Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 06 (NOV-DEC, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Breeding for Quality Improvement in Chickpea

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Chickpea is an important pulse crop that is grown in the cool season of semi-arid and arid regions of the world. It is the second most consumed food legume and India ranked first in chickpea production worldwide. It is mostly grown for its nutritious seed/grain and that are excellent source of protein, carbohydrates, minerals, vitamins, dietary fibre, folate, B-carotene, and health-promoting fatty acids. However, it is known as the king of pulse crops. Chickpea is used as whole or dehulled to make dal and used flour (besan). It is used as a salad, curry and other several preparations like snacks, sweets and soups.

Health benefits of chickpeas

It is a rich plant protein source, which helps in improving muscle and bone strength. Chickpeas are low in glycemic index as they help in type 2 diabetes by managing the blood sugar level. It is an important source of magnesium, zinc and selenium which provide relief for anxiety and depression. It also helps against chronic disease as it has potassium and magnesium which prevent high blood pressure. It also has a good amount of iron so it has help in preventing iron deficiency.

Types of chickpea

Cultivated chickpeas are of two types

1. Desi: it has a yellow to dark brown coloured seed with a small size and irregular and wrinkled shape.
2. Kabuli: it has beige or white coloured seeds with large, bold and attractive seeds with smooth surfaces.

Quality traits

Traits that define some quality aspects of the products are known as quality traits. These traits are depending on the product and choice of the consumers.

Quality breeding

Making changes related to quality aspects in a crop plant by using genetic study and breeding techniques is known as quality breeding.

Quality traits and their improvement in chickpea

In chickpeas two types of quality traits are most important:

1.) Morphological
2.) Nutritional

These two are more important for chickpea elsewhere, there are a total of four types of quality traits namely, 1. Morphological, 2. Organoleptic, 3. Nutritional and 4. biological

1. **Morphological quality traits of chickpea:** In chickpea, two important morphological traits decide the choice and demand of the consumer's seed colour and seed size.

- **Seed colour:** In chickpea, there is enormous variability found in the seed colour. seed colour is classified into the ten major groups namely, beige, creamy beige, green, yellow, orange, reddish, brown, dark brown, grey and Black. The most popular colour in this is Yellow, and brown for the desi chickpea, and beige in the kabuli chickpea.
- **Seed size:** In chickpea, seed size is characterized according to the type of chick pea in which seed size is characterized according to 100 seed weight. Desi has mostly 13-25 g, kabuli has 30-45g and ≥ 45 g is Extra-large see kernel.

2. **Nutritional quality traits:** In chickpea, important nutritional quality traits are, 1. Protein content, 2. Protein quality, 3. Micronutrient and 4. Antinutritional traits.

- **Protein content:** Protein content in chick pea varies from 17-22 per cent. Most of the cultivated varieties have protein content between 18-20 per cent.
- **Protein quality:** It has a balanced essential amino acid profile as its protein is composed of all nine essential amino acids but, it is low in sulphur-containing amino acids such as methionine and cysteine.
- **Micronutrients:** It is a rich and important source of calcium, copper, iron, potassium, magnesium, manganese, phosphorus, and zinc and also has a trace amount of selenium.
- **Antinutritional factors:** It also has some antinutritional factor that affects its nutritional values and adaptability important anti-nutritional factors of chickpea are phytic acid and raffinose family oligosaccharides (RFOs).
- **Phytic acid**: it binds with minerals and some biomolecules like proteins and enzymes and reduces its bioavailability.
- **RFOs:** these are α-galactosides and it not digested by humans as we lack galactosidase enzyme.

Improvement in the quality traits

In chickpea, there need for improvement in quality as it will help in wide acceptance as well as also improve the health of people by increasing the nutritional values of chickpea.

There is a need to develop a cultivar which has the colour acceptance means which has yellow or light brown colour if it is the desi type and has a beige colour when it kabuli type, while has bold and attractive seed size as it is more acceptable with this type of morphology that also has a high amount of protein with all essential amino acid and good in micronutrient content with vary less or reduce the amount of antinutritional factors.

Well during quality improvement, it is notable that our aspect is to improve the quality of chickpea but, the notable thing is that this quality improvement is not at the cost of the yield if the yield of variety reduced it will be not accepted by the farmers. Our goal is to improve nutritional security will not be fulfilled if not accepted.

Breeding methodologies

Some methods that can be used to improve the quality of chickpea are

1. **Selection:** selection is the first step of the plant breeding programme, selection for quality traits helps develop the new cultivar or use the selection as a cultivar.
2. **Hybridization:** This is done by using parents that have good quality traits and higher yields to develop a new cultivar with improved yield and good quality.
3. **Wide hybridization:** identified wild sources which have good quality parameters can used to hybridize with the plant so that these traits transferred into cultivated cultivars.

4. **Mutation breeding:** mutation breeding helps in making random changes in plants' genotypes; some changes may lead to improved quality Ex. opaque 2 and flory 2 in maize which leads to QPM.
5. **Ideotype breeding:** it will be helpful by generally improving plant characteristics by specific needs by choosing characters and specific parents.
6. **Marker-assisted selection:** it can be used in the selection of and identification of genotypes which has good quality traits in the early stage.
7. **Genetic engineering:** it can be used to transfer the genes that can improve the nutritional and morphological quality of the plant.

Problems in nutritional quality breeding

- Priority is given to the quantity in place quality
- Some important traits are negatively correlated like yield and protein content.
- Low heritability of some quality traits.
- There is a lack of proper screening techniques.