



Scope Of Millets In Sustainable Agriculture And Prebiotics

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Abstract:

Sustainable agriculture involves practices that are environmentally friendly, economically viable, and socially responsible. Millets possess drought and climate resilience, and water and resource efficiency. Millet cultivation helps to meet the UN's goal of sustainable agriculture and food security (UN General Assembly, 2015). Although millet themselves do not contain live probiotic organisms, they act as prebiotics, which are nutrients that feed and support the growth of beneficial gut bacteria. Millets may be the best solution for the problem of hunger, food security, and loss of agrobiodiversity. This review focuses on the scope of Millet as a future crop in sustainable agriculture and as a source of prebiotics.

Keywords: Millets, Sustainable agriculture, Prebiotics, Biodiversity of crops.

I. INTRODUCTION

The Green Revolution changed the scenario of agricultural farming worldwide. Due to modernization and the usage of chemical fertilizers, which focused on high-yielding cereal crops and commercial crops, the significance of millets in agriculture declined in favour of crops like wheat, rice, cotton, maize, etc. (Choudhary et al, 2023). Over a period the utilization of chemical fertilizers and pesticides leads to degradation in soil structure, soil and groundwater pollution, rise in crop production costs, decline in agro-biodiversity, and imbalanced nutrient quality in diet.

Sustainable agriculture involves using eco-friendly practices, which minimize crop production costs, improve soil fertility, and ensure food security. It focuses on the long-term health of ecosystems and agricultural income.

II. MILLETS IN SUSTAINABLE AGRICULTURE

Millets belong to the family Poaceae (Gramineae). They play an important role as the food for lower-income groups in African and Asian countries (Das et al. 2019). Along with Jowar/ great millet (*Sorghum bicolor* (L.) Moench), some of the important millets are Pearl millet (*Pennisetum glaucum* L.), Proso millet (*Panicum miliaceum* L.), Finger millet (*Eleusine coracana* L.), Foxtail millet (*Setaria italica* L.), Indian Barnyard Millet (*Echinochloa frumentacea* Link), Little Millet (*Panicum sumatrense* Roth), Kodo millet (*Paspalum scrobiculatum* L.). The Indian government announced 2018 as the 'National Year of Millets' and

the Food and Agriculture Organisation (FAO) proclaimed 2023 as the 'International Year of Millets' to promote its cultivation.

Major aspects of millets that contribute to sustainability in agriculture are,

i. Drought and Climate Resilience: Millets have deep root systems that enable them to absorb moisture efficiently from the soil, allowing them to withstand water-stressed conditions. This resilience is making them a sustainable choice for farmers worldwide.

ii. Agro- Biodiversity: Cultivation of millets conserves the agro- biodiversity, and preserves the traditional farming practices. Species diversity, genetic diversity, and adaptability among the millet crops conserve the agro-biodiversity. Millets can be grown as mixed crops, and provide shelter and sustenance to beneficial insects, birds, and other wildlife, contributing to ecosystem balance. Mixed cropping and crop rotation practices which include millets ensure food security due to their exceptional drought tolerance.

iii. Water Efficiency, low nutrient requirement, and less investment: Compared to major crops such as rice and wheat, cultivation of millet crops requires less water, and they are mostly rain-fed. Millets have low nutrient requirements, which reduce the need for synthetic fertilizers, and their associated burden on environmental resources, and crop investment. They also support the interdependence between agriculture and dairy farming.

iv. Eco-friendly: Millets reduce the risk of pest and disease outbreaks, which reduces the need for chemical pesticides. Millets are also well suited for organic farming, which reduces the need for chemical fertilizers making them environmentally friendly.

v. Economic and Social Aspects: Millets have the potential to play a main role in rural poverty alleviation and improving the economic and social well-being of farmers. They offer income security and diversified income sources, such as millet flour, and many varieties of snacks creating a market, thereby increasing the farmers' income. Promotion of millet cultivation can revitalize rural communities by promoting self-sufficiency (Choudhary et al, 2023).

III. MILLETS AS PREBIOTICS AND SOURCE OF NUTRIENTS

a. Probiotics

Probiotics are live microorganisms, primarily bacteria or yeasts, which are believed to provide health benefits when consumed in adequate amounts. They are commonly grown in fermented foods like malt, yogurt, and supplements. Probiotics are thought to help balance the gut microbiome by promoting the growth of beneficial bacteria and aiding digestion. They help to revitalize the gut microflora, when their levels are reduced by usage of antibiotic drugs and chemotherapy. Probiotic foods produce vital nutrients which support immune responses against pathogens (Abd El-Salam et al., 2012).

b. Prebiotics

Prebiotics are non-digestible fibers or compounds found in certain foods that promote the growth and activity of beneficial bacteria in the gut. Unlike probiotics, which are live bacteria, prebiotics serve as food for the existing good bacteria in the digestive system. By feeding these bacteria, prebiotics help improve gut health, enhance digestion, and potentially support the immune system (Abd El-Salam et al., 2012; Lamini et al., 2011).

Millets are major sources of dietary fiber, vitamins, polyphenols, rich in proteins with sulphur containing amino acids like methionine and cysteine, essential minerals such as calcium and zinc,

etc.(Amadou et al., 2013, Devi et al., 2011)). With all the attributes they are placed as 'Nutraceuticals'. Resistant starch present in millets supports the growth of useful colon microorganisms.

Millets have several health benefits. They have a low glycemic index (GI), due to the presence of high amounts of resistant starch, and release glucose slowly into the bloodstream(Anju & Sarita, 2010; Balasubramanian, Vishwanathan, & Sharma, 2007; Gupta et al., 2017). Moreover, millets are gluten-free, making them an alternative to wheat for individuals with gluten sensitivities. This makes millet a valuable source to combat malnutrition and ensure global food security. Plenty of polyunsaturated fatty acids (PUFA) present in millets save patients with chronic heart diseases. Millets like kodo millet, finger millet, little millet, foxtail millet, barnyard millet, and great millet were shown to have significant antioxidant activity (Singh & Raghuvanshi, 2012; Kamara et al., 2012; Devi et al., 2011; Quesada et al., 2011; Radhika et al., 2011).

Millets are popularly consumed in the form of malt, rotis, beverages, and snacks. Food processing units making millet noodles, papads, digestive biscuits and muesli etc. In probiotic foods, fermentation improves the nutritional value and availability of bioactive compounds with the help of healthy microbiota.

IV. CONCLUSION

Millets have a better scope in sustainable agriculture due to their drought and climate resilience, promotion of agrobiodiversity, less crop investment, and eco-friendly practices. Hence, they may be selected as a better alternative to widely consumed staple grains like rice and wheat. Millets provide better nutrients to economically weaker sections in Africa and Asia. Their role in drought resilience, biodiversity conservation, and promotion of the growth of prebiotics, nutritional richness, and health make them invaluable assets in promoting sustainable agriculture. The promotion of millet cultivation can revitalize rural communities by preserving traditional farming practices, conserving agrobiodiversity, increasing the livelihood of rural farmers, and improving self-sufficiency. Millets have a lot of scope in the form of prebiotics/ probiotics /nutraceuticals, which provide protection and treatment against chronic ailments. Governments should encourage millet cultivation by offering subsidies, crop insurance, millet and allied processing units to the farmers, and supply the millets to the people below poverty line through the Public Distribution System(PDS).

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