CHAPTER I
INTRODUCTION

1.1 FERTILIZER INDUSTRY

The fertilizer industry is one of the most energy intensive sector within Indian economy and is therefore of particular interest in the context of both local and global environment discussions. Increase in productivity of this good with the use of cleaner and more efficient technologies in the manufacturing sector will be most effective in merging economic, environment and social development objectives. Being the backbone of agricultural productivity, the role of fertilizers will always remain crucial. In developing countries like India, with increase in demand for food the demand for fertilizer supply has experienced an upward shift.

Fertilizers production in India is nutrient wise. The three main nutrients nitrogen (urea), phosphate and potash are used for fertilizers creation. Urea, ammonium sulphate, calcium ammonium nitrate (CAN) and ammonium chloride are the nitrogenous fertilizers produced in India and single super phosphate (SSP) is the only phosphatic fertilizer that is produced in India. Additionally, nutrients are combined to produce several complex fertilizers. Production of complex fertilizers include (Di-ammonium Phosphate) DAP, several grades of nitro phosphates and NPK complexes. Urea, DAP, SSP and Muriate of Potash (MOP) are the most commonly used fertilizers.

Among these, urea and DAP are the main fertilizers that are produced indigenously. Due to the lack of viable resources or reserves of potash in India, the entire feedstock requirement for potassic fertilizers are imported. Thus, Potash based fertilizer demand is entirely met by imports, for phosphate fertilizer raw materials are imported and lastly natural gas and (liquid natural gas) LNG are being imported for urea fertilizer production. In India, technical problems, power shortages and stringent government policies lead to problems in production expansion.

Indian fertilizer industry is one industry with immense scopes in future. India is primarily agriculture oriented country and its economy is highly based on the agrarian produce the agricultural sector and its other associated spheres provide employment to a large section at the country’s population and share about 25 per cent
to the GDP. The Indian fertilizer industry is one of the allied sectors of the agricultural sphere. India has emerged as the third largest producer of nitrogenous fertilizers. The adoption of book to break five year plan has paved the way for self sufficiency in the production of food grains. In recently production has gone up to an extent that there is scope for the export at food reins. The surplus has been foliated by the way of chemical fertilizers. The large scale use of chemical fertilizers has been instrumental in bringing about the green revolution in India. The fertilizer industry in India began its journey way back in 1906. During this period the first single super phosphate factory was established in Ranipet in Chennai (Anon., 2017a).

1.1.1 History of Fertilizer Industry

Fertilizer in the agricultural process is an important area of concern. The industry had a very humble beginning in 1906, when the first manufacturing unit of SSP in Ranipet near Chennai with a capacity of 6000 MT a year was established. Fertilizer & Chemicals Travancore of India Ltd. (FACT) at Cochin in Kerala and Fertilizer Corporation of India (FCI) in Sindri in Bihar were the first large sized plants set up in forties and fifties with a view to establish industrial base and attain self-sufficiency in food grains. An impetus to the growth of fertilizer industry in India was given by green revolution in sixties. At present there are 57 large scale fertilizer units. The units manufacture an extensive range of phosphate, nitrogenous and complex fertilizers 29 at these 57 units are engaged in the manufacturing of urea while is of them produce calcium ammonium nitrate and Ammonium Sulfate. The remaining 20 fertilizer plants produce complex fertilizer and DAP. There is also a member of medium and small scale industries in operation.

Further a significant addition to the production was witnessed in seventies and eighties. The fertilizer industry has played a majors role in achieving self-sufficiency in food grains as well as in rapid and sustained agricultural growth.

The growth of Indian fertilizer industry has been largely determined by the policies pursued by the government which mainly confine to control the pricing, distribution and movement of fertilizers. The industry is capital intensive and the production process is energy intensive with the combined cost of feedstock and fuel accounting for anywhere between 55 and 80 per cent of cost of production, depending on the type of fertilizers. The rapid buildup of fertilizer production capacity in the
country has been achieved as a result of a favorable policy environment facilitating large investments in the public, co-operative and private sectors (Anon., 2017b).

1.1.2 Growth of Fertilizer Industry

The Indian fertilizer industry has come a long way since the setting up of the manufacturing unit of SSP near Chennai in 1906. A new impetus to the growth of Indian fertilizer Industry was provided by the set up the two fertilizer plants – Fertilizer and Chemicals Travancore of Indian Limited (FACT) in Kerala and the Fertilizer Corporation of India (FCI) in Bihar. This was during the forties and the fifties. The aim was to create an Industrial base that would provide India with self-reliability in food grains. With the effect from 25th July 1991, the government implemented three major policy decisions (a) decontrol of Ammonium Sulphate CAN and ammonium chloride (b) Increase in the selling prices of all other fertilizer by 40 per cent and (c) Introduction of a subsidy ceiling on SSP. However within a span of three weeks, the government revised the extent of the price like to 30 per cent with effect from 14th August 1991 and exempted the small and marginal farmers from it completely. With effect from 25th August 1952, the government de controlled all phosphate and potassic fertilizers and abolished the Retention Price Scheme (RPS) covering the farmers brought back ammonium sulphate.

An ammonium chloride with the purview of the control and subsidy and rescued the selling price of urea by 10 per cent while returning this under control of the RPS. These policy changes were expected to achieve (a) Reduction in subsidy (b) Continued growth in food grain production and (c) keeping healthy soil intact. Unfortunately none of these could be achieved. India witnessed significant growth of the fertilizer Industry during the sixties and the seventies. By 2003, India has an installed capacity of 12.11 MMT of nitrogen and 5.36 MMT of phosphate. Today with 57 large sized fertilizer plants manufacturing a wide variety of the nitrogen, complex phosphate. Fertilizers the India fertilizer industry is the 3rd largest producer in the world. One of the major factors that have led to the rapid increase in the production capacity of fertilizers in India the policy environment. With the formulation and implementation of investor friendly policies large investment poured in to the private public and co-operative sector’s and this and this propelled the growth of the Indian fertilizer industry. Reports showed the total installed capacity of fertilizer production in 2004 to be 119.60 LMT of nitrogen and 53.60 LMT of
phosphate. These figures went up to 120.61 LMT of nitrogen and 56.59 LMT of phosphate in 2007. The production of fertilizers was 113.54 LMT of nitrogen and 42.21 LMT of phosphate during 2005-06. Indian fertilizer has reached international levels of capacity utilization by adopting various strategies for increasing the productions of fertilizers (Anon., 2017b).

Higher fertilizer consumption was met adequately by carry over inventory, indigenous production and imports. Production of fertilizers registered a growth of almost 7 per cent in terms of nutrients in 2015-16. In terms of products, urea production increased significantly from 22.593 MMT in 2014-15 to 24.461 MMT in 2015-16, an increase of 8.3 per cent. Production of DAP at 3.822 MMT in 2015-16 was higher by 10.9 per cent compared to 3.445 MMT in 2014-15. Complex fertilizers (other than DAP) registered a growth of 7 per cent in production from 7.829 MMT to 8.379 MMT during the same period. Production of SSP also increased by 2.5 per cent to 4.335 MMT in 2015-16 compared to 4.230 MMT in previous year (Chander, 2016).

Expansion and increase in efficiency through modernization and revamping of existing fertilizer units. Using alternative source such as coal or liquefied natural gas for the production of fertilizer especially urea. Reviving some of the closed fertilizers plants. Establishing joint venture projects with companies in countries.

In order to meet the demand for gas this is one of the primer requirement for the production of nitrogenous fertilizers. India has entered into joint ventures with foreign companies in number of countries. Joint ventures have also been established for the supply of phosphoric acid. Indian fertilizer manufacturing companies has joined and with companies in Senegal Oman, Jordan, Morocco, Egypt, Tunisia and other countries. It is therefore evident that the Indian fertilizer industry has witnessed extensive growth and development in short span of time. With such extensive growth it is not surprising that the India ranks Germany, the leading fertilizer manufacturing countries of the world. The India government has devised policies conducive to the manufacture and consumption of fertilizers. Numerous committees have been formed by the Indian government to formulate and determine fertilizer policies. The dramatic development of the fertilizer industry and the rise in its production capacity has largely been attributed to the favourable policies. This has resulted in large scale investment in all three sector viz. public, private and co-operative.
At present there are 57 large scale fertilizer units. These manufacture an extensive large of phosphates, nitrogenous and complex fertilizers. 29 of these 57 units are engaged in the manufacturing of urea, while 13 of them produce calcium ammonium nitrate and ammonium sulphate. The remaining 20 fertilizer plants manufacture complex fertilizer and DAP. There are also about 12 medium and small scale industries in operation. The department of fertilizer is responsible for the planning promotion and development of the fertilizer industry. It also takes into account the import and distribution of the fertilizer and also the financial aspect. There are four main divisions of the department. These include fertilizer imports, movement and distribution, finance and accounts fertilizers projects and planning and administration and vigilance. It makes an assessment of the individual requirements of the States and Union Territories and those lays out an elaborate supply plan. Though the soil of India is rich slit, it lacks chief plant nutrients like potassium, nitrogen and phosphate. The increase in the production of fertilizer and its consumption acts as a major contributor to overall agricultural development (Anon., 2017c).

1.1.3 Factors Affecting Fertilizer Consumption

The use of fertilizers is affected by a number of factors like irrigation, high yielding variety seeds, size of the farm credit etc. Increased area under high yielding varieties led to increased food grains production. These high yielding varieties respond more to the use of chemical fertilizers. There exists a large gap between actual and potential level in fertilizers use. Increased fertilizer use efficiency leads to a number of benefits to Indian agriculture. They are economy in use of fertilizers, reduction in unit cost of production, prevention of fall in agricultural productivity, production of environmental quality and efficient use of other inputs such as irrigation and high yielding varieties in developing countries actual fertilizer use is usually below the economic potential.

In the production process in agriculture cultivator’s demand for fertilizers generally depends on three factors, viz., (a) Decision on fertilizer application, (b) Choice of crop (i.e., for which crop fertilizer should be applied); and (c) Rate of application (per unit of cropped area). The first factor is basically a state of awareness and knowledge of the farmer regarding fertilizer use on crops he commonly grows. The other two issues are generally governed by profitability of fertilizer use at farm level. The level of fertilizer use increases with increased response to the use of
fertilizers. The level of fertilizer use is influenced by the price of fertilizer relative to the price of the product. Agro-climatic factors like rainfall and its distribution, irrigation and its quality, genetic characteristics of seeds, fertility of the soil, proportion of area under fertilizer intensive crops (cropping pattern) etc and technological factors like method of application of fertilizers, time of application and choice of fertilizer material also influence usage of fertilizers.

The institutional factors such as access to credit and its cost for small farmers in particular, farmer” asset or liquidity, tenancy system, markets for inputs and output, distribution of input and output, distribution of fertilizer outlets, supply and distributional conditions for fertilizers influence demand for and supply of fertilizers. Desai (1990), pleads strongly for non-price factors such as irrigation, diffusion of HYV, cropping pattern, supply and distribution of fertilizers and agricultural extension services as major determinants of fertilizer demand, more than propping up prices of crops or lowering fertilizer prices trough subsidies (Anon., 2017d).

1.1.4 Fertilizer Industry in Gujarat

There are main four companies which produce chemical fertilizer in Gujarat. Out of them the Gujarat State Fertilizer Chemical Limited established the first ever chemical fertilizer factory in Gujarat at Baroda in 1967. GSFC was first joint sector industrial unit in India with equity capital of State government 49 per cent and public 51 per cent. It was also first unit to manufacture DAP. Fertilizer in India them in nine years later, in 1976 the Gujarat Narmada Valley Fertilizer Company Limited popularly known as GNFC established a chemical fertilizer factory at Barouche. GNFC promoted by the government of Gujarat and GSFC.

After the establishment of these two companies in Gujarat, in 1975 Indian Farmers Fertilizer Co-operative Limited (IFFCO) set up its plants at Kalol and Kandla in Gujarat.

Krushak Bharti Co-operative Limited (KRIBHCO) established its manufacturing unit in Gujarat. First used by ancient farmers fertilizer technology developed significantly as the chemical needs of growing plants were discovered. The use of synthetic fertilizer has significantly improved the quality and quantity of the food available today. Their long term use is harmful the environmentalists (Anon., 2017e).
1.2 TYPES OF FERTILIZERS
Fertilizers are classified as two major types:

- Chemical fertilizers are generally synthetic or man-made compositions.
- Organic fertilizers are derived from natural products, that were once living organisms.

Both chemical and organic fertilizers come in several forms. Three types of chemical fertilizers are: dry/granular, or liquid, which may actually be in liquid form or water soluble powder. A separate type of dry fertilizer is the so-called slow-release or controlled-release. This type is designed to dissolve over a period of time (3-4 months, 4-6 months, etc.) to provide an extended period of feeding. Nutrients are released by a combination of temperature and water. Thus, during warm weather, every time you water or it rains, some nutrients are being released for the plants to use.

1.3 ORGANIC FERTILIZER

An organic fertilizer refers to a soil amendment derived from natural sources that guarantees, at least, the minimum percentages of nitrogen, phosphate, and potash. Virtually any organic material can be used as a fertilizer; however, materials vary considerably in the concentration of plant nutrients they contain and the rate which these nutrients are released for the plant use. Therefore, some organic fertilizers are better for certain situations than others, and different materials need to be applied at different rates to supply the correct amount of plant nutrients. Our most important natural resource is the soil that is why it is crucial to save and protect it considering the present and also the future. It is our task to preserve the humus top soil and to increase its organic matter contents, to improve the nutrient providing ability and carry on an environment-friendly nutrient management

A common misconception is that organic fertilizers are safer for plants and the environment than inorganic (chemical) products. Improper organic fertilizer application can also contribute to surface and ground water pollution, may induce a plant nutrient deficiency or toxicity, or cause salt burn. Properly used, both organic and inorganic fertilizers are safe for plants and the environment. The purpose of this guide is to provide general selection and use information for organic fertilizers. See the related guide, selecting and using inorganic fertilizers for similar information on inorganic products.
These nutrients may be supplied by either organic or inorganic fertilizers, or a combination of materials. Many nursery and garden supply stores now stock a wide variety of organic fertilizers. In addition, many organic materials are produced around the home, or can be obtained at little or no cost from livestock operations, municipal green waste collection centers, and local landfills.

Organic fertilizers are used to improve soil quality and tilth, and to provide nutrients for plant growth. They provide nitrogen, phosphorus, and potassium, as well as other elements essential for plant development and overall good health. Nutrient values vary greatly among organic fertilizers. They also vary greatly for a given organic fertilizer. For example, as the table on the following three pages shows, the nitrogen in raw bone meal ranges from 2 to 6 per cent, and the phosphorus from 15 to 27 per cent. Differences reflect variations in the age of organic material, its decomposition rate, application method and timing, incorporation time, time exposed to the elements (rain, sun), the percentages of organic matter and water the material contains, carbon-to-nitrogen ratio, microbe population, and soil type. Values for manures vary according to time of year, time in the open air, percentage of added straw, and rate of incorporation. The speed of release shown in the table indicates how quickly nutrients are made available to plants.

Some materials are regulated by oregon tilth. To be considered organic, they must result from organic farming methods. For example, cocoa shell meal and cottonseed meal must not be contaminated with pesticide residues. Raw manure is also regulated; composted manure is not. Wood ashes must not be from treated wood.

Nitrogen, phosphorus, and potassium are represented by N, P, and K in the table headings, to conform to standard commercial practice in labeling fertilizers. Phosphorus is actually present in the form of P2O5, potassium as K2O.

1.3.1. Types of Organic Fertilizers

Organic fertilizers can be grouped into the following categories:

1.3.1.1 Manures and composts

Out of all the organic fertilizers, good quality manure is excellent source of organic nutrients, which consists of solid and liquid feces and litter. Fresh manure may be available from the livestock operations. Commercial, packaged manures generally contain composted material. Compost can be made from the materials such
as yard waste, sawdust, manures and industrial by-products. Composted materials are generally ready to mix into the soil when you can no longer identify what the material originally consisted of. It usually has a dark brown appearance, is granular in size and has a musty smell.

Human manure, some people refer to human excreta as human manure, and the word “humanure” has also been used. Just like animal manure, it can be applied as a soil conditioner. Sewage sludge is a material that contains human excreta, as it is generated after mixing excreta with water and treatment of waste water in a sewage treatment plant sewage sludge.

1.3.1.2. Green manures

Green fertilizing is a method of organic fertilizing when a plant is produced for the purpose of turning its whole mass into the soil as a fertilizer before it begins to bloom. Green manures are crops grown for the express purpose of plowing them in, thus increasing the fertility through the incorporation of nutrients and organic matter into the soil. Leguminous plants such as clover are often use for this, as they fix nitrogen using Rhizobia bacteria in specialized nodes in the root structure.

1.3.1.3. Plant, stubble and root residues

The roots of cultivated plants play a significant role in the maintenance of the fertility, digestion of nutrients and improving the structure of the soil. They have a great advantage on the organic manures that they homogenously net in the soil and in this way the organic material distribution is even. The amount of the root residues is considerable, in the upper 200 mm layer of the soil expressed in dry matter per hectare the values are the following: peas 600 kg, maize 2500 kg, sunflower 3900 kg. Beside the roots the stem residues also have a remarkable role. The amount is influenced by the sowing density and the stubble height.

1.3.1.4. Other fertilizers

Peat is also suitable for organic fertilizing, primarily to correct the harmful characteristics of manures and sub serve composting. Its advantages are the great hygroscopic ability and bactericidal effect, which facilitate the use of malodorous materials and the considerable decrease of the number of pathogens. Lime is a naturally occurring material produced by crushing rocks containing high amounts of calcium and magnesium carbonates. The inhabitants of the coasts have been using the
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nutrient supply of the algae (Fucaceae and sea-weed) to improve the soil for centuries.

There are two types of algae-products sold in Europe: one is calcareous algae, the other is a liquid product made of dried green and brown algae. The ordinary dose of calcareous algae is 400-600 kg/ha, with the effect of an average 10-15 per cent increase of crop. Bacterial fertilizers are not novel, however brilliant achievements of science. Their principle is to beneficiate the flora of the free living, nitrogen-fixing bacteria in the soil, so the use of chemical fertilizers containing nitrogen is unnecessary.

1.4 INTRODUCTION OF CASHEW

Cashew tree is believed to be a native of Brazil, from where it has dispersed to different parts of the world primarily for soil conservation, afforestation and wasteland development. The term ‘Cashew’ has originated from the Brazilian name ‘Acajaiba’ and the Tupi name ‘Acaju’, which the Portuguese converted into ‘Caju’ and is commonly known as ‘Kaju’ in India. It is known as ‘Paragi Andi’ in Kerala meaning foreign nut, ‘Lanka Beeja’ in Orissa assuming its introduction from Sri Lanka, and ‘Mundiri’ indicating the shape of the nut in Tamil Nadu.

Cashew often referred as a ‘Wonder Nut’, is one of the most valuable processed nuts traded on the global commodity markets and is also an important cash crop. It has the potential to provide source of livelihood for the cashew growers, empower rural women in the processing sector, create employment opportunities and generate foreign exchange through exports.

1.4.1 Processing of Cashew Nuts

Processing of nuts is the recovery of kernels from raw nuts by manual or mechanical means. India has been a pioneer in cashew processing. The growing demand for kernels in the world market and the availability of cheap labour mainly of women possessing the requisite skills are the favourable factors for the rapid growth of processing industry in the country and it has a monopoly over the manual processing of cashew. Though mechanization is introduced in cashew processing, the availability of skilled and cheap labour in India and better quality of kernels under manual processing, limits the scope for extensive mechanization. Factories in general
have mechanization in roasting/boiling and packing. Predominance of manual labour continues in the processes like shelling, peeling and grading.

1.4.2 Manufacturing Process

The process of manufacture is well-established. Raw cashew nut are dried in sun and stored in gunny bags. The stored raw cashews are boiled by using steam in a boiler. The boiling helps to soften the cashew shell. It becomes easy to remove nut inside cashew seed after boiling.

The shell of steamed cashew nut is removed by skilled labour by using cashew cutting hand operated equipments. The cashew shell is used to extract cashew nut shell liquid (CNSL), which is an important by-product of cashew industry. The cashew kernels obtained are dried in a cabinet dryer. The outer reddish skin known as testa, is removed to obtain cashew nut after drying. Actual recovery of cashew nut is around 30 per cent, whereas 50 per cent account for shell and remaining 20 per cent is process loss.
1.4.3 Cashew Grades

Grading is done based on "counts" or number of kernels per lb. Based on the shape, size and colour of the kernel, cashew kernels are graded into white or scorched wholes, pieces, splits, butts, etc. The Government of India Act prescribes 33 different grades of cashew kernels of which only 26 grades are commercially available and exported. W-320 are the most popular among cashew kernels and also the most available worldwide. Butts, splits and pieces are priced low and are used for cooking, preparation of sweets and savoury snacks. Packing was usually done by vita pack method (exhausting the air inside the packing tin, pumping in carbon dioxide and sealing).
Table 1.1 Grades of cashew nut

<table>
<thead>
<tr>
<th>Grade</th>
<th>No./lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>W 180 (Known as the ‘King of Cashew’, are larger in size)</td>
<td>160-180</td>
</tr>
<tr>
<td>W 210 (Popularly known as ‘Jumbo’ nuts)</td>
<td>200-210</td>
</tr>
<tr>
<td>W 240 (an attractive grade which is reasonably priced)</td>
<td>220-240</td>
</tr>
<tr>
<td>W 280</td>
<td>260-280</td>
</tr>
<tr>
<td>W 320 (Most popular variety among cashew kernels and highest in terms of availability, worldwide)</td>
<td>300-320</td>
</tr>
<tr>
<td>W 400</td>
<td>350-400</td>
</tr>
<tr>
<td>W 450 (smallest and cheapest white whole kernels and hence the favourite among low priced whole grades)</td>
<td>400-450</td>
</tr>
<tr>
<td>W 500</td>
<td>450-500</td>
</tr>
</tbody>
</table>

1.4.4 Value Added Nuts

Value addition in cashew can be done through preparing sweetened and flavoured cashew from cashew kernel baby bits. Cashew kernel baby bits could be coated with combination of different colours (Apple Green, Chocolate Brown, Kesari, Lemon Yellow, Orange, Red and Raspberry Red) and flavours (Vanilla, Cardamom, Ginger and Clove). The value added cashew products in included salted and roasted kernels with chilly or pepper flavours. The export of value added cashew kernels from India is insignificant. This is mainly due to the reason that the importers and packers in the major markets like United States do not want the Indian suppliers to send value added products, which they consider, would adversely affect their packing industry. However, there is a scope for increasing the export of value added cashew kernels in the non-traditional markets like West Asian countries.

1.4.5 By-products of Cashew

There are two main by-products of cashew: CNSL and Cashew Apple. Details of these by-products are discussed below.

1.4.5.1 Cashew nut shell liquid (CNSL)

CNSL is an important economic product of the plant, which is extracted from the shells of the raw nut and has various industrial uses like preparation of type writer rolls, drying enamels, water-proof coating for cement and brick flooring, manufacture
of paints, varnishes and plastics. CNSL is a by-product of cashew industry, which is obtained from the shells. It is one of the few natural resins that is highly heat resistant and is used in the paint, automobile and foundry industry. Some of the advantages of CNSL based polymers are that it has improved flexibility, termite and insect resistance and anti-microbial property.

1.4.5.2 Cashew apple

Cashew apple, the swollen peduncle to which the nut is attached, is noted for its high ascorbic acid content (Vitamin C), which is five times more than that of any citrus fruits. The astringency is due to the presence of tannins, which can be removed by addition of suitable additives before processing. A number of processes have now been developed for converting the cashew apple into various products such as juice, jam, syrup, chutney and beverage. The ability of cashew apples to supply and fortify the nutritional requirement for Vitamin C, particularly in Africa. Cashew apple juice was found to contain the highest amount of Vitamin C (203.5 mg/100 ml.) of edible portion and when cashew apple was blended with other tropical fruits it boosted their nutritional quality. Cashew apple is normally not eaten due to its high astringency.

In certain parts of India like Goa, cashew apple is used to distil cashew liquor referred to as Feni. But in the main cashew producing areas of India, 95 percent of cashew apple is not consumed, as the taste is not popular. Although, Krishi Vigyan Kendra (KVK), Vridhachalam in Tamil Nadu had been organizing various training programmes for the processing of cashew apple. Instead, it was mostly used as a manure or fodder. Similarly, in Koraput district (Orissa), little efforts had been made for value addition to cashew apple and the apples were discarded at the time of collecting raw nuts. Even in Kerala, cashew apple processing had not been taken up on a large scale, except for Madakkathara research station of Kerala Agricultural University (KAU) and very few processors in Kannur (Yadav, 2010).

1.5 INTRODUCTION OF CASHEW SHELL CAKE

Cashew nut shells have not been fully utilized until now and most of them are still in a form of wastes. That amount of cashew nut shell wastes would be very potential if they were composted into organic fertilizers and fungicides. Cashew nut shell wastes are organic matter containing macro elements such as N (0.84 per cent), P (0.21 per cent), K (0.70 per cent) and micro elements such as Ca (0.13 per cent) and Mg
(0.24 per cent), that are useful for plants. Cashew nut shell contains high lignoselulose that is difficult to hydrolyze so that it will take a very long time to become organic fertilizer through natural composting.

This can cause comulation of wastes that have negative effect to the environment. Therefore, treatments using proper composting techniques such as utilizing bioactivator (Trichoderma spp. and selulotic bacteria) and chopping cashew nut shell, are needed to solve the problem. Both of treatments are expected to accelerate decomposition and produce good quality compost that can be applied to the plant as organic fertilizer and fungicide.

The addition of cashew nut shell can significantly increase the composting rate of cashew nut shell waste as raw material for organic fertilizer and it can improve the quality of cashew nut shell compost formulas suitable with the compost of organic fertilizers. The treatments of cashew nut shell compost gave better effect on the growth and nutrient uptake of crop. Cashew nut shell compost formula in 50 g polybag-1 can substitute 100 g polybag-1 goat manure to increase the growth old crop. The increase of doses of cashew nut shell compost formula to 100 g polybag-1 can enhance the growth of crop. Cashew nut shell compost formula can improve the balance of nutrients in the soil so that it enhances the growth.

The experiment results on the effectiveness of cashew nut shell compost formulas as organic fertilizers and pesticides showed that both the cashew nut shell compost formulas in 50 g polybag-1 and 100 g polybag-1 which were enriched with Trichoderma spp. gave significant influence to increase resistance against pathogen attack, Ridigoporuslignosus, the cause of white root fungus (JAP) disease and they were able to increase growth better than the control (top soil) because they can improve of crop. Application of cashew nut shell compost formulas are expected to reduce the land resource degradation as well as pollutant emissions, then to improve the recycled elements utilization of the farming system (zero waste), and finally to protect the environment and the welfare of local community life.
Table 1.3 Nutrient content

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Result</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td>0.72</td>
<td>Per cent</td>
</tr>
<tr>
<td>2</td>
<td>P</td>
<td>0.090</td>
<td>Per cent</td>
</tr>
<tr>
<td>3</td>
<td>K</td>
<td>0.32</td>
<td>Per cent</td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td>0.0012</td>
<td>Per cent</td>
</tr>
<tr>
<td>5</td>
<td>Cu</td>
<td>7.20</td>
<td>ppm</td>
</tr>
<tr>
<td>6</td>
<td>Fe</td>
<td>188.54</td>
<td>ppm</td>
</tr>
<tr>
<td>7</td>
<td>Mn</td>
<td>25.92</td>
<td>ppm</td>
</tr>
<tr>
<td>8</td>
<td>Zn</td>
<td>10.29</td>
<td>ppm</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>9.42</td>
<td>ppm</td>
</tr>
<tr>
<td>10</td>
<td>Mo</td>
<td>Absent</td>
<td>ppm</td>
</tr>
</tbody>
</table>

1.6 COMPANY PROFILE

Patel Agri Export was established in year 2013 as a partnership concern. Patel Agri Export – is one of the leading cashew importing and processing firm in India. The firm’s activity is exclusively limited to cashew nut processing and selling. The firm imports cashew nut from West Africa, East Africa, and other parts of the world for processing of raw cashew nut.

The company’s policy is to deliver safe- food product, consistently meet trade specifications and customer expectations in terms of quality and on time-delivery in a cost effective manner. Patel Agri Export aim to develop successful & long-term business relationship with customers to maximize their satisfaction. Firm believe that quality depends on the raw materials of the cashew nut.
### Table 1.3 General Information of the Company

<table>
<thead>
<tr>
<th>Name and Address of the Company</th>
<th>Patel Agri Export, Upaleta Road, Ta-Dhoraji, Dist-Rajkot, Dhoraji-360410 (Gujarat, India)</th>
</tr>
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<tbody>
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<td><a href="http://www.patelagriexport.com">www.patelagriexport.com</a></td>
</tr>
<tr>
<td>E-mail</td>
<td><a href="mailto:info@patelagriexport.in">info@patelagriexport.in</a></td>
</tr>
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<td>Brand Name</td>
<td>Nut But</td>
</tr>
<tr>
<td>Tag line</td>
<td>Quality With Trust  Owner</td>
</tr>
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</tbody>
</table>
| Owner of the company            | 1. Rajubhai Patel  
2. Chintanbhai Patel                                                                  |
| Types of Product                | 1. Cashew nut  
   i) Cashew Kernels  W- 180, W-210, W-240, W-320, W-450  
   ii) Scorched Whole SW-240, SW-320, SW-450  
   iii) Scorched Pieces SP, SS, SSP  
   iv) White Pieces F-13, F5, LWP, SWP, BB  
   v) Desert Whole SSW Mission  
2. Cashew nut shell liquid  
3. Cashew shell cake |

### 1.6.1 Mission & Vision of the Company

- To process 20 per cent of global requirement of cashew consumption.
- To supply 50 per cent of India requirement of cashew consumption.
- To establish presence in Asian retail market with value added packs of cashews nuts.
Introduction

1.7 SCOPE OF THE STUDY
The study as facilitate decision making processing with the help of comparative cost analysis. The information about awareness and adoption of KANBI fertilizer was help the company to reform promotional strategies to increase awareness, if necessary. The study was be helpful to know which factor affect the purchasing decision of farmers. Accordingly company can work on it.

1.8 OBJECTIVES OF THE STUDY
1. To estimate the processing cost of KANBI fertilizer
2. To measure awareness and adoption of KANBI fertilizer by the farmers
3. To identify the factors influencing the purchase of KANBI fertilizers
4. To identify the factors discriminating the users and non-users of KANBI fertilizer

1.9 LIMITATIONS OF THE STUDY
1. This survey is restricted to Junagadh and Rajkot district.
2. The sample size for the survey is limited to 50 farmers, which might not be representing the whole district.
3. Data were derived from primary sources by structured questionnarie and personal interview of farmers, which may different from actual data.