

अयं निजः परो वेति गणना लघुचेतसाम् ।  
उदारचरितानां तु वसुधैव कुटुम्बकम् ॥

(महोपनिषद्, अध्याय ६, मंत्र ७१)

'This person is mine, and that one is another's' is made by narrow-minded people. For those with a noble character, the whole world is a family

(Maha Upanishad, Chapter 6, Verse 71)

Millets And OtHer Ancient GRains International ReSearcH Initiative

# MAHARISHI

A G20 Initiative under India's Presidency





# MAHARISHI

Millets And OtHer Ancient GRains International ReSearcH Initiative

## Executing agency



ICAR- Indian Institute of Millets Research, Hyderabad (INDIA)

## Financial support

Ministry of Agriculture and Farmer's Welfare, Govt. of India





*"Millets (Shree Anna) have been part of India's lifestyle for centuries...we want to share our experience linked to millets and its farming with the world. We also want to learn from the world with whatever new expertise is available with the other countries. I would therefore like to request the agriculture ministers of other countries to jointly develop a stable mechanism in this direction. Let this mechanism in future develop a new supply chain from farms to markets, and from one country to other country"*

- Narendra Modi  
- Hon. Prime Minister of India

On 18th March 2023 during Inauguration of Global Millets (Shree Anna) Conference





*“We must ensure food and nutritional security for our 1.44 billion population, preserve our soil for future generations, and contribute to global food availability. While many countries are pursuing material progress at the cost of nature, India must choose a path of sustainable development that protects nature.”*

- Shivraj Singh Chouhan  
Hon. Minister of Agriculture & Farmer's Welfare

During 96<sup>th</sup> Annual General Meeting of ICAR on 7<sup>th</sup> July 2025





डॉ. एम. एल. जाट  
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## MESSAGE

**MAHARISHI (Millets And OtHer Ancient GRains International ReSeArch Initiative)**, an initiative declared in India during G20 summit, aimed at global spread of millets and ancient grains to ensure food, nutrition and livelihood security at the global level. It was initially envisioned by Hon'ble Prime Minister Shri Narendra Modi as a reflection of the Indian philosophy of "Vasudaiva kutumbakam" towards hunger free and prosperous world.

Millets, often called "nutricereals," are not only climate-smart but also hold the potential to become engines of economic growth, particularly in rainfed ecologies. More importantly, the initiative provides a global platform for synergistic progress in research and development in millets and ancient grains throughout the world.

I am happy to note that Ministry of Agriculture and Farmer's Welfare, Govt. of India has extended funding support of US\$ 2 Million as initial seed funds for establishing MAHARISHI secretariat at ICAR- Indian Institute of Millets (Shree Anna) Research, Hyderabad.

This ambitious program stands as a testament to India's commitment to leveraging cutting-edge science, digital technologies, and traditional knowledge systems to transform global agriculture and health landscape, particularly in the domain of production and utilization of Millets and Ancient Grains. Let us collectively work to make this initiative a model for integrated agricultural development, and a beacon of hope for the future of sustainable food system.

(M.L. Jat)

Dated the 15<sup>th</sup> July, 2025  
New Delhi



डॉ. देवेश चतुर्वेदी  
सचिव  
**Dr. Devesh Chaturvedi**  
**Secretary**



भारत सरकार  
कृषि एवं किसान कल्याण मंत्रालय  
कृषि एवं किसान कल्याण विभाग  
**Government of India**  
**Ministry of Agriculture & Farmers Welfare**  
**Department of Agriculture & Farmers Welfare**



### Message

MAHARISHI (Millets And OtHer Ancient GRains International ReSearcH Initiative) represents an important step towards strengthening global food and nutritional security through sustainable and climate-resilient agriculture. At a time when the world is facing serious challenges related to climate change, soil degradation, and malnutrition, this initiative brings timely focus to millets and ancient grains.

These crops, traditionally grown, are naturally suited to low-input farming, offer high nutritional value, and support the livelihoods of small and marginal farmers. Their renewed relevance is being recognized both nationally and globally. The International Year of Millets in 2023 and the strong endorsement during India's G20 Presidency have laid the foundation for collective global action.

MAHARISHI builds on this momentum. It aims to create a shared international platform that combines scientific research, policy support, and traditional knowledge to promote the production and use of these grains. It brings together researchers, governments, and other stakeholders to work towards common goals of sustainability, resilience, and equity in agriculture.

This document outlines the vision, structure, and collaborative efforts behind MAHARISHI. It reflects the commitment of India to lead global efforts for a more secure and sustainable future.

I congratulate all those involved in shaping this initiative and look forward to its meaningful impact in the years ahead.



(Devesh Chaturvedi)

New Delhi  
15<sup>th</sup> July, 2025



## Message

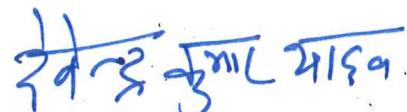
**MAHARISHI (Millets And Other Ancient GRains International ReSearch Initiative)** marks a transformative step in reimagining our food systems through the lens of resilience, nutrition, and sustainability. At a time when the world is grappling with the challenges of climate change, nutritional insecurity, and unsustainable agricultural practices, this initiative brings renewed focus to millets and ancient grains, the crops that are deeply rooted in tradition yet hold immense promise for the future.

India, as a global leader in millet production and innovation, has played a pivotal role in bringing these crops to the international stage. The endorsement of millets by numerous countries during the **G20 India Presidency in 2023**, along with the **United Nations' declaration of 2023 as the International Year of Millets (IYoM)**, reflects a growing global recognition of their importance. These milestones underscore the need for coordinated global efforts to promote climate-smart and nutrition-sensitive agriculture.

MAHARISHI reflects India's strategic commitment to harnessing the power of integrated science—combining genomics, digital agriculture, and traditional knowledge systems—to unlock the full potential of millets and ancient grains. What makes MAHARISHI truly significant is its inclusive and impact-oriented approach, with a clear focus to build a global platform for researchers, policy makers and other stakeholders.

This introductory volume presents the vision, structure, and scientific foundations of the initiative and the dialogues and deliberations among the world leaders in creation of MAHARISHI. It is a call to action for researchers, policymakers, and global partners to come together in building a sustainable, equitable, and resilient agri-food future.

I congratulate all contributors and stakeholders involved in shaping this initiative and look forward to its transformative impact on Indian agriculture and beyond



(Dr Devendra Kumar Yadav)

Deputy Director General (Crop Science)  
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## Foreword

**MAHARISHI (Millets And OtHer Ancient GRains International ReSearcH Initiative)** represents a major step in mobilising global scientific and institutional collaboration to reorient our food systems towards resilience, diversity, and sustainability. At a time when the world is confronting intersecting challenges of climate variability, nutritional insecurity, and land degradation, millets and other ancient grains offer practical, scalable solutions grounded in both science and tradition.

India, through ICAR and its allied institutions, has made significant advances in millet research, from germplasm improvement to value chain development. MAHARISHI builds upon this scientific foundation to create a global platform that facilitates joint research, innovation, and technology transfer across countries and institutions. It aims to strengthen international partnerships in crop improvement, sustainable production systems, and nutrition-led agriculture.

What distinguishes MAHARISHI is its holistic and inclusive approach. It brings together researchers, policymakers, development partners, and farmers to co-create context-specific solutions that are adaptable to different Agro ecologies and socio-economic settings. The initiative encourages open collaboration and knowledge exchange, aligned with the global goals of food and nutritional security, climate resilience, and rural livelihoods.

This document outlines the scientific rationale and institutional architecture of MAHARISHI and highlights the consultative process that shaped its design. I am confident that this initiative will serve as a catalyst for long-term collaboration and innovation in the field of millets and ancient grains.



(Dr. Sharat Kumar Pradhan)

Assistant Director General (Food, Fodder and Crops)  
Indian Council of Agriculture Research  
New Delhi



## Preface

**MAHARISHI (Millets And OtHer Ancient GRains International ReSearcH Initiative)** represents a timely and strategic response to some of the most pressing global challenges of our era—climate change, food insecurity, and nutritional deficiencies. Anchored in the rich agricultural legacy of millets and other ancient grains, this initiative repositions these traditional crops at the forefront of sustainable agricultural transformation. Through this document, we reaffirm India's commitment in advocating and working for a diversified, resilient, and nutrition-sensitive global food system.

This document is structured in two key parts:

**Part A** highlights importance of millets critical to current and future food systems—adaptable to diverse environments, resilient to biotic and abiotic stress, and superior in water and nutrient efficiency due to their C4 nature. While historically neglected, millets have resurged as powerful tools to fight hunger, enhance soil health, and reduce agricultural emissions. Their short-duration growth cycles and compatibility with organic and intercropping systems make them ideal climate-smart crops.

Despite their immense potential, several challenges continue to hinder the widespread adoption of millets and ancient grains—these include low yields, limited processing infrastructure, underdeveloped markets, policy gaps, and the persistent perception of millets as "lesser grains." This document examines these issues and outlines strategies to address them through global research coordination, enhanced capacity-building, and clearly defined research priorities

**Part B** is the chronicles the origin and evolution of the MAHARISHI initiative, highlighting India's diplomatic and strategic leadership under its G20 Presidency. It traces the journey from MIIRA to MAHARISHI, emphasizing the broad international support the initiative has garnered. It also outlines the establishment of the MAHARISHI Secretariat at ICAR-IIMR, Hyderabad, which plays a central role in driving global research and development on millets, building capacity, and fostering policy convergence. The genesis of MAHARISHI stands as a testament to India's proactive global engagement and serves as a blueprint for future international collaboration on sustainable and resilient food systems.



(Dr C Tara Satyavathi)

Director  
ICAR-Indian Institute of Millets Research  
Hyderabad



## Contents

Introduction.....	1
1. Background .....	1
PART A.....	3
1.1. Why millets.....	4
1.2. Impact of climate change.....	5
1.3. Underutilized Grains Initiative: Millets and Underutilized grains as climate smart crops	6
1.4 Achieving impact of MAHARISHI.....	7
2. Major issues and challenges facing millet production and research .....	8
2.1. Issues in millets and ancient grains improvement, adoption and utilization .....	8
2.2. Access to skills in both new and old technologies.....	10
2.3. Support for multinational research and public private partnerships .....	10
3. Research Priorities .....	10
PART B .....	11
4. MAHARISHI Vision and Mission .....	12
4.1. Vision .....	12
4.2. Mission.....	12
4.3. Strategic significance of MAHARISHI.....	12
5. India's leadership in millet promotion .....	13
5.1. National Year of Millets 2018: Key initiatives and outcomes .....	13
5.2. Institutional frameworks and policy push for millets .....	15
6. India's G20 advocacy for millets .....	15
6.1. Strengthening global agriculture: India's G20 priority areas .....	16
6.2. India's Proposal of MIIRA: G20 AWG issue note .....	17
6.3. Bilateral meetings with G20 and invited countries on MIIRA .....	18
(Before 1 <sup>st</sup> ADM) .....	18
6.4. India's clarifications and diplomatic positioning.....	20
7. Countries positioning: Broadening the scope.....	21
7.1. Countries stand on MIIRA during First ADM .....	21
7.2. Bilateral meetings for conceptual refinement and global positioning.....	21
7.3. Inclusion of Ancient Grains (MIIRA to MAHARISHI) & countries stand during Second ADM .....	24
8. Global consensus on MAHARISHI .....	24
8.1. Endorsement in MACS Varanasi.....	24
8.2. Excerpts of NDLD and output document & chair summary report .....	25

9.	Institutional mechanism and Secretariat.....	26
9.1.	Establishment of ICAR-IIMR- Hyderabad as the MAHARISHI Secretariat.....	26
9.2.	Role of ICAR – Indian Institute of Millets (Shree Anna) Research.....	26

## List of Figures

Figure 1.	Global trends in cultivation of millets. The figure illustrates trends in area under cultivation and production from 1962 to 2018.....	2
Figure 2.	Millet production in 2021 ( <a href="https://www.fao.org/faostat/en/#data/QCL/visualize dt 3rd July 2025">https://www.fao.org/faostat/en/#data/QCL/visualize dt 3rd July 2025</a> ).....	5
	Figure 3: Priority areas of agriculture working group of G20 India Presidency 2023 .....	17

## List of Tables

Table 1:	Policy Interventions in millets over years in India .....	15
Table 2:	Country-wise perspectives on millets and MIIRA .....	18
Table 3	Countries positioning during 2nd ADM.....	21

# Introduction

Millets are small seeded, hardy grass species which include sorghum, pearl millet, finger millet, foxtail millet, proso millet, kodo millet, little millet, barnyard millet, and brown-top millet. Apart from these there are other ancient grains that are consumed as food which include teff, fonio, sekia, job's tears, buckwheat, amaranth, quinoa, barley etc. These food grains have disappeared from mainstream food platter and replaced with wheat and rice. Millets and ancient grains are nutritious and contain many health benefiting constituents for human, hence honoured them with Sanskrit name 'Shree-anna', which means honoured food. Millets are hardy crop which are inherently resilient to biotic and abiotic stress.

The global crisis looming due to climate change, depleting natural resources, increasing CO<sub>2</sub> concentration and temperature has to be addressed. Millets and ancient grains are less resource intensive for cultivation and provide solution to sustainable agriculture. MAHARISHI is an opportunity highlighting the research challenges relevant across the globe and provides platform for combined and coordinated action across the research community offers our best options for success.

## 1. Background

Since, beginning from early settlers to the thriving civilisations, human was dependent on millets and ancient crops for food and nutrition. Till green revolution, globally major part of the food demand was met by cultivating millets and other ancient crops viz. pearl millet, sorghum, finger millet, foxtail millet, proso millet, barnyard millet, kodo millet, brown-top millet, jobs tears, teff, fonio, sekia, amaranth etc.

In recent years however, global food security has experienced a serious reversal. Hunger levels have been rising due to the compounding impacts of the COVID-19 pandemic, cross-border conflicts, and climate change. According to the Food and Agriculture Organization (FAO), global undernourishment has sharply increased, with projections suggesting that by 2030 hunger may remain as prevalent as it was in 2015. Escalating fertilizer costs, local conflicts, and extreme weather events have disrupted food production and supply chains, disproportionately affecting vulnerable populations. Despite sustained global commitments to the Sustainable Development Goals (SDGs), there is an urgent need for more inclusive, resilient, and sustainable agri-food systems.

In that context, MAHARISHI offers a crucial and strategic pathway for reviving millets and ancient grains. These crops have the potential to address the challenges of climate change, depleting natural resources and increasing life-style disorders. This initiative is aimed to revive these crops keeping the interest of small and resource poor farmers and other stakeholders worldwide. Its inception marks the establishment of a global platform for innovation and

collaboration in millets and other ancient crops. Initially proposed during the 2nd Agricultural Deputies Meeting (ADM) in March 2023 in India, the initiative was subsequently endorsed by the participants of the G20 Meeting of Agricultural Chief Scientists (MACS) in April 2023 to contribute to improving world food and nutritional security through bringing millets in global consumer's diet.

MAHARISHI provides a framework to establish strategic research and organization priorities for millet research at the international level in both developed and developing countries. It serves as a conduit for communication among the research community, funders and global policy makers and aims at securing efficient and long-term investments to meet millet research and development goals. It also initiates and supports activities in-order-to improve communication among global research partners and increase access of all to information, resources, and technologies with respect to millets.

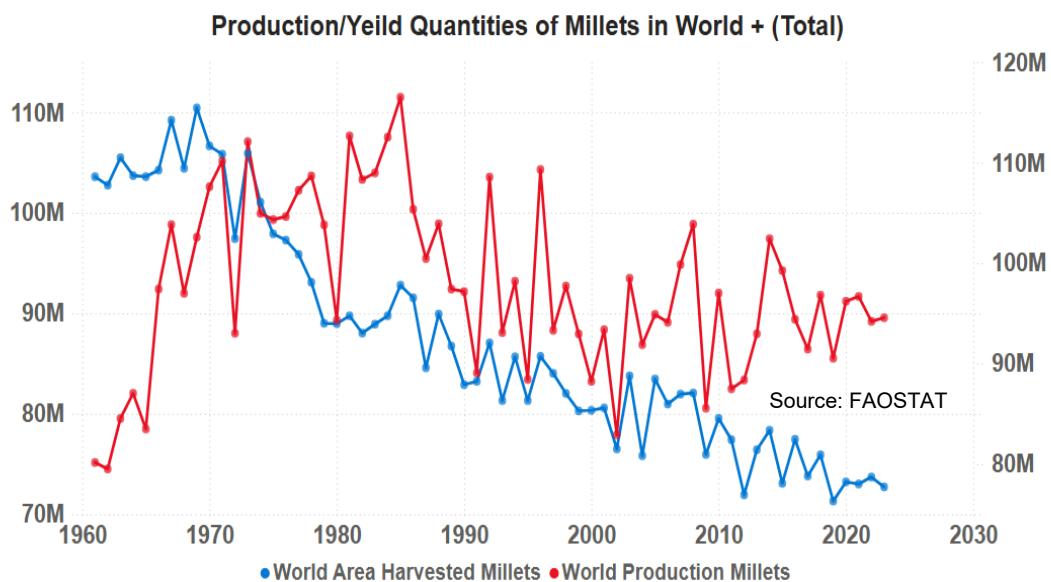


Figure 1. Global trends in cultivation of millets. The figure illustrates trends in area under cultivation and production from 1962 to 2018

# PART A



## 1.1. Why millets

Millets are the most versatile crops which can be grown in diverse agroclimatic condition. These crops have wide adaptation and most suited for the current agrarian vulnerabilities viz. climate change, drought, depleting natural resources, rise in CO<sub>2</sub> and temperature etc. Paleo-botanical studies revealed that millets and other ancient crops were the first choice of the early human settlers worldwide. Most of the millets and the ancient grain crops are C<sub>4</sub>, which means they have better water, nutrient and radiation use efficiency. They are also resilient to abiotic stress and resistance to pest and diseases.

These crops are mainly grown in arid and semi-arid regions of the world. Sorghum, pearl millet and finger millet are the major staple food of millions, globally. The other small millets include foxtail millet, proso millet, barnyard millet, kodo millet, brown-top millet, jobs tears, teff, fonio, sekia etc supported the tribes and people in the most remote places of the world, where the advanced agriculture technology did not penetrate. Most of the resource poor farmers or tribes grow minor millets for food and livelihood security.

Millets in general are crucial to the world food economy, they contribute to food security in many of the world's poorest, most food-insecure regions. As per the UN Food and Agriculture Organization's data millets can be a sustainable alternative to rice and wheat, as a staple food. It can also help in providing food security to large population in the coming years. In Africa and Asia, more than 70% of the sorghum and cumulatively, 95% of the millets are consumed as food. A large proportion of farm households aim simply to produce enough grain to meet household requirements - and many often fail to meet even this limited goal. Only a small proportion of the harvest is traded, mostly on local food markets. Since, the beginning of systematic research in these crops, considerable progress is made in enhancing yield and other agronomic traits in sorghum and pearl millet. However, these efforts are sporadic and unmatched to the progress made globally in the major cereals viz. wheat, rice, and maize. Millets and ancient crops remained unexplored and neglected. Millet cultivation and consumption has many advantages which can be summarized as 'good for people, good farmer and good for earth'. The major constraints in small millets cultivation are low yield, shattering, lodging, unavailability of processing, absence of value chain, marginal and subsistence farming, changing food habits and declining demand, low remuneration etc. and to some extent the social stigma of 'lesser grains' attached with these crops. However, "The millets market is set to grow from its current market value of more than \$9 billion to over \$12 billion by 2025. Favourable government initiatives to proliferate the global millets market size over 2019-2025.

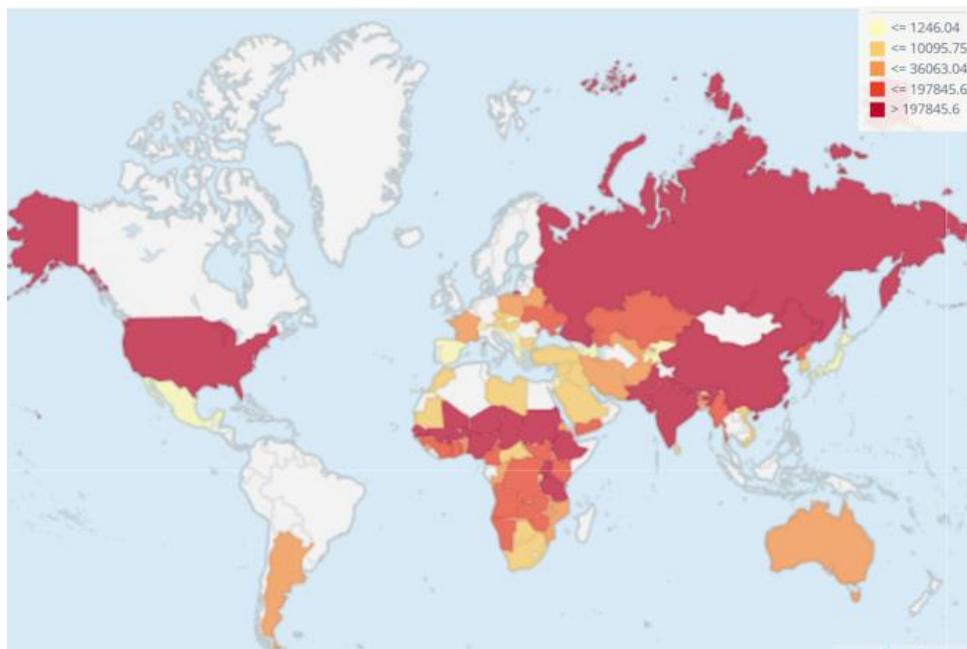


Figure 2. Millet production in 2021 (<https://www.fao.org/faostat/en/#data/QCL/visualize> dt 3<sup>rd</sup> July 2025)

The looming threats of climate change, rising CO<sub>2</sub> levels and temperatures, pollution, and ecological imbalances have led to the rediscovery of minor millets and ancient crops as viable solutions to these global challenges. Millets, in particular, offer a sustainable pathway for addressing agrarian issues due to their climate-resilient nature and low input requirements.

However, the limited shelf life of millets has historically hindered their market growth. Despite this, their inherent gluten-free quality presents significant opportunities for the development of gluten-free and low glycemic index (GI) food products. With a growing shift in consumer preferences toward low-cholesterol, fat-free, and health-conscious diets, the demand for gluten-free foods is on the rise.

This trend is encouraging manufacturers to incorporate natural and gluten-free ingredients, especially in health food products. The increasing inclination toward adopting healthier eating habits and low-calorie alternatives is expected to further stimulate market growth and position millets as a key component in the future of sustainable and nutritious food systems.

## 1.2. Impact of climate change

The millets in general are C4 plants and show better photosynthetic efficiency than rice and wheat under high temperature and CO<sub>2</sub> concentration. Proso millet, foxtail millet, little millet, barnyard millet matures in 70-80 days. Due to short duration, the water requirement is low and the per day productivity is high. The inbuild resilience to biotic and abiotic stress is also high. These crops can be grown organically without or with less use of chemical fertilizers and plant protection chemicals. The shallow root system makes these crops suitable for intercropping and mixed cropping systems, it will not only increase

the cropping intensity but will enhance the soil productivity by up taking nutrients from entire soil profile.

### 1.3. Underutilized Grains Initiative: Millets and Underutilized grains as climate smart crops

The challenge of adapting agriculture and food supply to an increasing variable and unpredictable climate requires us to use all available options for increasing the diversity within our crops but also the diversity of the crops we grow. Offering farmers access to diverse cropping options holds the potential to improve the reliability of production but depends on developing suitable high yield varieties for crops that are currently underutilised.

The three major cereals, wheat, rice and maize, dominate the world's food production accounting for over 50 percent of our food. All have benefited for many decades of intense research, and this has resulted in our ability to keep pace with the increasing demand for safe and nutritious food.

The high yields of the three major cereals have ensured their global dominance but the relatively low yields of the underutilized grain crops reflect an opportunity. There are many reasons why these crops are low yielding but there are three prime points.

- First, these crops tend to be grown in difficult environments. In particular, they are known for their high tolerance to drought, heat and low nutrient or degraded soils.
- Second, they are usually produced under low input conditions with minimal fertilization, or chemical management of weeds and diseases.
- Third, investment in crop improvement is substantially lower than for the three major cereals; there are few well-resourced breeding programs, and the knowledge base for these crops is poor.

While these three factors that have influenced the yield of the smaller grain crops, they all now represent an opportunity. The broad adaptation of these crops to hot and dry environments and their tolerance to poor soils, means they may be better able to produce grain in environments most severely impacted by an increasingly variable climate. The low levels of chemical intervention in production systems have resulted in varieties that are better able to cope under low input. Finally, the success of these crops in some regions despite the very low investment in research and breeding, indicates that there is likely to be a large benefit through increased spending and greater coordination of research. For the major cereals the rates of genetic gain are slowing, as we approach the maximum achievable through breeding. However, for the underutilized grains we are at very early stages of using their genetic potential and there is the opportunity for major increases in productivity at large. This is the opportunity that this initiative seeks to capture.

## 1.4 Achieving impact of MAHARISHI

Achieving impact across multiple crops is difficult due to the dispersal of effort. In order to address this problem, a framework needs to be developed that can be applied to each crop in a staged fashion.

The objective will be to build a collaborative and active research community focused on addressing the major challenges facing the production of the underutilized grains. The key outcome will be to ensure that the investment in these crops grows and delivers rapid improvements in productivity.

One similar framework already exists in the Wheat Initiative where a number of low-cost options have been shown to be highly effective:

1. Establish mechanisms to connect researchers and institutions working on each crop to enhance the dissemination of research findings and information and identify research gaps and needs. This would be based around building Expert Working Groups (EWG) for each crop and addressing major challenges (such as breeding, disease and pest management).
2. Advocate for the importance of the millets and underutilised crops by sharing information on their production and consumption across the world, and the value from increased coordination and investment.
3. Build development of these crops into the 2030 Agenda for SDGs focusing on food security and nutrition
4. Establish web platforms to connect researchers, deliver information periodically (through, for instance, newsletters on the latest research, developments, and news regarding millets as well as other related remote/online activities), and share communication products, thematic briefs, and advocacy activities to encourage research and awareness
5. Organizing knowledge transfer, capacity-building activities and international research workshops and conferences. This would include building a program to encourage early career researchers to work on these crops.
6. Provide research and innovation prizes or awards to young scientists to support their research interests. Also support open access publication of research results
7. Raising awareness through print, electronic and social media, fairs and exhibitions to enhance demand for the millets and other underutilized grains

## 2. Major issues and challenges facing millet production and research

### 2.1. Issues in millets and ancient grains improvement, adoption and utilization

There is drastic decline in area of millets in general and cultivation of ancient grains viz. teff, job's tears, fonio, sekia has almost become negligible. The priority is yield enhancement in all these crops in general and followed by developing robust seed supply chain and market linkages. Some of the specific challenges to address are given below. Use of local landraces in the breeding program, pre-breeding programs including secondary and tertiary gene pools must be initiated. In general, the global programs can focus on introgression of novel genes to improve the biotic and abiotic stress tolerance, nutritional quality, biomass, sweetness etc must be initiated at global level. Omics studies to identify novel variants and utilization in MAS must be devised through networking and collaboration at global level. Improving genetic gains through genomic selection, use of gene editing technology for creating novel traits (viz. herbicide tolerance) require global competence and collaboration in specific areas viz. genomics, phenotyping, crop and climate modelling, bioinformatics, computing and data analysis, yield mapping, global positioning systems, are amongst a range of developments which can be replicated from rice, wheat, and maize improvement programs.

Nutritional profiling and documenting traditional knowledge in all the millets and ancient grains, validating with systematic experimentation will improve the possibilities of adoption and acceptance by people globally.

Policies encouraging farmers to grow millet and attain sustainability goals are as important as the research and development in the crop. Policy matters are country specific which must be deliberated and supported on a global platform. In summary, MAHARISHI is conceptualized to provide the necessary framework for implementation at global level. Some of the specific researchable issues related to millets and ancient grains are given below:

**Sorghum:** The declining genetic base in the improved breeding lines needs improvement. Broadening genetic base by use of local and landraces in the breeding programs, pre-breeding for utilizing secondary and tertiary gene pools. Sorghum must be seen beyond food crop; it can be an industrial and biofuel crop. Improve the biotic and abiotic stress tolerance, nutritional quality, biomass, sweetness etc will be initiated at global level. Important researchable problems in sorghum to address at global level are improving yield and enhancing genetic gains per cycle, drought tolerance, improving water and nitrogen use efficiency, striga resistance in Africa, shoot-fly resistance in Asia and Southeast Asia, grain-mold resistance, improving nutritional profile are some of the specific research challenges

**Pearl millet:** Pearl millet is the hardiest crop, it shows tolerance to drought, heat, salinity, and acidity tolerance. It is grown in the most arid part of the world under rainfed condition. Downy mildew, smut, ergot, are often cited as the most important problems and issues to be addressed, in order of importance. Hence major research thrust need to be on, but not limited to:

- Yield improvement; broadening genetic base; Downy mildew resistance; tolerance to drought and heat; fixation of heterosis using apomixis
- Micronutrients (iron and zinc) enhancement; rancidity and improving shelf life of pearl millet flour.
- Emphasis on dual-purpose early maturing hybrids, greater attention on hybrid development for the driest zone of the world (example. A1 zone in India)
- Development and promotion of green forage hybrids with higher yield and quality.
- Application of biotechnology viz. genomics, genomic selection, gene-editing technology to address the above challenges.

**Small millets:** Following are the researchable issues in small millets at global level

- i. The high priority in all small millets is enhancing yielding potential. Hybrid breeding in finger millet by devising male sterility system
- ii. Development of genomic resources (Employing tools of comparative genomics)
- iii. Gene discovery & allele mining from small millet genetic resource (Water and nutrients use efficiency; Improvement of nutritional quality (Grain and Fodder) and bio-fortification (Exploit with in species variability for nutrients, improve bioavailability and improving shelf-life) in proso millet, barnyard millet, little millet, kodo millet, brown-top millet, amaranth, buckwheat, quinoa, job's tears, teff, fonio, sekia etc
- iv. Crop improvement for resistance to biotic and abiotic stresses (Blast disease in finger millet, shoot fly in little, proso and foxtail millets, and Tolerance to drought, temperature, and salinity); shattering in small millets, lodging etc.

**Ancient grains:** At first, all the ancient grain database and global germplasm hub must be created which is accessible for research and development. Nutritional profiling, identification of functional compounds with health benefits, cataloguing the traditional knowledge associated with the ancient grains. Genetic improvement of these ancient grains for higher yield and value addition.

## 2.2. Access to skills in both new and old technologies

The researchers working in millets are few and barely any in other ancient crops. Crop breeding has advanced to a newer height, it is no more the conventional breeding, but the millet researchers are not exposed to the advances in crop improvement. The research staff must be trained in the advances in plant breeding and in the tools and techniques used in breeding (sequencing, genomics, transcriptomics, proteomics, metabolomicst, 'omics', etc) or aiding in selection viz. imaging, use of drones etc.

## 2.3. Support for multinational research and public private partnerships

Public-private Partnerships (PPP) play a pivotal role in scaling innovations, bridging research-to-market gaps, and ensuring farmer-level impact. For successful implementation of the MAHARISHI initiative, multinational collaboration is essential to pool expertise, infrastructure, and funding across geographies. The complementarity between public research institutions, which bring scientific rigor and germplasm resources, and private sector players, who offer market access, processing technologies, and investment, can accelerate varietal development, value chain integration, and consumer outreach. Strengthening international PPPs will also enable cross-country knowledge exchange, joint breeding programmes, capacity building, and coordinated policy advocacy, ultimately positioning millets as climate-resilient, commercially viable, and nutrition-rich crops on the global stage.

## 3. Research Priorities

- 3.1. Strengthen existing research activities
- 3.2. Advanced breeding methodologies, biotechnology, phenomics and genomics in millets
- 3.3. Enhance agronomy of underutilized grains in its broadest definition (crop production and soil management)
- 3.4. Broadening genetic base, utilizing global genetic resources
- 3.5. Value addition and international standards for global market



## PART B



## 4. MAHARISHI Vision and Mission

MAHARISHI was proposed in G20 MACS meeting in April 2023 in India and endorsed by G20 MACS participants to contribute to improving world food and nutritional security through bringing millets in global consumer's diet.

This initiative provides a framework to establish strategic research and organization priorities for millet research at the international level in both developed and developing countries. The MAHARISHI fosters communication between the research community, funders and global policy makers and aims at securing efficient and long-term investments to meet millet research and development goals. It also initiates and supports activities in order to enhance communication and increase access of all to information, resources, and technologies with respect to millets.

### 4.1. Vision

To cultivate a globally connected and forward-looking research ecosystem that unlocks the full potential of millets and ancient grains through collaborative knowledge exchange, innovation, and inclusive partnerships, ensuring sustainable agriculture, resilient food systems, and healthier communities for generations to come.

### 4.2. Mission

To establish robust mechanisms for connecting global researchers and institutions working on millets and ancient grains, enabling effective knowledge exchange, identification of research gaps, and dissemination of innovations.

Through digital platforms, collaborative workshops, open-access publications, and recognition of young scientists, the initiative aims to accelerate research, build capacity, and raise awareness of the nutritional, cultural, and climate-resilient value of these crops - empowering smallholder farmers and advancing sustainable food systems.

### 4.3. Strategic significance of MAHARISHI

In the context of today's global challenges related to food security, climate change, and nutritional needs, Millets And OtHer Ancient Grains International ReSearch Initiative (MAHARISHI) is a strategic lever to transform global food systems by mainstreaming underutilized grains, thereby ensuring a future that is healthier, more equitable, and environmentally sustainable.

#### ✓ **Advancing Global Food Security**

MAHARISHI promotes the diversification of global food systems by strengthening research and development on climate-resilient and nutrient-dense ancient grains. This reduces overdependence on a few staple crops and enhances the stability and sustainability of food supplies.

✓ **Climate-Resilient Agriculture**

By focusing on hardy, water-efficient, and low-input crops like millets and ancient grains, MAHARISHI addresses agrarian vulnerabilities such as drought, heatwaves, and soil degradation, making food systems more resilient to the impacts of climate change.

✓ **Nutritional Security and Health Outcomes**

Millets and ancient grains offer superior nutritional profiles, aiding in the fight against malnutrition, micronutrient deficiencies, and non-communicable diseases. MAHARISHI can contribute to improved public health through the promotion of bio-fortified, functional foods.

✓ **Empowering Smallholders and Marginalized Communities**

These grains are predominantly grown in rainfed and marginal regions by smallholder farmers and tribal communities. MAHARISHI enhances their livelihood security by building value chains, improving productivity, and linking them to markets and research networks.

✓ **Catalysing Innovation and Global Collaboration**

This initiative enhances international research cooperation, open data platforms, innovation incentives, encouraging knowledge sharing, technological advancements, and youth participation in agriculture.

✓ **Supporting G20 Global Commitments**

MAHARISHI directly supports the G20's broader goals of sustainable development, resilient food systems, and inclusive growth. It complements ongoing efforts such as the Agricultural Market Information System (AMIS) and builds on initiatives like the Wheat Initiative.

✓ **Strengthening Diplomatic Relations and Trade**

MAHARISHI serves as a platform for international collaboration, opening opportunities for bilateral and multilateral partnerships in research, and trade. Countries expressing readiness to collaborate can leverage this initiative to deepen diplomatic ties, enhance agri-research cooperation, and create new value chains in health food sectors.

## 5. India's leadership in millet promotion

### 5.1. National Year of Millets 2018: Key initiatives and outcomes

In a transformative move towards sustainable agriculture and nutritional security, the Government of India declared 2018 as the National Year of Millets. This landmark decision aimed to promote the production and consumption of millets, the traditional grains that had gradually fallen out of favour in India's agricultural and dietary systems.

## **Major Initiatives in 2018**

### **1. Rebranding Millets as “Nutri-Cereals”**

One of the first major steps was to reclassify millets as “Nutri-Cereals” in April 2018. This rebranding acknowledged the grains' superior nutritional profile and helped shift public perception from “poor man's food” to a valuable health food.

### **2. Integration into the National Food Security Mission (NFSM)**

Millets were brought under a dedicated sub-mission of the National Food Security Mission, with a budget allocation of ₹300 crore for the fiscal year 2018–19. The goal was to boost production, productivity, and area under millet cultivation in selected states.

### **3. Research and Public Outreach**

Indian Institute of Millets Research (IIMR), Hyderabad, played a crucial role in organizing national-level workshops, exhibitions, and farmer training programs. Various publications on the health and agronomic benefits of millets were released to engage the public and policymakers.

### **4. Market Development and Value Addition**

Efforts were made to promote value-added millet products, encourage millet processing industries, and link farmers with markets through farmer-producer organizations (FPOs) and cooperatives.

The National Year of Millets was more than a symbolic gesture—it catalyzed real change in policies, farming practices, and consumer behaviour. Key impacts included:

- Renewed farmer interest in millet cultivation, especially in dryland areas.
- Increased research and innovation in millet breeding, processing, and product development.
- Heightened public awareness about millets' health benefits, leading to greater demand in urban markets.
- Policy support, which laid the groundwork for India's leadership in the International Year of Millets 2023.

The declaration of 2018 as the National Year of Millets was a timely and visionary step in aligning India's agricultural priorities with the global goals of sustainability, nutrition, and climate resilience. It marked the beginning of a millet renaissance, reviving a forgotten food tradition and turning it into a movement for future health and ecological security. As India and the world continue to embrace millets, the seeds of change sown in 2018 promise to yield lasting benefits for farmers, consumers, and the planet.

## 5.2. Institutional frameworks and policy push for millets

The nutritional and environmental value of millets began gaining renewed attention in the early 2000s, leading to several state-level promotion efforts even before the National Millet Mission was launched in 2018. Central schemes like the Integrated Cereal Development Programme (ICDP), INSIMP, and the Rainfed Area Development Programme (RADP) under the Rashtriya Krishi Vikas Yojana (RKVY), and ICDP-CC under the Macro Management of Agriculture (MMA), aimed to revive millet cultivation. However, policy support remained limited and uneven, with most initiatives focusing on major millets like sorghum, pearl millet, and finger millet, often neglecting small millets and resulting in fragmented implementation across states.

Table 1: Policy Interventions in millets over years in India

<b>Year</b>	<b>Policy Interventions</b>
<b>2013</b>	National Food Security (NFS) Act includes coverage of ‘coarse grains’
<b>2017</b>	NITI Aayog releases the National Nutrition Strategy (NNS) under ‘Nourishing India’ recommending increased productivity and diversity in cereal production including millets.
<b>2018</b>	<ul style="list-style-type: none"> <li>● Millets officially declared as “Nutri-cereals”</li> <li>● Made part of National Food Security Mission (NFSM)</li> <li>● Declared 2018 as the ‘National Year of Millets’</li> <li>● Launched the Sub-Mission on Nutri-Cereals under NFSM with an outlay of ₹300 crore for 2018-19</li> <li>● India sends proposal to UN for declaring 2023 as ‘International Year of Millets’</li> </ul>
<b>2021</b>	<ul style="list-style-type: none"> <li>● UNGA approves and declares 2023 as the ‘International Year of Millets’ (IYM)</li> <li>● Government revises guidelines for procurement, allocation, and distribution of coarse grains: 9 months for jowar and bajra; 10 months for ragi and 6 months for maize. This would increase procurement and consumption of these commodities as the state would have more time to distribute these commodities in IPDS/OWS.</li> <li>● Provision for inter-state transportation of surplus coarse grains through FCI is incorporated to cater for advance demand placed by consuming state before the start of procurement</li> </ul>

## 6. India's G20 advocacy for millets

The Bali Declaration of the G20 (2022) reflected a unified global resolve to tackle rising food insecurity, climate challenges, and the need for sustainable, inclusive agricultural systems. It emphasized urgent actions to prevent hunger and malnutrition, highlighted the role of sustainable and climate-resilient agriculture, supported WTO-aligned transparent food trade, and endorsed

humanitarian aid and technological advancement. In response, under its G20 Presidency, India strategically mapped its agricultural priorities by aligning them with these global concerns. Drawing from the Bali Declaration's focus on food systems resilience, trade facilitation, and digital innovation, India identified four key priority areas: (1) ensuring food security and nutrition through international frameworks and millets promotion, (2) developing climate-smart and sustainable agriculture with integrated farming and green finance, (3) building inclusive food systems to uplift smallholders and youth, and (4) advancing digital and technological inclusion via open-access agri-data and innovation-driven startups. This roadmap, shaped in consultation with international partners like WFP and the MEA, aims to create a more resilient, equitable, and future-ready global food system.

## 6.1. Strengthening global agriculture: India's G20 priority areas

In light of growing global challenges related to climate change, nutrition, and sustainable farming, India has outlined a strategic roadmap under its G20 presidency to address key agricultural priorities. The framework, developed in consultation with international bodies like the World Food Programme (WFP) and the Ministry of External Affairs (MEA), targets three interconnected priority areas to ensure long-term food security and inclusive agricultural growth.

### **1. Ensuring Food Security and Nutrition**

India's initiative emphasizes the need for coordinated global efforts to reduce food loss and waste while promoting food safety and nutrition. Special focus is placed on bio-fortification and agri-diversity to combat malnutrition. Key deliverables include the development of a G20 framework for food security, international collaborations like the Millet Initiative for awareness and research, and the strengthening of Agricultural Market Information Systems (AMIS) for informed policymaking.

### **2. Developing Sustainable Agriculture with a Climate-Smart Approach**

To mitigate climate impact and promote environmental resilience, India advocates for integrated farming systems combining fisheries, animal husbandry, and crop cultivation. The sub-themes highlight resource efficiency, green financing, and technology adoption. Deliverables focus on sharing best practices, promoting renewable energy in farming, investing in green agriculture, and fostering research in climate-resilient crops.

### **3. Building Inclusive Agricultural Value Chains and Food Systems**

A people-centric approach underpins this priority, aiming to improve the livelihoods of smallholder farmers, women, and youth. The initiative seeks to enhance value chain efficiency through technological intervention and comprehensive risk mitigation strategies such as insurance models. It also promotes institutional mechanisms to connect farmers to markets and reduce post-harvest losses.

#### 4.Cross-Cutting Digital & Technological Inclusion

The initiative also stresses the importance of open-access agri-data platforms, digital knowledge sharing, and standardization of agricultural tech. Emphasis is placed on co-opting startups, leveraging emerging technologies like AI and Big Data, and establishing robust data protection frameworks to safeguard farmers' interests.

##### 6.2. India's Proposal of MIIRA: G20 AWG issue note

In alignment with India's G20 Presidency theme "One Earth, One Family, One Future," the Agriculture Working Group (AWG) aimed to prioritize global food security, sustainable agri-food systems, and inclusive agricultural livelihoods. By addressing traditional and emerging issues like food security, climate-resilient agriculture, and digitalization, the AWG sought to build consensus across four priority areas to ensure equitable and sustainable agricultural transformation

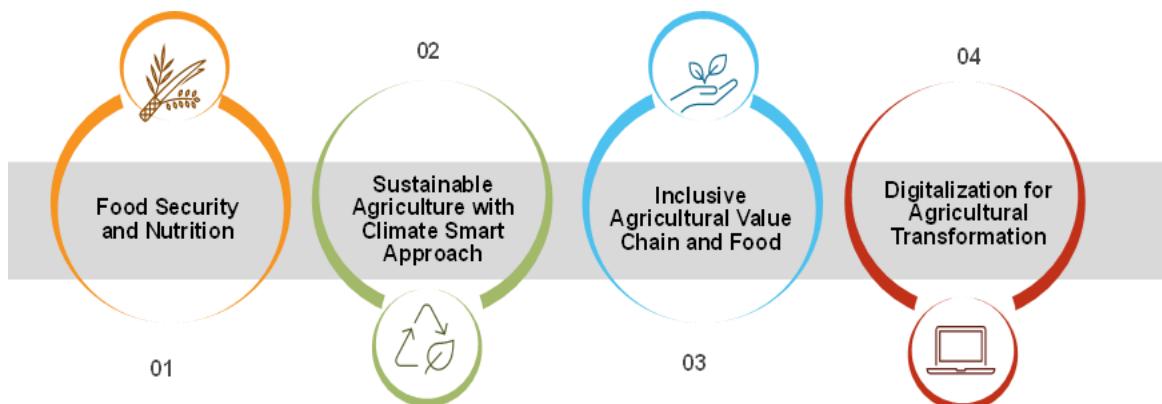


Figure 3: Priority areas of agriculture working group of G20 India Presidency 2023

Under Food Security and Nutrition, Millets are highlighted as nutrient-rich, climate-resilient crops ideal for dry and semi-arid regions, particularly in India, Asia, and Africa. They offer a solution to diversify global agriculture, reducing reliance on rice, maize, and wheat, which dominate 60% of the world's food energy intake. Promoting millets can enhance food security by improving availability, stability, and nutritional diversity, addressing the risks of crop concentration and climate vulnerabilities. As low-cost, nutrient-dense crops, millets contribute to dietary diversification, reducing dependency on starch-heavy staples. The United Nations declared 2023 as the International Year of Millets, emphasizing their potential as a "super-food crop of the future." To maximize their impact, increased research, awareness, and robust value chains are essential.

The G20 is encouraged to scale up millet production and consumption through a focused initiative, such as the proposed G20 Millet-International Initiative for Research and Awareness (MIIRA), to bolster global food security and nutrition. Its primary aim is to enhance research and awareness regarding millets and other Nutri-cereal crops, addressing food insecurity and promoting sustainable

agriculture. MIIRA was identified as one of the key deliverables in discussions focused on improving food production while adapting to climate change and preserving natural resources

### 6.3. Bilateral meetings with G20 and invited countries on MIIRA (Before 1<sup>st</sup> ADM)

In the lead-up to the G20 Agriculture Working Group (AWG) meetings, India actively engaged with various member countries to build consensus on the Issue Note and key deliverables, including the promotion of millets through the Millets and Other Ancient Grains International Research Initiative (MIIRA). These bilateral consultations revealed a range of country-specific positions, ideas, and support levels for the initiative, reflecting the global appetite for sustainable and inclusive agricultural systems.

Table 2: Country-wise perspectives on millets and MIIRA

Country	Positioning	India's Response
<b>G20 Countries</b>		
<b>Spain &amp; EU</b>  	The delegation from Spain inquired about the definition of the role of the Chief Agriculture Scientist, suggesting it be addressed in the upcoming MACS meeting	India responded that it would request the Director General of ICAR to share advance information regarding the MACS meeting. It was also noted that a review of past meetings would be undertaken to determine the appropriate level of participation
<b>ADB</b> 	ADB shown interest in MIIRA initiative and wanted to know if there is any scope to link MIIRA with meal for education kind of work.	
<b>United States</b> 	The USA expressed no objection to MIIRA. They appreciated its intent but suggested expanding the scope to include other nutrient-rich crops like quinoa.	India welcomed and thanked the U.S. for endorsing MIIRA
<b>Germany</b> 	Highlighted the importance of crop diversity with climate resilience and showed support for MIIRA initiative, German Delegates requested for a draft on MIIRA framework with draft Communiqué.	Indian Presidency expressed keen interest on talking about responsible investment on climate resilient crop production with a focus on nutrition
<b>Australia</b> 	On MIRA initiative, Australia reserved their decision and asked to take the opinion of other countries	

<b>Italy</b> 	<p>Italy agreed with India's priorities and asked for more detailed information about the MIIRA initiative. They emphasized negotiating broad principles over word-by-word text and advised circulation of a concept paper for feedback before MACS endorsement.</p>	<p>India mentioned that once MACS initiates the process, the concept paper on the MIIRA initiative will be circulated for approval, after which it can progress to the AWG Communiqué. India also noted that AWG will align the Communiqué based on overarching decisions taken at higher levels.</p>
<b>Brazil</b> 	<p>Brazil did not explicitly endorse the MIIRA initiative during the bilateral meeting but expressed strong interest in the broader millet agenda. They acknowledged the importance of combating hunger and food security, aligning with India's objectives. Brazil emphasized the socio-economic relevance of these issues and indicated ongoing discussions with India on millet trade, while awaiting further information on the initiative.</p>	<p>India emphasized India's key initiatives this year—MIIRA (Millet Initiative), inspired by the success of the wheat initiative, and the Smart Agriculture Framework for food security and nutrition, with a draft to be shared soon. India acknowledged Brazil's engagement with India on millet trade and requested them to propose dates for hosting a lunch with the TROIKA ambassadors.</p>
<b>France</b> 	<p>France acknowledged the significance of diversified crops such as millets for nutrition and food security. They supported the agro-ecological lens of the initiative and welcomed AMIS enhancement for better transparency and data sharing. However, they noted that One Health and AMR were missing in the note and should be discussed.</p>	<p>India stated that the One Health concept and AMR will be included in the MACS discussions and the Communiqué, and issues like cross-border conflicts affecting food security will be addressed as relevant. India also clarified that while there's no separate working group on food security, there will be synergy with other groups, and agreed on the suggestion to engage with the AWG Chair and Co-chair.</p>
<b>Mexico</b> 	<p>Mexico offered strong principle-based support for MIIRA but requested more detailed information. They inquired whether MIIRA would be voluntary and asked whether crops like sorghum were included (to which India affirmed). They stressed inclusivity, especially for smallholders and youth, and highlighted concerns regarding digitization and trade barriers.</p>	<p>India explained that MIIRA focuses on millets due to their drought tolerance, low pest susceptibility, and nutritional value, aiming for coordinated G20 support while remaining open to including similar crops from other countries. India also affirmed that sorghum is considered part of the millet initiative and emphasized inclusivity, especially for small farmers, women, and youth.</p>
<b>Canada</b> 	<p>Canada clarified they are neither a producer nor a consumer of millets but are supportive of MIIRA based on the success of the Wheat Initiative. They viewed MIIRA as a learning opportunity and expressed optimism for negotiations on all fronts.</p>	<p>India welcomed and looked forward for negotiations in upcoming meetings</p>

<b>China</b> 	<p>China expressed general support for the priority areas, including MIIRA, but requested a video or document for better understanding before making formal recommendations. They appreciated India's efforts and expressed readiness to provide feedback once more clarity is available.</p>	<p>India introduced the MIIRA initiative to the Chinese delegates and invited their suggestions, assuring that a brief would be shared during the second day of the ADM, with detailed discussions planned at the MACS meeting in Varanasi. India added that MIIRA may be included in the Communiqué if consensus is reached during MACS.</p>
<b>Invited Countries</b>		
<b>Netherlands</b> 	<p>The Dutch delegates expressed keen interest in MIIRA, supporting India's initiative wholeheartedly and exploring ways to assist. They emphasized the importance of collaboration between government, academia, and industry, and were particularly eager to align with MACS discussions.</p>	<p>India informed that the MIIRA concept note will be shared for feedback, with inputs to be incorporated into the draft Communiqué, which will be discussed during the 2nd ADM. India assured that suggestions from MACS will also be considered and shared that the MACS meeting will focus on Sustainable Agriculture. Lastly, India invited the Netherlands to the 2nd ADM in Chandigarh and the AMIS Rapid Response Forum.</p>
<b>Singapore</b> 	<p>Although not a millet-producing country, Singapore acknowledged the role of millets in enhancing global food security. They offered full support for MIIRA and showed willingness to explore millet integration into their domestic food systems if it proves beneficial for nutrition and resilience.</p>	<p>India welcomed Singapore's stand on MIIRA</p>

#### 6.4. India's clarifications and diplomatic positioning

India, under its G20 Presidency, responded constructively to each country's inputs, showing flexibility and openness while reinforcing its commitment to global food and nutrition security. Specific steps taken by India include:

- Sharing concept notes and draft communiqués for feedback.
- Aligning MIIRA with past successful models like the Wheat Initiative.
- Offering to include other ancient grains and cereals in future phases of MIIRA.
- Ensuring inclusivity by focusing on smallholders, youth, and women.
- Positioning MIIRA as a voluntary, consensus-driven initiative.
- Integrating MIIRA discussions into the broader G20 platform through the MACS meeting in Varanasi.

India reiterated that MIIRA is part of its broader mission to establish resilient, climate-smart, and nutrition-secure food systems globally.

## 7. Countries positioning: Broadening the scope

### 7.1. Countries stand on MIIRA during First ADM

The Millets International Initiative for Research and Awareness (MIIRA), spearheaded by India, has garnered widespread global attention and interest. Countries such as China, the European Union, South Africa, and Japan have extended their support for the initiative, recognizing its potential in promoting climate-resilient and nutrition-rich crops. Meanwhile, nations including Canada, France, Germany, Italy, Mexico, and the United States have shown a generally positive outlook but have sought further clarity, detailed documentation, and a more inclusive approach before offering formal endorsement. Collectively, the international response underscores strong support for MIIRA's objectives, coupled with a shared recommendation to expand its scope to other climate-resilient crops, ensuring regional adaptability, voluntary participation, and practical implementation.

### 7.2. Bilateral meetings for conceptual refinement and global positioning

Table 3 Countries positioning during 2nd ADM

Country/ Organization	Positioning	India's Response
Australia 	Australia supported India's millet initiative and suggested including soybean among the supported crops. It viewed the effort from multiple angles and expects broader international consensus on promoting climate-resilient crops.	India explained that the Millet Initiative under MIIRA includes ancient grains and emphasized the need for Australia's support in building global consensus. India highlighted that, like the wheat initiative, MIIRA could be anchored in a research organization with seed funding to initiate the process.
Brazil 	Brazil expressed support for the paragraph, emphasizing the need to avoid focusing on a single crop.	
Argentina 	Argentina expressed support and agreed to the initiative	India informed Argentina that the Millets initiative is outlined in a concept note, with voluntary membership. The detailed text for negotiation will be developed following the MACS meeting.

 <b>Canada</b>	<p>Canada welcomed the initiative as a strong deliverable under India's presidency, particularly appreciating the focus on R&amp;D of traditional crops. They acknowledged its importance and noted limited millet research in Canada, committing to consult their scientific experts</p>	<p>India informed Canada that the MILLETS initiative focuses on ancient grains, and a concept note has already been shared. A refined version will be presented at the MACS meeting for detailed scientific deliberation.</p>
 <b>European Union</b>	<p>European Union Fully supported the initiative, welcomed MAHARISHI, and appreciated India's leadership—expressed strong commitment to the effort</p>	
 <b>United States of America</b>	<p>United States of America Supported the initiative, noting that their biotech wheat variety is already in the market and offers greater resilience and nutrition. Emphasized the need for consensus-building with realistic timelines, an inclusive approach for farmers globally, and clarified that their initiatives are not U.S.-centric. Expressed openness to further discussion.</p>	<p>India clarified that the MILLETS initiative aims to promote not just millets but other ancient grains as well, with a concept note currently in a non-negotiable annex form and to be finalized after the MACS meeting. India emphasized inclusivity, global farmer representation, and building synergies with institutions like IIMR and ICRISAT, following a model similar to the wheat initiative.</p>
 <b>Japan</b>	<p>Japan will consult with agricultural deputies to explore potential synergies.</p>	<p>India highlighted its focus on making agricultural value chains more resilient and inclusive by promoting sustainable food production systems. Key areas include climate-resilient agriculture, improved seed varieties, biofortification for better nutrition, and advancing the One Health approach, with deeper discussions planned during the MACS meeting.</p>
 <b>OECD</b>	<p>OECD suggested finding an alternative acronym for MAHARISHI</p>	<p>India informed OECD that it is reviewing the wording around "millets and other ancient grains" and will work on appropriate nomenclature. Further discussions and refinements are planned during the MACS meeting.</p>
 <b>France</b>	<p>France Fully supported the paragraph, expressed readiness to cooperate, and</p>	<p>India welcomed France's stand</p>

	appreciated the millet initiative.	
South Africa 	South Africa expressed reservations and will provide a position after the MACS meeting	India awaited South Africa's inputs
Germany 	Germany appreciated the initiative and suggested using a more accurate term like 'traditional grains' instead of 'ancient grains,' which they felt is not a proper definition	India welcomed Germany's stance
China 	China requested the inclusion of soybean, acknowledged the role of traditional crops and millets in agricultural diversity, expressed support, but will await the outcome of the MACS meeting.	
Italy 	Italy expressed a positive view on MAHARISHI and noted it will be discussed in the MACS meeting. They raised concerns about listing specific crops and suggested avoiding including a crop list in brackets.	India conveyed that the organisational structure for the Millets initiative is being developed, with financial commitments to be proposed later. The initiative draws from the 2011 communiqué, keeping millets and wheat as separate focus areas, with further expert discussions on both planned during the MACS meeting.
Russia 	Russia highlighted that millets pose a challenge due to unsuitable agroclimatic conditions and are not grown domestically. However, they expressed willingness to conduct research on millets in collaboration with India. They noted that such research falls under Russia's Ministry of Education.	India clarified that the MILLETS initiative is voluntary, with no obligation for countries to grow millets, but aims to promote research collaboration and knowledge exchange. India welcomed Russia's interest in research cooperation and suggested including underutilized crops relevant to Russia in the concept note, encouraging partnerships post-second ADM and before the MACS meeting.
United Kingdom 	United Kingdom noted an overemphasis on millets and suggested placing greater focus on ancient grains. They will consider alternative nomenclature for 'ancient grains.'	

### 7.3. Inclusion of Ancient Grains (MIIRA to MAHARISHI) & countries stand during Second ADM

As MIIRA evolved into MAHARISHI to inclusively cover millets and other ancient grains, the initiative received broad international support with varying degrees of engagement. Countries like the EU, France, Brazil, and Argentina fully endorsed the initiative, appreciating India's leadership. Australia and China suggested the inclusion of soybean, while Canada acknowledged its importance and committed to further scientific consultation. The U.S. supported the intent but highlighted the need for inclusivity and alignment with global farmer interests. Germany and the UK recommended revisiting the terminology, suggesting "traditional grains" over "ancient grains," and OECD echoed the need for an alternative acronym. South Africa, Italy, and China preferred waiting for detailed discussions at the upcoming MACS meeting. Russia, though unable to grow millets due to climatic constraints, expressed interest in research collaboration. Overall, MAHARISHI is seen as a strategic deliverable under India's G20 presidency, strengthening global cooperation on agri-diversity, food security, and trade.

## 8. Global consensus on MAHARISHI

### 8.1. Endorsement in MACS Varanasi

The **Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI)** was launched under India's G20 Presidency as a global platform to promote nutrient-dense, locally adapted, traditional, indigenous, and underutilized crops that are both climate-resilient and sustainable. This initiative builds upon the foundation of the *International Research Initiative for Wheat Improvement (IRWI)*, endorsed by the G20 in 2011, and reiterates the significance of ancient grains in improving agricultural diversity, food security, and nutrition amidst changing climatic conditions.

Rationale behind endorsing Underutilized grain crops in "Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI)" is that these crops have significant potential to advance several Sustainable Development Goals, including ending poverty and hunger, promoting health, and nurturing resilient and sustainable communities. However, their yields remain low primarily because they are grown in challenging environments with poor soils and limited water, rely on low-input farming practices with minimal use of fertilizers or pest control, and receive far less research and development investment compared to major cereals. Despite these challenges, these hardy crops offer immense promise for diversifying the global food system and supporting climate-smart agriculture. By enhancing livelihoods and contributing to sustainable intensification, adaptation, and mitigation, they can play a vital role in building a more secure and resilient agricultural future.

The G20 Meeting of Agricultural Chief Scientists (MACS) in India, 2023, endorsed the “Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI)” to promote research on climate-resilient, nutritious grains like millets and other underutilized crops, aligning with the UN’s International Year of Millets 2023.

MAHARISHI aims to enhance international research collaboration, raise awareness, and avoid duplication by aligning with ongoing efforts in the CGIAR system and other global research programmes. It proposes the creation of Expert Working Groups (EWGs) for each crop to address specific production challenges, while also encouraging digital knowledge-sharing platforms, international workshops, and thematic advocacy campaigns. The initiative supports capacity-building, knowledge transfer, and recognizes innovation by offering research awards to young scientists. A strong emphasis is placed on aligning the development of these crops with the 2030 Agenda for Sustainable Development Goals, particularly in the areas of nutrition and food security. Awareness campaigns through print, electronic, and social media, alongside fairs and exhibitions, are planned to increase global demand. India has committed USD 2 million for millet-related activities, while other G20 countries will support research on crops relevant to their contexts.

## 8.2. Excerpts of NDLD and output document & chair summary report

Through NDLD, G20 endorsed enhanced research cooperation on climate-resilient and nutritious grains, including millets, quinoa, sorghum, rice, wheat, and maize, as emphasized during the 12th G20 Meeting of Agricultural Chief Scientists (MACS) in 2023. The launch of the “Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI)” is supported to enhance collaborative research, complementing the UN’s International Year of Millets 2023.

Under the G20 MACS Global Research Collaboration Priority (GRCP), members supported the launch of the “Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI)” to promote research collaboration on climate-resilient and nutritious grains, including millets and underutilized traditional grains. The initiative was built on the momentum of the International Year of Millets 2023 (IYoM 2023) and intended to address challenges caused by fragmented global research efforts. A framework would be developed to coordinate work across multiple crops.

### **Key aspects include:**

- Voluntary contributions (funding, expertise, resources) by G20 members.
- Collaboration with public and private institutions.
- Post-2025 activities may continue, but G20-level reporting ends, except for stocktaking.

### **Core Activities:**

- Connect global researchers and institutions.
- Facilitate open-access data sharing and knowledge platforms.
- Organize capacity building, workshops, and conferences.
- Offer research prizes/awards to encourage innovation.

### **Implementation:**

- Secretariat: Indian Institute of Millets Research (IIMR), Hyderabad.
- Technical support: ICRISAT, One CGIAR, and other IOs and research bodies.
- Encouragement to include other traditional grains like quinoa, sorghum, rice, wheat, and maize.

The declaration concludes by welcoming G20 engagement in advancing global research on traditional, climate-resilient crops through the 12th G20 MACS.

## **9. Institutional mechanism and Secretariat**

### **9.1. Establishment of ICAR-IIMR- Hyderabad as the MAHARISHI Secretariat**

At the MACS 2023 meeting, a wide array of themes were discussed including innovations for transforming agri-food systems, technological interventions for climate resilience, biofortification, blue growth through seaweed farming, and digital agriculture. A major outcome was the adoption of the Chair Summary cum Outcome Document, which outlined key areas of cooperation in agricultural R&D, food security, nutrition, and public-private partnerships. A significant highlight was the launch of the Millets And OtHer Ancient GRains International ReSearch Initiative (MAHARISHI), aimed at fostering global collaboration in R&D on climate-resilient and nutritious grains.

As part of MAHARISHI initiative, it was agreed to establish mechanisms for researcher collaboration, digital knowledge-sharing platforms, international workshops, and recognition programs for scientists. Importantly, the Indian Institute of Millets Research (IIMR), Hyderabad was designated as the Secretariat for MAHARISHI, with technical support from ICRISAT, One CGIAR Centres, and other international partners. MAHARISHI positions itself as a pioneering effort to elevate the role of ancient grains in achieving global food and nutrition security.

### **9.2. Role of ICAR – Indian Institute of Millets (Shree Anna) Research**

ICAR–Indian Institute of Millets Research (IIMR), Hyderabad, has been designated as the Global Centre of Excellence on Millets to share best practices, research, and technologies internationally. The Centre offers a comprehensive ecosystem covering crop improvement, protection, production, value addition, entrepreneurship, and outreach.

It plays a pivotal role in:

- Developing improved millet varieties using genomics, speed breeding, and biofortification.
- Supporting millet-based startups through its Nutri hub incubator, offering mentoring, training, and funding via national programs like RKVY-RAFTAAR, NIDHI-DST, and ICAR-Agribusiness Incubation.
- Value chain scaling from farm to fork with focus on low-cost and efficient processing technologies.
- Training farmers, women, and tribal communities for millet-based livelihood opportunities, including integration into public food systems (PDS, ICDS).
- Mainstreaming millets through consumer campaigns, events (Millet Walkathon, Cyclathon, Nutri-Cereal Conventions), and strategic partnerships with government and private players (e.g., APEDA, MARICO, ITC, NITI Aayog).
- Extending millet research globally, particularly across Asia, Africa, and the Global South, to improve food and nutritional security under climate-stressed conditions.
- ICAR-IIMR collaborates with state governments and international organizations to promote South-South cooperation, technology transfer, and market linkage, making it a vital driver of the international millet movement.

The ICAR-IIMR's initiatives have significantly advanced millet research, technology dissemination, and entrepreneurship, contributing to food security and sustainable agricultural practices. The ongoing collaborations and infrastructure developments position the institute as a leader in millet research and innovation.