

## A Review on the Potential use and Cultivation of Chia Seeds (*Salvia Hispanica L.*) in India

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### ABSTRACT

Chia (*Salvia hispanica L.*) is grown mainly for its seeds. It belongs to the mint family- Lamiaceae. The species *S. hispanica* yields several dry indehiscent fruits referred to as seeds which are highly nutritious. In recent years, chia seeds have grown tremendously due to their high nutritive and medicinal values. Today it is one of the most important “superfood”. Chia has been introduced to India in the year 2015 by Central Food Technological Research Institute (CFTRI) Mysore from Central America and were initially grown by farmers in few areas near Mysore. Presently the cultivation has spread to other areas of Karnataka and also to the neighbouring states. Chia is a new crop, but the economic value of chia seed in the national and international market is very high. Successful cultivation of chia crops in India will increase economic enhancement, improve living standard and health. Chia is becoming very popular as a superfood all around the world with a dramatic increase in cultivation and consumption to fulfill high demand in the International and Indian market, therefore can be cultivated as a profitable commercial crop in India. Cultivating chia is only one of many experiments, to make agriculture, food and nutritional security drought-proof.

**KEYWORDS:** Chia seeds, Superfood, Rainfed, Immunity, Nutritional security

### INTRODUCTION

Chia is a herbaceous plant, identified from southern Mexico and North Guatemala [1]. The plant produces purple and white flowers which are three or four millimeters tiny and hermaphrodite in nature. The species *S. hispanica* yields several dry indehiscent fruits referred to as seeds which are edible, were used with beans, Amaranth or corn as essential foods in the pre- Columbian period. These seeds are oval-shaped and have a diameter of two millimeters. There are two types of seeds viz. black with some mottling and white seeds. The white type is priced at a premium as it blends well with Indian food products. CFTRI has developed chia- blended products such as ice creams, chocolates and jams, which are being commercialized by various companies [7]. The seeds absorb liquid when soaked and develop a mucilaginous coating that provides a distinctive gel texture to chia- based foods.

Because of this property, chia seeds cannot be conventionally washed and cleaned, therefore minimal to no pesticide usage is recommended. In a post-covid world, there is a need for immunity boosting and nutritious foods with little or no chemical residues, as chia have.

Chia plants can grow in a wide range of well drained clay and sandy soils with reasonable salt and acid tolerance. Commercial field production for chia seeds has been estimated at 550–600 kg/ha and it is widely cultivated in Mexico, America, Canada, Chile, Australia, New Zealand and Southeast Asia for different purposes [3], [4]. Yield differs with cultivars and growing conditions [5]. Under appropriate agronomic conditions the yield of 2500 kg/acre has also been reported [11].

**How to cite this paper:** Mrs. Arti Singh | Dr. Ashok Kumar Verma "A Review on the Potential use and Cultivation of Chia Seeds (*Salvia Hispanica L.*) in India" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-5, August 2022, pp.1265-1271, URL: www.ijtsrd.com/papers/ijtsrd50638.pdf



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*Salvia hispanica* L.

With the increased global public health awareness, there ultimatum calls for functional foodstuff with positive health impacts. The utilization of therapeutic foodstuff to avert illnesses like obesity, diabetes and heart disease is obtaining motion among people. Chia seeds were used as dietary and medicinal herbs in the ancient period by Aztec and Mayan communities. Chia seed is receiving scientific attention in the present time and has been recognized as a novel food. It is a customary food in Southern and Central America. It contains large amounts of phytochemicals and proteins, making it more important worldwide for its numerous health benefits to sustain healthy serum fat levels. These seeds contain polyunsaturated omega-3 and omega-6 fatty acids with anti-inflammatory effects, promote cognitive performance, lower cholesterol levels and hypertension. Caffeic acid found in the seeds has antioxidant compounds which protect the body from free radicals and contain anti-ageing properties. Fibre present in high concentrations which is connected with lowering inflammation and controlling bowel movement, reflecting usefulness in IBS (Irritable bowel syndrome). Nevertheless, the efficacy and safety of natural food require validation by numerous scientific research and studies. Nowadays, most of the chia species are utilized worldwide for their nutritional characteristics and beneficial impacts on human health [8]. A recent report published in The Hindu Business Line on 02/11/2021 infers that India became food secure after considerable planning and efforts, maintaining and improving it further by adding nutrition security is absolutely necessary. With large parts of India under rain-fed farming, it is imperative to focus on it to ensure betterment of the agricultural sector in India. The great challenge for the coming decades will be the task of increasing food production with less water availability, particularly in arid and semi- arid regions (FAO, 2003).



**Chia seeds**

Rain-fed areas produce nearly 90% of millets, 80% of oilseeds and pulses, 60% of cotton which support nearly 40% of our population and 60% of our livestock. These facts present an existing vulnerability to ensuing climate change. The only option we have is being prepared, adapting and mitigating climate change. Rain-fed areas are ecologically fragile and hence vulnerable to climate change, largely inhabited by poorer farmers. But at the same time, rain-fed areas provide nutritional security through millets, pulses and oilseeds. Productivity of most of the rain-fed crops is meagre as compared to their irrigated cousins and hence traits of resilience and improved productivity are screened for rain-fed crop improvement programmes. Major challenges of rain-fed agriculture are frequent droughts and famines, soil degradation, low investment capacity and poor market linkages. There is generally enough rainfall to double and even quadruple yields in rain-fed farming systems even in water-constrained regions, which when available at the wrong time cause dry spells and most of the water is lost. To improve production of the crop and rural livelihoods in rain-fed areas, rainfall-related risks need to be reduced, which means the investment in water management is an entry point to unlock the potential in rain-fed agriculture. It is very important to introduce suitable genotypes for Indian farmers which can give good returns even if the rainfall is inadequate or nil. Chia is a crop with potential use as human food [9], have tolerance to grow in arid

environments, therefore preferred to be used as a suitable crop as an alternative to the main crop industry [10].

#### **Uses of Chia as a superfood [27]:**

1. **Energy Enhancement:** The word "Chia" comes from the Mayan language which means "strength". Chia seeds are a balanced blend of protein, carbohydrates, fats and fibre. It is said that 1 tablespoon of Chia can sustain a person for 24 hours. Consuming Chia seeds can enhance exercise performance for workouts by providing more energy.
2. **Heart Health:** Chia seeds have ability to reverse inflammation, regulate cholesterol and lower blood pressure which makes it extremely beneficial to consume for heart health.
3. **Anti-Aging:** Antioxidants in Chia seeds have been shown to stop up to 70% of free radical activity, as well as speed up the skin's repair systems to prevent premature skin aging.
4. **Diabetes Prevention:** Numerous studies have shown that Chia seeds completely prevent the onset of dyslipidemia and insulin resistance, which are two factors that play an important role in causing diabetes.
5. **Digestive Health, Detoxification and Elimination:** Chia's high fibre content helps promote bowel regularity. It also creates a gelatin-like substance in the stomach which works as a prebiotic support

in the growth of probiotics in our digestive system. This might be a remedial option for IBS. Similar to *Psyllium*, the swelling action of Chia in the body helps to cleanse and soothe the colon and absorb toxins, while lubricating and strengthening peristaltic action.

6. **Weight Loss:** Chia curbs hunger and suppresses appetite, which can also lead to weight loss. The rich fibre content in Chia absorbs water and gives a satiating feeling.
7. **Anti-inflammatory Properties:** A number of arthritis sufferers have reported reduced pain and inflammation after a few weeks of taking Chia seeds. The high concentration of omega-3 helps to lubricate joints and keep them supple. Additionally, Omega-3s are converted into prostaglandins which are known to have both pain relieving and anti-inflammatory effects.
8. **Antioxidants:** Chia seeds are an excellent source of antioxidants containing even more antioxidants than fresh blueberries which keep the oils from going rancid – contributing to a long shelf life.
9. **Brain Power:** Eicosapentaenoic Acid (EPAs) and Docosahexaenoic Acid (DHAs) are known to make cell membranes more flexible, thus making nutrients more readily available and efficient nerve transmission. This helps to improve brain function including memory and concentration.
10. **Control blood sugar:** The unique combination of soluble and insoluble fiber helps to slow down the rate at which complex carbohydrates are digested and then assimilated into the body. The soluble fiber helps to stabilize blood glucose levels resulting in steady, sustained energy etc. Preliminary research shows that chia seeds could help people to control their blood sugar levels and protect their hearts.
11. **High Quality Protein:** Chia seeds contain about 20% protein which is higher than that found in many other grains such as wheat and rice. Chia seeds contain strontium, a trace mineral which helps to assimilate protein and produce high energy.
12. **Protect against cancer:** Though few studies have been done, early research done with animals has suggested that Chia may have a protective benefit against cancer. Research from Argentina showed that Chia seeds inhibited growth and metastasis of tumors in rats.

## BRIEF REVIEW OF LITERATURE

Although the leaves of chia plants have potential commercial interest because of their composition, the

seeds are the attractive part, fundamentally for the protein, fiber, antioxidants and oil contents [26]. The cultivation cost is around 15,000/ acre, which is similar to other traditional cereal crops like finger millet and maize. In *S. hispanica*, several changes in qualitative characteristics, including seed coat color and stem pigmentation have evolved as a result of cultivation and domestication. A single recessive gene, designated as 'ssc' is known to control the characteristic white color of the seed coat. A single dominant gene known as 'SSP', is responsible for controlling the striated stem pigmentation [16].

Chia seed is composed of high dietary fiber (18 - 30 %), ash (4 - 5 %), protein (15 - 25 %), fats (30 - 33 %), lipids (31 - 35 %), carbohydrates (26 - 41 %), minerals, vitamins and also contains a high amount of antioxidants [2] [6], higher concentration of essential fatty acids i.e., PUFAs (Polyunsaturated Fatty Acids) of omega-3 (58 - 64 % of the total lipids) and omega-6 [13]. This fatty acid is found to be very good for overall healthcare. These characteristics are helping to rapidly increase its production worldwide. The ALA (alpha linolenic fatty acid) in Chia seed is the only known essential PUFA omega-3 that the body can't produce on its own [14].

Chia is an attractive crop as it is growing well in India since its introduction. The mucilage present inside the epidermal cells of a mature chia seed when come into contact with water, it immediately expands, rupturing the primary cell layer that protrudes from epidermal cells and surrounds the seed. This increases its size and imparts a characteristic gel appearance to chia [15].

Rainfall conditions are highly variable for different cultivars, ranging from 300 to 1,000 mm during the growing season, optimal is a well distributed rainfall during early growth and development, dry conditions during seed maturation and harvesting [16]. At the genetic level, moisture stress has been considered to be a quantitative trait which influences maximal plant yield and productivity in Sorghum and Maize [17]. Changes in water balance and available soil water are crucial to crop yields as water directly affects plant physiology and responses [18], [19].

In the food industry, chia seed has been used in various forms such as whole, oil, ground or gel [20], [21]. About 48% of the daily allowance of chia seed intake is recommended according to the United States dietary guideline 2018. Chia seeds are added as supplements into food products such as pasta, cereals, snacks, biscuits or cakes. Seeds of chia can be used as substitutes of fats and eggs due to their hydrophilic characteristics [21], [22]. Chia absorbs about twelve times more water of their weight when soaked. Chia

gels can be utilized as a replacement for eggs or oils in baked items [23]. Butter can be fortified with Chia to increase the nutritional value [20].

According to a report published in Asia Pacific chia seeds market- Growth, Trends, Covid-19 Impact and Forecasts (2021 - 2026), Mordor Intelligence- "The increased awareness about functional food has created more demand for the chia seeds in the market globally. Short lifecycle (90-105 days), lower cultivation cost, crop largely untouched by pests, diseases, animals and high returns are the primary reasons for its acceptance among farmers."

## CONCLUSION

Natural Products, especially plant products have been used for the treatment of various diseases for thousands of years. Terrestrial plants used as medicines in Egypt, China, India and Greece from ancient times and an impressive number of modern drugs have been developed from them. According to the World Health Organization, 80% of the people living in rural areas depend on herbal medicines as their primary healthcare system mainly because synthetic drugs have many side effects that often lead to serious complications [24], [25]. Pharmaceutical research in technologically advanced countries like the USA, Germany, France, Japan and China has considerably improved the quality of the herbal medicines which are now-a-days used in the treatment of various ailments.

In 2020-21, Indian imports were valued at \$388.92 billion, an 18 percent drop from 2019-20, when the country imported goods and services worth \$474.71 billion. In the last financial year, Indian exports stood at \$290.18 billion, down 7.4 percent from \$313.36 billion in 2019-20. In India's foreign trade, imports have always outpaced exports, a fact illustrated by these figures from the past two years. Widespread economic disruptions caused by Covid-19 in 2020 did not change this reality.



The Indian government's flagship Atmanirbhar Bharat Abhiyan (Self-Reliant India Mission) strives to significantly improve domestic manufacturing and thereby reduce import dependence. Currently (as per data in year 2017) India shares 5% of the global chia seed market of superfood and drink launches; the largest i.e. 19% shared by US. Successful cultivation of chia and production of relevant health/ food/ beauty products using chia on a large scale in India, can reduce chia imports from other countries. There will be no requirement for importing these seeds and paying huge amounts just in order to be healthy. India can also be a key player in chia exports if we overcome certain environmental constraints and work on the yield and seed quality of the genotypes being grown here.

In 2018, chia seed consumption in Germany was 5,551 tons, or \$18.4 million. Demand will continue to grow due to a population with about 10% vegans. Chia seeds are significant for the future of the agricultural industry, in terms of providing a vitamin-rich source of vegan protein. Increasing consumer awareness about the importance of omega-3 fatty acids in the Asia Pacific region is increasing the demand for chia seeds. Furthermore, chia seeds are gaining popularity among vegetarians in the Asia Pacific region, as it is very difficult to find omega-3 fatty acids in plant-based diets. Its high protein content helps in muscle recovery after physical exertion. Hence, the preference for chia seeds among vegetarians and vegans has increased significantly. According to the future market Insight (FMI), demand is the strongest in the food and beverage sector for chia seeds. It is expected to reach 76,074.3 MT by the end of 2027. In conclusion, the chia seed market is growing really fast, it is an accessible and profitable sector due to the high demand as this superfood represents an important opportunity for the import-export of chia seeds on an international scale.

Cultivating chia is only one of many experiments, to make agriculture, food and nutritional security drought-proof. Agricultural scientists have estimated that millet production fell 65 percent since the 1970s and say that a return to the low or no irrigation crops is the need of the hour. Due to their health properties, Chia seeds are very popular in India. The superfood market is still underrated in India but there is going to be sharp growth due to the growing awareness about healthy food and new trends of switching to veganism and vegetarianism. Indian farmers can make farming a profitable business through superfoods cultivation as most of them need low inputs, less water and withstand harsh weather conditions.

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