



Grain Amaranth: A Pseudocereal and Pseudomillet

(*Shivani Tandle)

Department of Agronomy, College of Agriculture, VNMKV, Parbhani-431402

*Corresponding Author's email: shivanitandle9374@gmail.com

Pseudocereals

There are few species of plants other than those of Poaceae, which produce small grains which have a similar grain chemical composition and used for food as in the case of cereals. These are termed as Pseudocereals. Buckwheat (*Fagopyrum esculentum*), grain amaranth (*Amaranthus hypochondriacus*), and Quinoa (*Chenopodium Chempiawae*) are considered under pseudocereals. There are certain botanically unrelated plants whose seeds are also used in a similar manner as that of cereals. Pseudocereals possess similar calorific value as cereal grains. Nonetheless, they carry higher nutritional value than cereal grains in terms of quality of amino acid (protein) composition, antioxidants, vitamins and minerals. Pseudocereals made up of higher percentage of bran fraction to endosperm than common cereals.

Millets

Millets are small grained cereals. The term millet is applied to a variety of small seeds, which are of minor importance as food. Millets are coarse seeded, annual cereal grasses used for food, feed and forage. The term 'coarse grains' is also used to describe the millets. The millets are the staple food of the poor, the working classes and the farming community. The whole grain is used in soups, stews or as a cooked cereal, popped; roasted or sprouted grains. Millets contain no gluten and hence not suitable for making bread, but they are good for people who are gluten - intolerant. However, the flour from the millets is blended in 15 to 40% with the refined wheat flour to prepare biscuits. The millets also provide substantial quantities of palatable fodder for cattle. Small millet grains are nutritionally rich. These grains are particularly low in phytic acid and rich in iron and calcium.

The millets are classified into three groups viz., major millets, minor millets or small millets and pseudo millets. The major millets are sorghum, pearl millet and finger millet in India. Small millets may be defined as millets cultivated for their small grains which are borne on short, slender grassy plants. The small millets also refer to a group of small - seeded cereal crops. Small millets may also be called minor millets. The important small millets grown in India are foxtail millet (*Setaria italica*), kodo millet (*Paspalum scrobiculatum*), common or proso millet (*Panicum miliaceum*), little millet (*Panicum sumatrense*) and barnyard millet (*Echinochloa colona*). Small millets grains are nutritionally rich in iron and calcium and low in phytic acid. They provide palatable fodder for cattle. The Pseudo millets also refer to false millet crops. There are two pseudo millets are Amaranth (*Amaranthus hypochondriacus* L.) and Buckwheat (*Fagopyrum esculentum*).

Introduction

Amaranth is a high nutritive value crop which belongs to the family Amaranthaceae, subfamily Amaranthoideae and genus *Amaranthus* and grows in wide range of climatic conditions and has high yield potential with low water requirement. Amaranth grows best

under hot and humid climate although, it tolerates drought, low fertility and adverse climate condition. It has C4 metabolism as well as deep root system. The crop can be grown in any type of soil. Amaranth has a short growing period, grain amaranth can be harvested at 90 days. It has rich sources of protein, carbohydrates, lipids and minerals as well as balanced composition of essential amino acids. Which are lacking in other cereals (Raiger *et al.* 2009). Grain amaranth (*A. hypochondriacus* and *A. creuntus*), pseudo-cereal, is a native to South America and a relative of the local amaranths (*Amaranthus spp.*).

Distribution and Adaptation

Amaranth are widely distributed through out the world. Although, Grain amaranth is native to the USA. Currently, many countries of Asia and Africa grow amaranth as a grain crop and vegetable crop. In kenya, grain amaranth is considered as a newly introduced crop and milled amaranth flour is added into maize-based gruel (Kauffman, 1992). In Ethiopia, little information is available about the grain amaranth. The cultivation and use of amaranth has generally been limited to western parts of country. Amaranth seeds are fermented to make alcoholic beverages. E.g. Beer in Ethiopia, the ministry of agriculture registered grain amaranth as a crop in 1991.

In India, Amaranth is cultivated both in hills as well as plains covering states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Meghalaya, Arunachal Pradesh, Nagaland, Tripura, Jharkhand, Chattishgardh, Maharashtra, Gujarat, Orissa, Karnataka, Kerala and Tamilnadu. It is cultivated as both pure as well as mixed crop during kharif and Rabi season. The exact information about grin amaranth area, production and productivity of national level is lacking. However, it is estimated to be grown in about 40-50 thousand ha. area. The crop is mostly cultivated at mid and high hills of the Himalayan region as a pure as well as mixed crop. The crop is grown in other part of country including north-eastern region. In Uttarakhand it is mainly grown in Chamoli and Uttarkashi as a sole crop or taken as a mixed crop and on the borders of the field of other crops during kharif season. In Gujarat, it is grown in districts of North Gujarat and middle Gujarat as a sole crop or taken as mixed crop during rabi season. In Gujarat state, this crop mainly cultivated in villages of Balnaskantha and kheda districts where this crop replaces wheat and potato an account of water scarcity. (Solanki *et al.*, 2021). At present the area in this district alone is estimated to be around 6000 ha and the grain market at palanpur (Gujarat) receives about 6-10 thousand tonnes grain annually.

Nutritional Value

Among the cereals this crop posses an exceptionally high nutritive value with high content of protein, carbohydrates, lipids and minerals as well as balanced composition of essential amino acids. The small seeds of grain amaranths compare favourably with maize and other true cereals in nutritive value and yield. The grain amaranth has 16% protein, 62% carbohydrates, 8.0% lipids and 3% minerals. The grain amaranth has high quality of protein. They contain essential amino acid such as lysine 5%, methionine 4.0% that are lacking in other cereals. (Raiger *et al.*, 2009)

The lysine content is nearly twice than that of wheat protein and maize protein. Amaranth protein itself is low in leucine 4.7% which is high in maize 13%. The total lipid content of grain amaranth ranges from 8.0-10% dry matter which is generally higher than that of other cerals. It is an excellent source of iron and beta carotene, calcium, potassium, phosphorous, vitamin- A and vitamin-C. Presence of higher amount of folic acid also helps in increasing the blood haemoglobin level. This crop has high yield potential with low water requirement. The leaves are rich in vitamin-A, calcium and iron content. Amaranth has high fibre content 7% which is more than in wheat, barley, rye and rice, maize (Mustafa *et al.*, 2012) which has the beneficial role of dietary in human nutrition.

Uses

Amaranth is a highly nutritious food. It has multiple uses. Its tender leaves are used as vegetables. The grains are used in various culinary preparations, popped grains of amaranth are used in the form of puddings or mixed with sugar syrup to make sweet balls (Laddoo) and confectionary, or mixed with honey to make flat round breading and with milk and sugar to make porridge. The grains are also used for making candy and preparation of breads, crackers, ice-creams and lysine rich baby foods. Amaranth grains is also used in fortified food where the staple food is low in certain element. Amaranth flour can be used for making chappatis, when mixed with maize and finger millet flour. Grains can also be fermented for making beer and used as a substitute for wheat in baking product.

Grain amaranth can be used to produce more nutritious industrial product in agro-industry. It is useful in high quality cosmetics, pharmaceuticals and natural dyes. It is also used in preserving meat and apple fruits. Amaranth oil containing 'Squalene' a cosmetic ingredient and skin penetrant is also used as a lubricant for computer disc. Black seeded cultivars of amaranth are used as cattle feed. Plant parts are also used as pig feed. It is also used as forage crop because it contain high forage yields, high protein and low levels of oxalates and nitrates in amaranth.

Grain amaranth has been found to have medicinal values. The rural people use its grains for the treatment of foot and mouth diseases of animals as well as measles and snake bites. The leaf and stem extract is used in treatment of kidney stones. The topopherol fraction of amaranth oil contains important element of cholesterol lowering agents and some of which are used for treatment of cardiovascular diseases. The plant is also used in piles to purify blood and leaves are used to relieve chest congestion.

Morphological Characteristics

The grain amaranth is bushy plant that grows 0.6 to 2m and different genotype present degree of branching. Grain amaranth are erect annual and fast growing semi-hard plants with broad leaves and have pinkish or reddish creamy inflorescence. The amaranth have monoecious flowers (Brenner *et al*,2000) arranged in large often colourful inflorescences. Whose shape have been compared to those of sorghum. Each pistillate flower produces a seed 1 to 1.5 mm in diameter. The grains are small and round shaped and golden to creamy in colours and are rich in proteins and minerals. Each plants is capable of producing about 40,000 to 60,000 seeds. The weight of 1000 seeds varies from 0.7-0.9 gram.

Varietal Development

The family Amarathaceae has more than 80 species out of which 60 species are considered as weed and about 50 are consumed as herb or leafy vegetables world wide (Janick,1997). Some varieties which are introduced from America for grain production and from Africa for their leafy vegetable production. Three principle species considered for grain production are *Amaranth hypochondriacus* L., *A. cruentus* and *A. caudatus*.

Factors limiting of Pseudocereals and Pseudomillets productivity:

Production of pseudomillets is subject to wide fluctuations and the area is declining, except in the case of finger millet.

The major constraints limiting pseudo millets production are:

- These crops are often grown in uneven marginal lands, poor in fertility, shallow and gravelly, with low moisture retention capacity.
- These crops are grown under rainfed conditions in low rainfall arid regions.
- Improved crop management practices are not adopted by the farmers due to socio economic constraints.
- There is no organized program for production and supply of seeds of improved varieties.

- There is no ready market for the disposal of surplus produce at a remunerative price.
- There is lack of extension and development support.
- There is lack of awareness among the farmers about millets production.

References

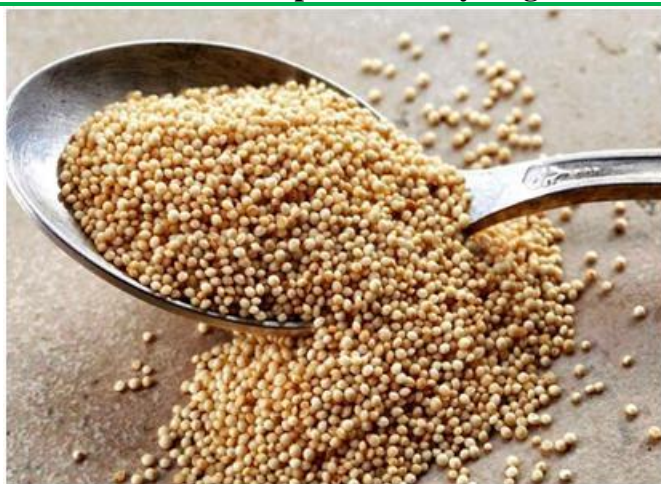
1. Brenner, D.M., Baltensperger, D.D., Kulakow, P.A., Lehmann, J.W., Myers, R.L., Slabbert, M.M. and Sleugh, B.B. (2000). Genetic resources and breeding of *Amaranthus*. *plant breeding reviews*, **19**:227-285.
2. Kauffman, C.S. and L.E. Weber (1990). Grain amaranth. P.127-139.
3. Mustafa, A.F., Sequin, P. and Gelinas, B. (2011). Chemical composition, dietary fibre, tannins and minerals of grain amaranth genotypes. *International Journal of food sciences and nutrition.*, **62**(7): 750-754.
4. Raiger, H.L., Phogat, B.S., Dua, R.P. and S.K. Sharma (2009). Improved varieties and cultivation practices of grain amaranth. *Intensive agriculture*, 8-17.
5. Solanki, R.P., Solanki, R.M., Patel, H.A., Odedra, R.K., Prajapati, V.S. and Dodia, V.D. (2016). Effect of scheduling irrigation and organic manure on yield attributes, nutrient content and uptake of rabi amaranthus (*Amaranthus paniculatus* L.) in Saurashtra Region. *International Journal of Science, Environment & Technology.*, **5**(4) : 2076-2083



Amaranth crop at maturity stage



Inflorescence of amaranth



Grain amaranth



Amaranth Laddoos