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Amaranthus: a multi-nutrient crop species

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INTRODUCTION

Amaranthus group of plants comprises of more than 70 different species, many of them are weeds and some of them are edible. Edible Amaranthus is considered as one among the few multi-purpose crops due to its high nutritional quality as food and feed. Amaranthus used as green leaf vegetable are excellent source of protein, vitamins, mineral nutrients and bioactive metabolites. Grain Amaranthus, which was domesticated for cultivation 6000 years ago, is known to be an underutilized crop in that needs much more attention of farmers, agriculturalists, food technologists and consumers. Almost all the essential nutrients required for human body are available in these plants. Among the vegetables, Amaranthus species are rich sources of micronutrients and dietary minerals. The unique nutritional composition of this crop has the potential of enhancing the biological value of processed food as well. In addition, *A. viridis* has its presence as a medicinal herb in traditional Ayurvedic medicine for the treatment of diabetic, asthma, inflammation, ulcer and hyperlipidemia. *A. caudatus* which is a grain Amaranthus is known to induce insulin secretion and a potential source for anti-diabetic effects through food stuff (Martinez-Lopez et al., 2020).

VEGETABLE AMARANTHUS

Vegetable Amaranthus is popularly cultivated and consumed in India, South East Asian countries, China and Caribbean islands. *A. tricolor, A. blitum, A. dubius, A. cruentus* and *A. viridis* are the popular cultivated species. The plants are able to grow in hot climate. The green leaf vegetable is rich in proteins, calcium, iron, vitamins A, C, B2, B3 and B6. In

addition to providing energy, vegetable Amaranthus sustains mineral balance in the body, reduces bad cholesterol, prevents anemia and improves eyesight.

A. tricolor originated in South Asia and later spread to all parts of the world. This species is considered as superior to spinach in taste and contains 90-200 mg/kg carotenoid, 14-30% protein and 280 mg/kg ascorbic acid. *A. blitum* is from Mediterranean region and is currently cultivated in India. The plants grow faster and the time between planting to harvest is 3-6 months. In South India, 3 weeks old tender plants are harvested, and they have a greater consumer preference.

Since Amaranthus leaves are rich sources of nutrient elements like iron, calcium, magnesium, potassium, phosphorous and manganese, they help in electrolyte balancing. The high dietary fibre (three times more than wheat) improves digestion. Tocotrienol is a type of vitamin E which performs the reduction of LDL cholesterol level in human body (Ahsan et al., 2014). The phytosterols present in the leaves lower blood pressure and thus prevent heart related issues. Lysine along with vitamins and minerals are antioxidants present in the leaves and thus provide anti-cancer and anti-ageing properties to this green leaf vegetable. Due to the presence of high calcium, the calcium deficiency related disorders can be treated by consuming vegetable Amaranthus.

GRAIN AMARANTHUS

Grain Amaranthus is grouped under pseudo-cereals. Pseudo-cereals are seeds or grains of dicot plants that are consumed like monocot cereals like rice, wheat, sorghum and maize. Pseudo-cereals are rich in protein and characterized by high amounts of lysine and hence considered as better than cereals in terms of nutritive value. It can be used to make flakes, pops, soup, porridge and flour. Grain Amaranthus has anticancer, antioxidant and anti-allergic activities and keeps blood sugar level under control. The nutrients lower the plasma cholesterol level, provide protection to heart functioning and stimulate immune system. Seed oil consists of metabolites like tannins, trypsin inhibitor, tocotrienols and squalene. Squalene present in grain oil is ten times more squalene in olive oil (He and Corke, 2003). This compound is also used in cosmetics and pharmaceuticals. The balanced amino acids in the grains of Amaranthus is because majority of the proteins are present in the embryo of seed while other cereals have proteins mainly in the endosperm.

Grain Amaranthus is cultivated in small scale in India, Peru, Mexico and Nepal. The cultivation is much easier since the plants are fast growers and produce enormous number of seeds for easy harvest and the crop is tolerant to environmental stresses. Grain Amaranthus is gaining popularity in India. Seed flour is used to make a kind of bread and the popped grain is also consumed by soaking in milk. *A. hypochondriacus* (Prince's feather), *A. caudatus* (Inca wheat), *A. cruentus* (Red amaranth) are the species

of grain Amaranthus. High yielding *A. hypochondriacus* is native of Mexico which is now cultivated in many parts of the world including India. *A. cruentus* is domesticated before *A. hypochondriacus* in Central America. This species is used both as pseudo-cereal and leafy vegetable. It is commonly known as blood amaranth, purple amaranth and caterpillar amaranth. *A. caudatus* is native of Argentina and Peru highlands. It has a unique elephant hood-like inflorescence which is also used as ornament.

AMARANTHUS AS ALTERNATIVE

Amaranthus grains consists of 16% protein, 0.49% calcium, 17.5% iron and 0.6% phosphorous as against 7% protein, 0.2% calcium, 3.5% iron and 0.25% phosphorous in rice grains (Venskutonis and Kraujalis, 2013). The treatment for patients with coeliac disease is life-long elimination of food products containing gluten. The currently marketed gluten-free products have poor nutritional value. The gluten-free bread made from grains of Amaranthus have high level of other nutrients like protein, minerals, fiber and fat. Amaranthus represents a natural and healthy alternative to gluten-free products with added ingredients. In some countries, green leaf Amaranthus species is used as substitute to spinach during summer season. In terms of mg/100g raw leaves, vegetable Amaranthus contains 215 mg calcium, 0.9 mg zinc and 43.3 mg vitamin C compared to 99, 0.53 and 28.1 mg of the same nutrients in spinach.

FUTURE PROSPECTS

Amaranthus, a crop which had a sustained cultivation in the history of mankind but disappeared from cultivation for centuries, is now emerging again and showing great potential for food and nutritional security. Dual use production system that utilizes the seeds as well as green leaves from Amaranthus will be highly promising for the small-scale farmers. In such systems, time and number of harvest of leaves are critical to avoid significant impact on the grain yield. Leaves could be important source of nutrients to the farming family and grains could be the source of income. Amaranthus is a crop that can grow under variety of soils and environmental conditions including drought, salinity, alkalinity and frost. Among all the under-utilized crops to begin re-utilizing, Grain Amaranthus is the suitable crop to start with.

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