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Finger Millet: A Certain Crop under Uncertain Climate

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Due to changing climatic conditions such as global warming, uneven rainfall distribution is seriously affecting the agricultural production system. Increasing global population in conjunction with climate change is also adversely affecting farming by giving stress to produce more food from less land. Climate change has been foreseen to seriously affect production of food and its health in many dry seasonal zones around the world (FAO, 2005). Water scarcity results in a reduction in the dietary range and in total food consumption, which can lead to malnutrition and food insecurity. (IPCC, 2007). A single staple food crop cannot meet all the main criteria, the wide variety and diversity of local food crops (like small millets) can be a option of such climate resilient crops.

Most of the world's population relies on cereals like rice, wheat and maize as their staple food, though millets have been largely ignored, especially since the green revolution occurred. Millets are a group of small seeded annual grasses that are cultivated for food and forage purposes, which are cultivated as grain crops in dry areas of tropical, subtropical and temperate zones, mainly in marginal areas (Baker, 2003).

Millets are very important agricultural plant genetic resources that extend food safety to poor farmers having infertile, arid, poor and marginal lands, particularly in Asia and Africa. These crops are also known as 'Orphan Crops,' or even 'Lost Crops.' Millets are not necessarily lost but suggest their cultivation by developing countries. Because of their role in biodiversity and the livelihoods of the poor in different regions of the world, these ignored crops are important. According to World summit on food security data, by 2050 at least 70 percent more food production is needed to sustain the rising population (Tester & Langridge, 2010). The finger millet has been the focus of scientific research because of this scenario of its unique growing quality under less moisture, higher temperature and poor soil conditions. Finger millet (Eleusine coracana) is believed to have originated in African highlands of Uganda and Ethiopia. Nevertheless in the Himalayan region (India and Nepal) it has found to be grown at 30 ° N. It belongs to family Poaceae. Interesting characteristics of finger millet are its ability to withstand cultivation at altitudes above 2000 m above sea level, its high drought tolerance and the long storage life of the grain. Its grain as well as plant is resistant to drought, pathogens and pests. Finger millet is rich in polyphenols, especially in calcium.

The nutritional, antioxidant properties of finger millet grains and possible health benefits: Finger millet is one of the most significant dryland crop in red soil and other soil areas in India. It is a good source of lysine and methionine and is also rich in vitamins. Lower incidence of cardio - vascular disorders, diabetes and duodenal ulcers among the finger millet eating population make it best healthy food. (MSSRF, 2002). It is known as "Nutri Cereal" because of its nutritional value. It provides healthy feed and contains up to 61 percent of total

digestible nutrients. It is important for pregnant and lactating mothers and children's diets and also for marginal farmers' economies.

Nutritional value of finger millet per 100 g

Carbohydrate 88 g	88 g
Fat 1.5 g	1.5 g
protein	7.6 g
Vitamins	
Vitamin A (Retinol)	0.48 mg
Vitamin B1 (Thiamine)	0.33 mg
Vitamin B2 (Riboflavin)	0.11 mg
Vitamin B3 (Niacin)	1.2 mg
Calcium	370 mg
Fiber	3 g

Health benefits of finger millet are -Increased faecal volume, delayed nutrient absorption, digestive barrier, versatility of intenstinal contents increased faecal transil time, beneficial for heart health, colon cancer prevention, helps in weight loss, decreased blood lipids, daily finger millet intake can help resolve anxiety, depression, and insomnia. It has also the characteristics of fermentability. It is also used as a natural medicine for liver disease, leprosy, measles, tuberculosis, pleurisy and smallpox.

Finger millet – As a wonder grain

- Salinity and drought tolerance
- Wide variety choice
- It can grow in all seasons
- Highly nutritious versatile grain, long storage life of grain,
- Simple primary processing of grain

Besides the very good nutritional benefit of finger millet, its potential to endure several abiotic stresses and resistance to pathogens makes it an excellent model for exploring this crop's vast genetic and genomic potential, that gives us a good option to build procedure for making climate resilient staple crops

Abiotic Stress Tolerance / Climate resilience of finger millet

Now a-days climate change is a major threat to global food security, and has adversely affected the agricultural crop production system, as productivity and total food production will decline due to unfavourable climatic conditions. All the crops are not prone to adverse climatic conditions, and the degree of susceptibility varies from species to species. Under limited resources, finger millet is given more importance for its production, along with higher nutritional value. The demand for climateresilient crops such as finger millet has increased due to global concerns about food and nutritional insecurity and decrease of agricultural productivity due to climate change. While high temperature stress is the main abiotic stress in many parts of India which has a significant impact on crop yield and quality. This brings into focus finger millet the crop is adapted to a wide range of climatic conditions.

Finger millet can be grown in a wide range of soil and climatic conditions and need less water during the growing period, making it a potential substitute crop under natural disasters situation such as flood and drought. It is ideal for contingency crop planning for short to medium duration varieties to mitigate drought it is mainly due to its short growth cycle, low water demand and high drought tolerance. Finger millet tolerates cooler temperature better than other millets and is also known to flourish under hot climatic conditions. When favourable environment come back after stress relief, the small millets,

particularly the finger millet, recover quickly and grow vigorously and have also recorded that under a range of climate conditions even under low moisture conditions it can grow well and yield due to its drought tolerance. DNA biosynthesis seemed to be unaffected by the water stresses in finger millet but an increase in proteins and RNA de novo synthesis is detected during mild stress conditions. In stressed finger millet seedling polyribosome content also increases. Proline, a solute which accumulates during water stress, increased the accumulation of radioactive precussors in proteins. Finger millet can tolerate slightly acidic soils (pH 5) to moderately alkaline soils (pH 8.2).

In order to feed the astronomically growing world population, it is not only important to increase the production of food grain, but also to preserve sustainability in the production process this can be achieved in future by integrating all management practices for finger millet.

Biotic Stress Tolerance in Finger Millet

Finger millet has been considered to be immune from diseases for decades and many blast-resistant finger millet lines have been found to identify the source of immunity over the last 15 years. Both physical and chemical composition of the grains determines the mechanisms of resistance to pests and pathogens. The physical structure of the grain serves as the first line of defense against infection and infestation. Hardness and small size of the grain is a major restraint found to minimize mold infestation. Besides this, the cell wall composition, seed phenols (such as ferulic acid), glume color and pigmented testa contribute to the resistance of grain molds. Chethan and Malleshi (2007) has examined the role of polyphenols in finger millet, such as pcoumaric acid and flavonoid. Such correlation studies have shown a clear negative association between blast disease and phenols. However, plants typically respond to fungal infection by developing a range of toxic compounds such as phytoalexins, which may be many ways to expand the grain's defensive capability. Prolamins are the finger millet grain's storage proteins and are organized into protein bodies that act as nutritional and physical barriers because of their insect and fungal protease

Sustainable production from finger millet based cropping systems

In the present agricultural scenario, growing only cereals is not so much remunerative to meet the consumers diverse demand and the rapidly growing population. If crop production is totally chemical intensive, it may produce more food grains in per unit area per unit time, however it is only possible for a short period of time and cannot maintain quality of agricultural food and long term sustainability in crop production by using these practices. It is a growing demand of incorporation of pulses, cereals, oilseeds and millet based cropping system. The intercropping of finger millet with various oilseeds and pulses has wide scope for maximum utilization of the land and other resources. Finger millet is very good for different cropping system, sequential cropping, crop rotation, strip cropping etc. Important finger millet based cropping system follow in India as finger millet + field bean (6: 2) for Bihar; finger millet + pigeon pea (8-10: 2) for Karnataka; Tamil Nadu and finger millet + soybean 90:10 row proportion for Uttarakhand. Some major finger millet based sequential cropping or crop rotations such as rotation with pulses like black gram/ green gram. Soybean/rice bean for northern regions and pigeon pea/ horse gram/ groundnut for southern regions of India.

Conclusion

Now, finger millet is not only a cereal but also known as a 'Nutri cereal' and considered as a possible solution for food and nutritional security under changing global climate conditions. Despite of excellent nutraceutical values, it is tolerant to wide range of abiotic and biotic stresses, which makes it a perfect crop for present day population growth and climate change

situations. In future, production of a super cereal could be possible by integrating various agronomically relevant traits into the genome of single-finger millet genotype. Finger millet production scenario can be improved by means of modern agronomic practices and timely management of the crop in field conditions. Daily use of finger millet and its products in your diet may help in managing various body disorders by preserving homeostasis to blood glucose. The finger millet based meals may be desirable due to the protective function of its seed coat matter which has health advantages.

References

1. Baker, R. D. (2003). Millet Production-Guide A-414. New Mexico State University, College of Agriculture and Home Economics, Las Cruces.
2. Chethan, S. and Malleshi, N.G. (2007). Finger millet polyphenols: optimization of extraction and effect of pH on their stability. Food chemistry 105: 862-870.
3. Dwivedi, S., Upadhyaya, H., Senthilvel, S., Hash, C., Fukunaga, K., Diao, X. (2012). "Millets: genetic and genomic resources" in Plant breeding Reviews 32: 247-375
4. FAO A. (2005). The State of Food Insecurity in the World: Eradicating World Hunger-Key to Achieving the Millennium Development Goals. Rome: Food and Agricultural Organisation of the United Nations.
5. IPCC CC. (2007). The physical science basis. Cambridge University Press, Cambridge.
6. Lupien, J.R. (1990). Sorghum and millets in human nutrition. FAO, ICRISAT. At: Ao. Org, 86:17.
7. Tester, M. and Langridge, P. (2010). Breeding technologies to increase crop production in changing world. Science 327: 818-822.