grafts need to be watered frequently depending on the season. (2) Excess water needs to be drained by providing drainage holes in polybags. (3) Shoots on the rootstocks have to be nipped off frequently. (4) Polythene wrapping at the union has to be removed about three months after grafting to prevent girdling.(5) When the scion leaves turn from brown to green, rootstock leaves have to be removed (approximately 60 days after grafting).(6) Flower shoots that sprout during the normal

flowering season should be removed at the nursery stage.(7) To prevent roots penetrating into the ground, grafted plants should be shifted frequently or placed on thick gauge black polythene sheets. (8) Partial shade has to be provided to avoid sun-scorch by placing the grafted plants in a lath/screen house. Direct sunlight should be avoided as polythene bags tend to perish. Watering on alternate days should be done in summer.(9)Regular insecticide sprays need to be given to control leaf sucking insects.(10)When transporting grafted plants, terminal shoots and taproots should be protected.

Land Preparation: -Grab your tools and say goodbye to unwanted guests like weeds, shrubs, and any debris. Imagine giving your land a clean slate.Cashews love sunshine, so ideally, time your land prep for the dry season. This allows the sunlight to kill weed seeds and soil-borne pests naturally. Once the ground is prepped, it's time to create individual homes for your future trees. Digging pits about 2ft x 2ft x 2ft with a spacing of 23-26ft is a good rule of thumb.

Leave the pits open: Don't plant immediately! Leave the dug pits open for 2-3 weeks. This allows the soil to weather and lets any harmful elements escape.

Planting Season: -Planting of grafted plants is usually carried out during the monsoon season from July-August both in the west coast as well as in the east coast. Orchards should have pits dug to receive grafted plants well in advance of the main monsoon weather.

Cashew plantation: -Cultivators with land scarcity can go for high density cashew plantation and consider pit sizes 45cm x 45 cm x 45 cm with a spacing of 5m x 5 m (fit for 400 grafts/ hectare land). Fill the pits with a mixture of FYM @10-15kg, neem cake @1kg and top soil. Perfect time for planting is June-July while you should consider seedlings of 45 days for plantation.You do kaju farming in India in a space of around 5mX8m.

Land optimization: -Cashew trees can grow well on marginal lands, maximizing land use and preventing soil erosion.

Fertilizers &Manures: - Organic matter gives off nutrients to the soil over a period, which guarantees a complete ordeal of nourishing your trees.Follow the recommended dosages and application timings provided by agricultural experts in your area.Application of 10-15 kg of farmyard manure or compost annually is generally recommended for cashew. In addition, the current fertilizer recommendation is 500g N (1.1 kg urea), 125g P_2O_5(625g rock phosphate) and 125g K_2O (208g muriate of potash) per tree per year. This has increased production in the All-India cashew trials carried out at the research centers. These trials also showed that the cashew responds well to increased N applications up to 750g. Since local NPK fertilizer mixtures do not deliver the required nutrients, application of straight fertilizer is recommended.

Recommended Doses of NPK Fertilizer for Cashew (g/plant)

Year	Urea (gm)	Rock Phosphate (gm)	Muriate of Potash
1	330	200	70
2	660	400	140
3 onwards	1,100	625	208

Weed Control: Weeds are one of the most annoying things for cashew trees as they use nutrients and water to grow. Here's a two-pronged approach to keep them at bay:

Natural Methods

Mulching: Spread the ground under your cashew trees with natural materials like straw, leaves, or wood chips. Weeds will be suppressed because they won't get sunlight and moisture.

Manual removal: Small weeds and young trees can be treated with hand weeding frequently. This ensures the safe removal of the weeds and, at the same time, preserving your very important cashews.

Chemicals: -In very weed-infested areas, selective herbicides can also be an effective tool.

Intercropping: -Tall growing varieties of cashews like sorghum and millet should not be there between young trees because of the extra shading. Uminous crops like beans and groundnuts are ideal for the intercropping. You should cultivate horse gram, cowpea, ground nuts, etc., as intercrops with cashews.

Irrigation and Drainage: -Cashew cultivation is generally carried out under rainfed conditions. In homesteads however, it is preferable to give some supplementary irrigation during the warm summer months from January to March. An application of about 200 liters of water per tree every fortnight was found to double cashew yields in trials conducted at the National Research Center at Puttur. Both in the homesteads and large-scale orchards, cashew is susceptible to waterlogging and proper drainage is essential in low lying areas.

Pruning &Training: -Proper pruning and training are essential for cashew trees. Here's how to help them develop a strong structure and maximize nut production:

Early Years (1-4 years): Think "single stem first!" Remove any side shoots emerging from the main stem to encourage a robust central trunk up to around 1 meter high. This allows for better light penetration and air circulation within the canopy.

Branching Out (4+ years): Once the central trunk is established, you can allow some side branching.

Maintain Height: Cashew trees tend to grow tall. To make harvesting easier and maintain a manageable size, consider occasional de-topping (trimming the topmost growth). Aim for a height suitable for your needs and consult a local agricultural expert for specific recommendations.

Plant Protection

Pests: More than 60 species of insect pests have been identified in cashew in India. The major pests are the tea mosquito, stem/root borer, leaf minor, leaf and blossom webber and flower thrips. No major diseases that cause economic losses have been reported so far in cashew.

Tea mosquito bugs: They are sap feeders that damage the leaves, flowers, and maturing nuts.For efficient management of the tea mosquito bug (*Helopeltisantonii*), it is important to check the build up of the pest population on the cashew crop as well as on the alternate hosts such as neem, drumstick, cocoa, guava etc. Tea mosquito bugs can be effectively controlled by three sprays at flushing, flowering and fruiting stages with endosulfan or monocrotophos (0.05 %) for the first and second sprays and carbaryl (0.15 %) for the third spray.

Shoot borers: These pests bore into stems, which prevent tree growth and lead to dieback.Root and stem borer infestation is usually controlled with swabbing tree trunks with carbaryl (2 %) or using a coal tar/kerosene suspension (1:2).The stem and root borer (*Plocaecderus ferrugineus* L.), is capable of killing cashew trees. In severe cases of injury by this pest, gummosis of the stem and yellowing followed by drying of leaves can occur. The effective control measure is to remove immature stages of the pest and swabbing the trunk and exposed roots with carbaryl (0.2 %) or neem oil (5 %) and application of Sevidol 8G (75g/tree) into the basin around the tree.

Leaf miners: These tiny creatures called insects burrow within the leaves, which eventually affects their health and photosynthesis.

Diseases

Dieback: This fungal pathogen kills off branches, causing overall tree sickness and death.

Anthracnose: This fungal disease is associated with the presence of dark spots and lesions on leaves, fruits, and stems, respectively.

Inflorescence blight: This fungal disease has an impact on the flower clusters, which in turn results in diminished nut production.

HARVESTING OF NUTS AND CASHEW YIELDS

Normally, about 92 % of the trees yield by the third year from planting. The average yield per tree increases from about 2 kg at 3-5 years to 4 kg at 6-10 years and 5-10 kg when trees are 11-15 years of age. Thereafter, trees yield in excess of 10 kg as the trees get older.Bearing commences after the third year of planting and the trees will be in full production by the tenth year whilst the economic life of a tree is about 20 years. The main harvesting season is from February to May.

Cashew production(with shell) 2023

Country	Tonnes
Ivory Coast	1,044,450
India	782,000
Vietnam	347,634
Indonesia	164,152
Philippines	136,264
World	3,934,839

Source: FAOSTAT of the United Nations

Present status of cashew nut production: -Cashew is grown in the western and eastern coastal areas and further inland in some parts of Karnataka and Madhya Pradesh. Currently, the area under cashew is around 634,900 ha with a total production of 417,000 tons. With 118,000 ha and a production of 140,000 tons, Kerala accounts for 18.6 % of the area and 33.5 % of production respectively. The highest productivity is observed in Kerala and Maharashtra with over one ton per ha. The high yields in Maharashtra are primarily due to the fact that cashew production is of recent origin and the major part of the plantations have been established with high yielding clonal material.

Cashew nut processing: -Processing of cashew is defined as the recovery of edible meat portion- the kernel from raw nuts, by manual or mechanical means. In India, the processing is by manual means. It consists of; 1. Roasting 2. Shelling 3. Peeling 4. Sweating 5. Grading 6. Packing

Roasting: -Roasting is designed to make shell brittle.

Open Pan Roasting: - The earliest process was the pan roasting wherein the nuts are heated on a metal pan over an open fire. Due to the heat and slight charring the shells become brittle. The two important methods of processing now adopted are; a. Drum roasting and b. Oil bath roasting.

a. Drum roasting: - The nuts are fed into a rotating hot drum, which ignites the shell portion of the nut. The drum maintains its temperature because of the oil oozing out of the nuts. The drum is kept in rotation by hand for about 2-4 minutes. The roasted nuts which are still burning are covered with wood ash to absorb the oil on the surface. The rate of shelling and the outturn of whole kernels are very high in this method.

b. Oil bath roasting: In this method, the nuts are held in wire trays and are passed through a bath of cashew shell oil maintained at a temperature of 200-202^{o}C for a period of three minutes whereby the shell oil is received from the shells to maximum possible extent. During roasting, the shell gets heated and cell wall gets separated releasing oil into bath. As the level rises the oil is recovered by continuous overflow arrangement. The roasted nuts are then converted into a centrifuge. The residual oil adhering to the surface of nuts is removed by centrifuging.

Shelling: After roasting, shelling is done by labour. Each nut is placed edgewise and cracked open with a light wooden mallet and the kernel extracted with or without wire prong. Care has to be taken that the inner kernel is intact and not broken into bits.

Peeling: Peeling is the removal of testa from the kernels. This is done with help of safety pin or small hand knife. Peeling is made easier when the kernels are subjected to a heat treatment for about 4 hrs in a drying chamber.

Sweating: After peeling, the kernels are spread out indoors on cement flooring so that they may absorb some moisture and become less brittle. This prevents the tendency to break easily during grading.

Grading: The next stage in the processing is the grading of kernels on the basis of specifications for exportable grades. There are 25 exportable grades of cashew kernels.

Packing: Final operation is packing in 10 kg capacity tins, which are subsequently evacuated and filled with carbon dioxide.

Value addition: The cashew industry is ripe with opportunities for value addition. By strategically investing in processing facilities and expanding the range of cashew-based products, such as cashew milk, butter, and snacks, the country can substantially increase the value of its cashew exports and create a multitude of employment opportunities. Furthermore, diversifying into other cashew-related products like cashew nut shell liquid (CNSL) and cashew apple products can open up new revenue streams.

The developing value-added cashew products such as cashew fruit juice, cashew powder, and cashew soup mix could gain a competitive edge in the market, particularly targeting hotels and restaurants. The specific products of ‘Wine from Cashew Fruit’ and use of ‘Cashew shells to produce power to run the cashew machines’ seen as potential value additions.

By-products of cashew nut: -After the processing of the shell and other left outs are used making some other products. The major bye products of cashew processing are: 1. Cashew Nut Shell Liquid 2. Shell charcoal

Cashew Nut Shell Liquid-The pericarp of the nut consists of a coriacious epicarp, spongy mesocarp and stony endocarp. The kernel covered with testa membrane is contained in a shell 1/8 inch thick. The mesocarp consists of a honeycomb network of cells containing a viscous liquid called cashew nut shell liquid (CSNL), which provides a natural protection to the kernel against insects. CSNL is a valuable raw material for a number of polymer based industries like paints and varnishes, resins, industrial and decorative laminates, brake linings and rubber compounding resins.

Cashew shell charcoal: The remains of shell after the extraction of CSNL is called shell charcoal. This is used as a fuel. The shell charcoal is used in processing of cashew for drying after shelling.

MARKETING

Raw cashew nuts are a seasonal commodity and the trading season is from March to May. Growers usually supply the primary or village markets where small traders collect and supply the urban markets. The cashew trade is seldom handled by exclusive traders. Usually, those traders who collect other plantation products also trade in cashew. Due to the highly competitive nature of the cashew trade growers have few marketing problems. When large quantities are collected by middlemen, the processors enter the marketing chain and make wholesale purchases. Quality is generally determined by appearance and cutting tests that traders employ prior to purchase. The current value of Indian production is estimated at around Rs. 10,000 million. This capital is made available by industry for procurement and processing operations.There are no growers’ cooperatives or organizations for cashew marketing. In addition to the local production of nearly 430,000 tons, India also imports a considerable quantity of raw nuts from several African and South-east

	Export Volume FY24 (MT)	Exported in FY24 (USD Mil)
Cashew Kernels	65808.42	338.88
Cashewnut Shell Liquid	3508.18	1.93
Cardanol	9714.12	7.36

Asian countries to satisfy the national processing capacity of 700,000 tons established in the country.

Exports:-The country has exported of Cashew Kernels to the world during the year 2023-24 as follows:

Major Export Destinations (2023-24): UAE, Japan, Netherland, Spain and Saudi Arabia.

Challenges of cashewnut production

1.Environmental concerns
2.Fluctuating market prices
3. Labour-intensive processing methods.
4.Maintaining consistent quality standards is a challenge in the cashew industry.

Opportunities:

- Sustainable farming practices,
- Fair trade initiatives,
- Technological advancements, and
- A commitment to environmental responsibility can collectively pave the way toward a more resilient and sustainable cashew industry.
- Long-term viability and ethical growth of this globally cherished commodity.

Problems

- Aging plantations
- Declining yields
- Labour shortages, and
- The escalating effects of climate change.
- Limited access to quality planting material,
- Inadequate extension services
- Low adoption rates of modern farming practices as significant contributors to the industry's struggles.
- Technology involvement,
- Post-harvest losses.
- To enhance the cashew production process, it is crucial to consider the impact of climate, soil conditions, agronomic practices, and market dynamics. Sustainable production methods that balance economic benefits with environmental conservation are essential.
- Market volatility
- Lack of sufficient value addition
- Lack of sufficient markets
- Lack of quality control
- Lack of collaboration among stakeholders
- International competition
- Shortage of trained manpower,
- Less wages
- Lack of proper welfare programmes for labourers
- Moderate mechanization
- Shortage of quality and quantity of raw materials,
- Lack of policy push by the government

Benefits

- Promotion of tourism
- Combat deforestation
- Prevent soil erosion

Environmental impacts: Challengesunsustainable practices like deforestation and excessive pesticide use can pose environmental risks. Balancing economic growth with environmental sustainability is a critical challenge for the industry's future. Deforestation, water pollution, and soil degradation. the importance of adopting sustainable land management practices, agroforestry systems, and responsible water usage to mitigate negative environmental consequences and safeguard the long-term viability of the cashew industry. The low plant density and improper spacing on cashew farms, reduced yields per hectare. This inefficiency in land utilization is compounded by the absence of a defined cropping pattern for cashew cultivation.Intercropping with maize or groundnuts on young cashew trees could be profitable, Promoting sustainable farming practices, such as agroforestry and integrated pest management, which mitigate environmental risks and enhance resource efficiency.

EMERGING TRENDS AND FUTURE DIRECTIONS

- The cashew industry is not without its challenges, as it faces the headwinds of climate change, pest and disease outbreaks, market fluctuations, and competition from other nut crops. To address these issues, study is actively focused on developing climate-resilient cashew varieties, implementing integrated pest management strategies, and enhancing market access for smallholder farmers.
- One promising avenue is the exploration of new technologies and innovative approaches to mitigate the impact of climate change on cashew production. This includes developing drought-tolerant varieties, improving irrigation systems, and promoting climate-smart agricultural practices.
- Additionally, identification and control pests and diseases that threaten cashew crops, utilizing eco-friendly and sustainable pest management techniques.
- To ensure the long-term viability of the cashew industry, efforts are also focused on improving market access for smallholder farmers. This involves strengthening value chains, promoting fair trade practices, and establishing direct linkages between farmers and consumers.
- Furthermore, on exploring the potential of diversifying cashew products and expanding into new markets to reduce reliance on traditional export destinations and mitigate the impact of market fluctuations**.**
- Research and development efforts have been concentrated on varietal improvement, soil and plant nutrition, effective fertilizer use, crop protection, agronomic practices, and propagation methods. These interventions aim to address the sector's challenges and enhance its productivity and sustainability.
- On cashew butter and more active research on cashew apple jam, cashew syrup, and mosquito repellent coils are encouraged to cashew industry.
- Emerging technologies such as precision agriculture and block chain based traceability systems also hold promise for the industry.

Solutions

- Strategies for sustainable cashew farming, agroforestry practices, and reforestation efforts are crucial for mitigating these environmental challenges.
- Emphasis on the importance of technology adoption, efficient resource management, and minimizing post-harvest losses to enhance the industry's competitiveness and sustainability. The development of high-yielding cashew varieties adapted to local conditions can significantly boost productivity.
- The global demand for cashews is experiencing a remarkable surge, driven by a growing recognition of their nutritional benefits and culinary versatility.

- Escalating demand presents a unique and promising opportunity to expand its presence in the global cashew market.
- By capitalizing on the cashew's rising popularity worldwide, the country can not only bolster its local market but also penetrate new international markets. This could involve expanding cashew cultivation, improving processing infrastructure, and investing in marketing and branding efforts to highlight the quality and unique characteristics of Indian cashews.
- Development of climate resilient cashewnut varieties
- The adoption of modern processing technologies
- Promotion of sustainable farming practices
- Further investment in research, extension services and farmer training
- More value addition is needed.
- Quality control of cashew products is needed.
- Collaborations among stakeholders including farmers, processors, packagers, distributors, govt. Agencies.
- Implementing supportive policies
- Establishment of farmers cooperatives
- Climate smart agriculture

Government policies

- Financial assistance to farmers,
- Encouraging research and development in cashew cultivation and processing,
- Facilitating market access for exporters.
- Drastic fluctuations in cashew production within the country have raised and the sustainability and efficiency of the industry. Government has to taken the crucial step of initiating cashew importation to prevent the collapse of the entire production chain.
- On-going research is focused on developing high-yielding cashew varieties that exhibit resilience to pests and diseases, coupled with innovative processing techniques that curtail labour costs and enhance product quality.
- Embracing modern technologies in both cashew cultivation and processing has the potential to revolutionize the cashew industry.
- The implementation of energy-efficient machinery for processing not only ensures fairness in labour practices but also contributes to a more sustainable and environmentally conscious industry.
- Furthermore, precision agriculture plays a crucial role in enabling effective nutrient management and pest control in cashew orchards, ensuring the production of high-quality raw cashews.
- Advancements in packaging technologies also contribute to reducing the industry's environmental footprint.
- By adopting cutting-edge technologies, the industry can undergo transformative changes.

RECOMMENDATIONS

- To tackle the issue of aging plantations and declining yields, a comprehensive replanting program should be implemented by the government.
- Focus on providing farmers with access to high-quality, disease-resistant cashew varieties adapted to the local environment.
- Bolstering extension services to educate farmers on modern cultivation techniques, including proper pruning, fertilization, and pest management etc.
- Attracting and retaining skilled labour within the cashew sector.
- Mechanization can reduce the labour intensity of certain tasks.
- Promoting training and skill development programs.
- Mitigating the impact of climate change and environmental degradation necessitates the adoption of sustainable farming practices within the industry.
- Water conservation techniques, like rainwater harvesting and drip irrigation etc.
- Adopting organic pest and disease management strategies.
- Use of cutting-edge & energy-saving technologies.
- To increase the value of cashews and reduce reliance on raw nut exports, investment in processing facilities and the development of a wider array of cashew-based products is crucial.
- Exploring the potential of cashew nut shell liquid (CNSL) and cashew apple products.
- To ensure that smallholder farmers receive fair prices for their produce and have access to market opportunities.
- Establishing farmer cooperatives, promoting direct trade relationships with international buyers, and facilitating access to information and resources on market trends and prices.
- Adopting modern technologies like precision agriculture, energy-efficient machinery, and block chain based traceability systems can substantially improve the efficiency.

CONCLUSION

One of the key factors in favour of expanding the cashew industry in India is the stable price in the international market when compared to other nuts such as almond, hazel nut etc. Nutritionally, cashew also compares well with other tree nut crops. It is a commodity rich in unsaturated fatty acids with high protein and low levels of saturated fats and soluble sugars. Higher levels of polyunsaturated fatty acids which lower blood cholesterol is particularly of high nutritional significance. The crop is steadily gaining acceptance in many western markets where consumers are more health conscious.The elaborate research network and development infrastructure in India is beneficial for the expansion of the cashew industry. Development and introduction of eco-friendly production packages such as organic farming and integrated pest management can provide a further boost to the development of the crop and the cashew industry in the future.The surge popularity of cashew can be attributed from the cashew's nutritional value, versatility in culinary applications, and increasing awareness of its health benefits.

As consumer preferences shift towards healthier snacking options and plant-based diets, the demand for cashews is expected to continue rising. This presents both opportunities and challenges for the global cashew industry. While increased demand can drive economic growth, it also necessitates sustainable production practices and efficient value chain management to ensure the industry's long-term viability and to meet the growing consumer needs.The burgeoning global demand for cashews, coupled with supportive government policies, technological advancements, and the untapped potential for value addition and diversification, offer a promising avenue for the sector's revitalization.To seize these opportunities and chart a path towards a prosperous future, concerted efforts are required from all stakeholders. Farmers need access to high-quality planting material, training in modern cultivation techniques, and fair compensation for their produce. Processors must invest in state-of-the-art technologies and explore value-added products to enhance competitiveness. Exporters need to proactively seek out new markets and establish a strong brand identity for India cashews, highlighting their unique taste and quality. The government, in turn, must continue its supportive policies, provide necessary infrastructure. facilitate production promotion, and create an enabling environment for investment and growth in the sector.While the path forward may be riddled with obstacles, the industry's potential for success is undeniable. The time for action is now, and the rewards for a concerted and strategic approach are immense, both for the industry and the nation.The cashew industry generates jobs in processing, packaging, and export, contributing to the rural economy. Cashew is a favourite snack for many people because of its fat, aromatic, sweet, and unique taste that it brings on the tongue. Not only delicious, but cashews also bring high levels of nutrients that are good for the heart, skin and bones. This is definitely an indispensable seed in every family.

"You have two options in life: stay home, and stay hungry, or go out there, pluck some cashews, and convert them into cash." ― Michael Bassey Johnson

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