

# Millets – A Solution in Combating Risk in Dryland Agriculture: A Review

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## Abstract

The world is dealing with both agrarian and nutritional issues. We must concentrate on dry lands in order to further increase grain production because agricultural lands with irrigation facilities have been fully utilised. It is difficult to use dry lands to produce enough high-quality grains because of their low fertility. The scope for enhancement of productivity under irrigated conditions is limited because of over-exploitation of available resources, but there is ample opportunity for boosting yield in drylands by adopting suitable crops and cropping systems. The agricultural sustainability in drylands is comparatively hard to achieve due to different constraints like poor soil fertility, lack of irrigation facilities and moisture stress, small holdings and less investment in agriculture. Choice of ecologically sound crops as millets and adoption of intercropping systems are two of suitable options for maximization of productivity in drylands. Millets are ancient nutri-cereals which can play a crucial role in food as well as nutritional security of the country and can assure agricultural sustainability in drylands under intercropping system. The combination of cereal and legume in intercropping is mostly preferred by the farmers in subsistence farming targeting livelihood security. Experiments carried out on intercropping of some small millets in India and abroad clearly indicated numerous benefits like enhancement of crops productivity, greater resource use efficiency, check in runoff of water and soil conservation in erosion prone areas, prevention of loss of soil nutrients, improvement of soil health, insurance against crop failure under aberrant weather conditions, higher monetary return and benefit-cost ratio. Climate-resilient millets are regarded as "Miracle Grains" because of their ability to adapt to a wide range of ecological conditions while using less

water for irrigation and producing more effectively in low-nutrient soils.

## Introduction

Increasing population and water scarcity around the world, attracted interest of scientists in finding drought-tolerant crops having agrarian sustainability and nutritive composition. Earmarked funding and interest in research for increased production and valorisation of these crops are being increased in many parts of the world. To fulfil food demand and enhance farmers' economic situation, sustainable crop choices is to be required. Interestingly, millet have been documented as the oldest cereals, ingested throughout the early phase of human civilization, as evidenced by the production of millet flour noodles around 4000 years ago in Northern China.

They have also been referred to as 'Cereals of the Future' owing to their sustainability and environmental impact. Recognizing the importance of millets, and creating a domestic and global demand along with providing nutritious food to the people, the Government of India, guided by the vision of Prime Minister Narendra Modi, spearheaded the United Nations General Assembly (UNGA) resolution for declaring the year 2023 as International Year of Millets. The proposal of India was supported by 72 countries, and UNGA declared 2023 as the International Year of Millets in March 2021.

## Suitability of Small Millets in Intercropping

Under fragile ecological and stress tolerance conditions, millets provide a sizable quantity of nutritive food as compared to fine cereals as these contain enough dietary fibre, minerals and moderate digestibility. Growing of millets and other crops in their pure stands is risky under rainfed and dryland conditions due unpredictable rainfall and drought. Under such conditions to achieve guaranteed

productivity, diversification of crops is must. Among the crop diversification options, intercropping is considered as the most suitable for sustaining crop productivity. In intercropping more than one crop is grown on the same field at the same time to produce more yields, to maximize resources use efficiency, enhance functional diversity and to minimize the risk due to biotic and abiotic factors. Furthermore, small millets are compatible for polyculture as mixed and intercropping, thus offer sustainable usage of available resources, food, nutrition and livelihood security to small holders in drylands.

### Benefits of Intercropping

Intercropping is advantageous in many ways as it assures greater resource use, reduction of population of harmful biotic agents, higher resource conservation and soil health and more production and sustainability of the system. In intercropping system, more than one crop is grown together on the same land and utilizes the soil nutrients, soil moisture, greenhouse gas flux and sunlight. Moreover, it facilitates soil fertility enhancement when cereals are intercropped with legumes and enables diversity of beneficial soil microorganisms. Under dryland conditions intercropping system provides a natural insurance against total crop failure and thus production sustainability. Different crops grown in intercropping system require dissimilar agronomic management including post-harvest care. Cereal-legume combination provides food and nutritional security to smallholders of drylands.

### Millets: A Plausible Solution in Dry Land

Areas which are plagued with drought, soil quality issues, crop yield, farmer suicides and malnutrition. Addressing these key issues specifically for small, marginalized farmers requires an in-grained sustainable strategy for the long-term to address all these issues.

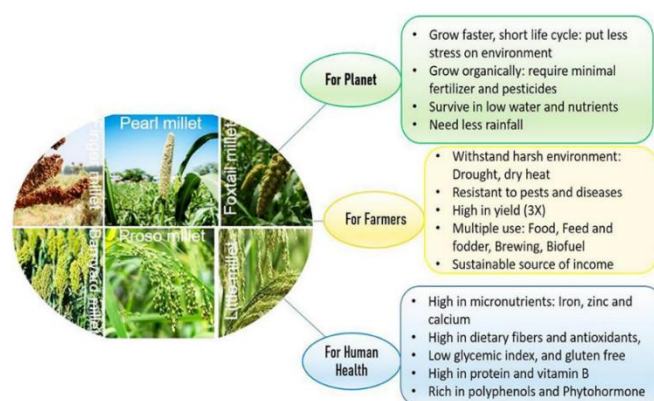
### Regenerative/Sustainable Farming

Regenerative Farming is a sustainable farming technique, focused on sustainability and self-conservation, reducing soil erosion, increasing water retention, improving soil health, increasing biodiversity, and more.

1. Improvement and maintenance of the natural landscape and agro-ecosystem
2. Avoidance of overexploitation and pollution of natural resources
3. Minimization of the consumption of non-renewable energy resources
4. Exploitation synergies that exist in a natural ecosystem
5. Maintenance and improve soil health by stimulating activity or soil organic manures and avoiding harming them with pesticides
6. Optimum economic returns, with a safe, secure, and healthy working environment

### Millets as cover crops

Millets can be grown as food, fodder, source of sugar production, biomass for biofuels, and as a cover crop. Cover Crops also reduce nitrogen leaching, provide high levels of lignin to promote soil-particle binding, and discourage wind and water erosion.



**Fig. 1: Properties of millets for climate smart agriculture, ensuring human health, food and nutritional security**

### Millets driving Carbon Credits

Millets have the potential to play a crucial role in future carbon trading, as their cultivation promotes carbon sequestration, resulting in increased carbon credits for farmers and the nation. If India substitutes around 11 per cent of alternative proteins with millets by 2035, India will see a reduction of 0.85 gigatons of CO<sub>2</sub> equivalent by 2030. A farmer who sequesters carbon credits is likely to earn from 780 – 2000 rupees, depending on buyer demand and volume. Farmers who follow sustainable farming can sequester 1-4 carbon credits per acre, or about INR 8000 or more per

acre from carbon credits trading. This price is expected to increase further, with an ET Report suggest that the demand for carbon credits will rise by 15 times by 2030 creating more demand for credit credits and higher rates for trade.

## Conclusion

Future agriculture will face some common environmental changes like enhanced temperature, uncertainties in rainfall, elevated CO<sub>2</sub> and GHGs levels, and more frequency in natural calamities. Under these conditions, climate resilient agriculture should be adopted in which cultivation of climate smart crops will play a pivotal role. There is no doubt that millets are the climate smart crops which can simultaneously mitigate the ill effects of climate change and adapt to the changed and wider agro-climatic conditions". In India, diversifying crop production to include more coarse cereals, such as millets and sorghum, can make food supply more nutritious, reduce resource demand and greenhouse gas emissions, and enhance climate resilience without reducing calorie production or requiring more land. Millets can contribute to sustainable food systems under climate change.

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