



## Minor Crops: A Path towards Crop Diversification

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**ABSTRACT:** With passage of time, there has been paradigm shift observed in dietary intake of people henceforth disturbing the balance of nutrients required by the body. Due to the leap towards major cereal crops to feed the growing population, impetus towards minor crops have observed a continuous decline. This approach have also led to emergence of various nutritional deficiencies. Though these crops are neglected but are treasure house of various nutrients needed for all-round development of an individual. This review examines and compares the nutritional aspects of major cereal crops to minor crops and also discusses the abundant health benefits provided by few minor crops, as well their prevalence in context to Indian subcontinent.

**KEY WORDS:** Cereal crops, Minor crops, Nutrition

### INTRODUCTION

There has been abundant production of cereal grains to meet basic caloric requirements, but these grains are not good source of all the nutrients which results in malnutrition in humans. With widespread cultivation of major cereal crops, there has been a reduced focus on domesticating the minor crops which enhance human health and build the resilience within the people. Through its constant efforts and steps like green revolution, India has been able to mitigate the hunger problem to some extent but failed in providing the necessary nutrients which are needed for all round development of an individual, due to which a big chunk of population still remains undernourished. According to recent data provided by [2021 Global Hunger Index](#), India ranks **101** out of the 107 countries which is a disturbing ranking because rank in Global Hunger Index of India has consistently declined in the past 10 years. The four indicators that were used to compute the score are population share which is undernourished, mortality rate under five, stunted children under age of five, share of children who are wasted.[1]

The simplification of the farming systems has led to constant focus on calorie availability rather than dietary nutrient diversity, this in turn resulted in increased problems related to the environment, including the future functionality of current cropping system with respect to adaptability to climate, multi-functionality of the agricultural landscapes and also provision of ecosystem services [2]

The number of edible species of plants are around 10,000, however only four main crops are consumed namely maize, potato, rice and wheat. These major crops account for around 60% of human's intake for energy, thus clearly depicting lack in diversity in the cropping systems. [3] One of the viable options providing a way out of this problem is to shift our cereal crop-centric approach towards the minor crops. These crops are often recognized as "poor man's crops" or "Orphan Crops" which include overlooked, underutilized, and uncommon crops which can provide a promising approach towards ensuring substantial household security by provision of few useful nutrients (Arivala- gan, Prasad, & Bag, 2012 [4] Currently many of these crops have lost their importance and area under their cultivation has reduced like millets, pulses, yam, amaranthus, buckwheat, cassava. The reasons of this decline in trend includes the ignored potential of these crops, various factors like lack of provision of minimum support price by government. Secondly increasing population also lead to increased focus on productivity of major crops, negligence towards nutritional aspect and some socioeconomic reasons. With globalization and free trade markets, there has been increased impetus towards staple food crops, which leads to inclination of farmers towards earning money to ensure financial security. Policy makers pay less attention to nutrient rich crop diet and agriculture practices which ensure such diet that results in less acceptance within the farming community. With commencement of Green Revolution in 1960s, there has been increased focus on developing high yielding varieties and genetically enhanced crops focusing on required traits like high yield jeopardizing the nutritional aspect of crops. Due to commercial reasons, various government breeding companies have been privatized and merged which have also created a bottleneck discouraging investment in minor crops and also the lack of cultivable highly competent cultivars which discourages the farmers to adopt to such cropping systems and expand the cultivation under minor crops. Also with increased impetus on grains, the farmers are facing difficulty to procure the forage and animal feed due to less attention paid to fodder crops. At the same time, the dual



purpose minor crops like sorghum and millets which serve both as dietary needs of humans as well animals are disappearing steadily. Under exploited crops can play major role in nutritional livelihood of the Indian population especially in rural areas because many people cannot afford to spend money on dietary sources like meat, egg, fish or poultry. These crops can be used to alleviate the nutritional security, health and help in poverty elevation in society. Being a country rich in agro-ecological conditions, India has optimal conditions for various minor crops with different nutrient contents. The intake of required nutrients is very less from satisfactory and around 50% less RDA (Recommended Dietary Allowance) is consumed by around 70% Indians. Vitamin A, zinc and iron deficiency are second largest risk in global diseases. around 330,000 children die every year due to severe VAD ( Vibroacoustic Disease ) in India, 22,000 people mostly pregnant women die in India due to severe anemia. Due to iodine deficiency, 6.6 million children are born mentally impaired every year. Nutrient deficiency accelerates the process of mortality as well morbidity in women. In such conditions minor crops like legumes, fruits, vegetables play a significant role especially in providing nutrients like carotenoids , ascorbic acid, thiamine, riboflavin, niacin, pyridoxine, minerals , fats , proteins and dietary fibers. [5] This review focuses on the current problems faced in nutritional security, underutilization of the minor crops and also encourages the further meticulous study to increase the nutritional security in population by viable options in adaption of these minor crops to improve nutritional security.

In present times, there are around 870 million people who deal with hunger crises in the world where there is enough food produced for everyone. Although, globalization has created abundant food supply in some parts of globe but it has also led to chronic shortage in other parts as well. From recent trends followed in India it can be observed that, currently large area in country is under major crops namely rice, wheat and sugarcane and only a portion of land is devoted to minor crops such as pulses and oil seeds.

**Table 1: Area under different crops**

(MillionTonnes)

Area	2002-2003	2008-2009	2012-2013	2019-2020
Crop				
Rice	71.82	99.18	105.24	118.43
Wheat	65.76	80.68	93.51	107.59
Sugarcane	287.38	285.03	341.20	355.70
Pulses	11.13	14.57	18.34	23.15
Oilseed	14.84	27.72	30.94	33.42

**Source:** Agricultural Statistics at a Glance , Government of India

From the statistics, it can be clearly deduced that area under the major three crops have considerably increased where as there has not been much impetus on other minor crops; this a matter of concern for all. Government’s agricultural development plans have largely focused on commercial crops like wheat and rice but the indigenous and traditional crops have been ignored but these can play a significant role in current malnutrition scenario.. In this review, multiple criteria analysis has been done to identify and highlight the indigenous and traditional crops which have great possible potential to enhance the food security in India. From nutritional aspect in general, there are plethora of benefits that are neglected from minor crops when we look at nutritional aspect. Some of nutritional aspects and its comparison is enlisted below.

**Table 2: Comparison of Nutritional aspect of various crops.**

Crops	Rice	Wheat	Sorghum	Bajra
Nutrient content				
Protein (g)	6.8	11.8	10.4	11.6
Calcium (mg)	10	41	25	42
Phosphorous (mg)	106	306	222	296
Iron (mg)	0.7	5.3	4.1	8.0
Vitamin A (mg/100g)	0	64	47	132
Folic Acid (mg/100g)	8.0	36.6	20.0	45.5

**(Source:** Nutritive value of Indian foods, NIN, 2007; *MILLET in your Meals*, <http://www.sahajasamrudha.org/>)



Thus the various underutilized crops found in numerous agricultural systems need to be reviewed and in recent decades there has been emerging interests on scientific and economic level which focus on lesser-known cultivated species. The various aspects of six underutilized minor crops namely- Quinoa, Buckwheat, Millets, Amaranthus, Cowpea, Breadfruit are being described.

## QUINOA

Among minor crops, quinoa is one of the most important crops as declared by findings. It has been declared by the Food and Agriculture Organization as one of the crops which have potential to offer food security in the next century. Quinoa is an annual herbaceous plant which belongs to Amaranthaceae family. Presently it is grown on 126,000 hectares with a total production of 103,000 tones in ..... Stats of Indian agriculture scenario depicts that only 444 ha have been put under cultivation with only 1053 tones of production in the year 2015. Quinoa crop can provide all the essential amino acids which are required for the growth of human beings. [6]

Quinoa has a protein content of around 15 - 20% approximately. Moreover, it is rich in essential fatty acids and natural antioxidants like alpha tocopherol, gamma tocopherol. This crop is also known to treat several feminine diseases like breast cancer and also heart diseases which are caused due to lack of estrogen. This crop is rich source of proteins, lipids, fibres, vitamins and minerals. This crop is also gluten-free which makes it an excellent alternative for celiac patients. The year 2013 was nominated as the “Year of Quinoa” due to its many benefits. This crop is suitable in adverse climatic conditions and it can prove to be major contributor in ensuring food security in India due to its suitability and adaptability to dry-land conditions. [7]

## BUCKWHEAT

Among many pseudo cereals available in India, buckwheat is one of the most important crops which has many promising nutritional aspects. It hails to family Polygonaceae and genus (*Fagopyrum* spp.). This crop is adaptable to the extreme cold temperatures, water stress, low soil fertility and variable climatic conditions thus making it sustainable crop. It is a multipurpose crop which can be used as staple food, medicine, animal feed and vegetables.

Globally it is cultivated in an area of 2.4 million hectares with Russia being the largest producer followed by China and Ukraine. Thus due to its various benefits, it can be used as super food, in India its cultivation is limited to hilly areas of Himachal Pradesh, Jammu Kashmir, West Bengal, Uttarakhand, Sikkim, Arunachal Pradesh, Assam, Meghalaya (Higher elevation region), Nagaland, Kerala, Manipur, Chattisgarh and. Tamil Nadu (Nilgiris and Palani hills) [8]

Buck wheat has many nutritional benefits. Starch forms the major component in this crop which ranges from 59% -69% of the grain composition followed by protein content that ranges from 11% to 14% and has well balanced proportions of all the essential amino acids such as lysine, arginine and aspartic acid. As compared with cereal crops, common buckwheat has highest amount of proteins. Mostly cereals are deficient in lysine and they need to be accompanied by pulses to give a well-balanced diet but this is not true in case of buckwheat as it is rich in lysine and this makes it unique amongst all cereals. It is also rich in minerals like magnesium, calcium, potassium, phosphorous, manganese, selenium, copper and zinc. It also contains considerable concentration of riboflavin, niacin, thiamine, pyridoxin, pantothenic acid and ascorbic acid. It also contains Rutin which is beneficial against cardio-vascular diseases. It is also gluten-free which helps people with celiac disease. [9]

## MILLETS

Millets are considered as one of the oldest foods and have good nutritional qualities. These are small seeded grasses which grow well under marginal conditions but they are not used to the extent which they should be. Based on the grain size, millets are categorised as major millets and small grain millets. Among major millets-pearl millet and sorghum are the best known whereas, small green millets include foxtail millet, kodo millet, proso millet, barnyard millet, little millet and finger millet. Introduction of millets into the cropping cycles will be a very crucial step to move towards sustainability. Due to their exceptional qualities, millets are also called miracle grains. Government of India has also approved 2018 as a “National Year of millets” to increase the production of the nutrient rich crop and boost the Agro industries to start processing it. Due to short growing season, millets take approximately 65 days to develop into fully mature crop. This is highly beneficial quality of crops to agrarian population as it increases the possibility of growing more than one crop in a year. Moreover, this crop is highly adapted to various climatic and soil conditions. But due to decrease in crop area under this crop and shifting impetus towards rice-wheat crop cycle, Indian population is also suffering



from various deficiencies like iron and iodine deficiency. The nutritional values of the millets vary from type to type, but on an average they contain 65 to 75% carbohydrates, 15 to 20% dietary fibre, 7 to 12% protein and 2 to 5% fats. In addition to this most of the millets are rich in vitamins, folic acid as well as the minerals like iron, magnesium, zinc, calcium, phosphorus and potassium. [10]

## AMARNATHUS

*Amaranthus* is a fast-growing plant which is distributed all over the world and it belongs to family Amaranthaceae. This plant is acclimatized to various abiotic stresses like drought, salinity and also has multipurpose applications. Its stems and leaves are sources of carotenoids and proteins. It also includes various essential amino acids like lysine and methionine. It also has magnesium, potassium, calcium, phosphorus, iron, zinc and manganese. It has flush of pigments like betalains, bexathins and betacyanins.

*Amaranthus* is a cheap source of minerals, dietary fibers, antioxidant compounds and proteins. Fresh leaves of this plant are one of the richest source of vitamin-C possessing 43.3 mg per 100g fresh leaves of recommended daily intake. *Amaranthus* also have high concentration of Vitamin- K amongst all edible green leafy vegetables, 100 g of the fresh leaves provides 95% of daily vitamin-K requirements.

[11] Currently the scope of this flower in India is majorly limited to South India in states of Tamil Nadu, Kerala, Karnataka, Maharashtra and Andhra Pradesh.

## COWPEA

Cowpea is a leguminous crop known for its drought hardy nature; it has wide and droopy leaves which help the crop to conserve soil moisture due to their shading effect. It has a fast penetrating root system and the initial growth is very quick which leads to its establishment even in the moisture deficit conditions. Seed of cowpea are very nutritious in human diet, as well as the crop provides a very cheap livestock feed. It is free of metabolites and toxins which makes it palatable for human consumption. Its leaves contain protein (34.91%), low glycemic index carbohydrates (31.11 %), prebiotics (19.46 %), fat (5.42 %), iron (65.21 mg), calcium (1.62 g), phosphorus (0.56g), magnesium (1.66 g), potassium (13.445 g) and sodium (2.22 g). This amount of nutrients is more than sufficient to suffice the daily requirements of human individual. [12]. This crop is grown in Asia, Africa and America but the area under cultivation in India is very less. In India, it is grown as sole or intercropped in agroforestry or as a mixed crop. Its estimated area under cultivation is 0.7 million hectares in India and the major areas growing this minor pulse crop are Rajasthan, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat.

## BREADFRUIT

Breadfruit, scientifically known as *Artocarpus altilis*, is an evergreen tree with a wide crown. It has a native habitat ranging from New Guinea to Western Micronesia, but today it thrives well in tropical regions of Mexico, Central America, Hawaii, Guam, and West Africa to the northern countries of South America. In India, breadfruit has a potential for growth along the warm coastline, but is limited to Kerala and Konkan coast.

Ripe breadfruit has very bland taste, it is similar to tofu and isn't palatable on its own; however it can be made delicious with the help of certain ingredients. Raw breadfruit is starchy and needs to be cooked, boiled or stewed. Breadfruit resembles to the potato. It is a very nutritious food as it has nutrients like fibre, Vitamin C, thiamin, riboflavin, niacin, folate, calcium, iron and many more. Breadfruit helps the body to maintain bone health, regulate metabolism, prevent weakness caused by hypokalemia. In addition to this, one cup of this fruit can provide 43% of daily fibre and 106% of the daily vitamin C. With efforts, breadfruit can be made successful in Indian conditions, as it is a very efficient fruit in providing starch and thus a promising substitute to the potatoes.

## CONCLUSION

Effective and rational exploration of the sustainable plant resources is an important task to ensure the global food security. Impetus from major crops should be shifted towards underutilized crops for a sustainable future and valorization of the valuable and neglected crops should be in the focus of researchers. Under utilized crops are indispensable in food and nutrition security as they have a greater potential to generate income and also contribute to environment services. These crops can directly alleviate the hunger by increasing food production as well by supplying essential nutrients in the present scenario in which major food crops are limited.



This review paper concludes with the realization of importance and the neglected aspects of these crops in India, where they can shackle the barriers of malnutrition and help in attaining nutritional security

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