iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 11 **Issue:** IV **Month of publication:** April 2023

**DOI:** https://doi.org/10.22214/ijraset.2023.51199

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue IV Apr 2023- Available at www.ijraset.com*

# Enhancement and Innovation in Millet Consumption

Madhumitha M[1], Kaviya S[2], Nandita R[3], Divya.V[4], Pooja K[5]
[1, 2, 3, 4]*UG Scholars,* [5]*Assistant Professor, Department of Food Processing and Preservation Technology, Avinashilingam Institute for Home Science and Higher Education for Women,School of Engineering, Coimbatore, India.*

***Abstract:*** ***Millets is widely cultivated in many parts of India as a staple food for many people. Its production ranks him sixth in India after wheat, rice, maize, sorghum and vajra. Finger millet and pearl or cattail millet have, among other things, high nutritional, antidiabetic and antioxidant properties. Due to India's low socioeconomic status, large amounts of cereals are required to meet the nutritional needs of its growing population. is. These easy-to-grow, vigorous plants may be a good choice for farmers in semi-arid regions of India as they can contribute to a more stable and balanced food supply. If this millet were systematically cultivated, it would enable a significant portion of the malnourished population to eat an incredibly nutritious and inexpensive diet.***

***Keyword: Pearl millet, Finger millet , Millet pellet , Health benefits***

## I. INTRODUCTION

A World Bank study published in 1986 sought to guarantee that everyone has access to enough food for an active, healthy, and well-balanced lifestyle. Millets, which are often found in the wild and in tropic and semi-arid parts of the planet, are a great option for ensuring a steady source of food [1]. The Food and Agriculture Organisation (FAO) temporarily focused on food protection in 2001. It defined this as a situation in which everyone, always, has the bodily, social, and economic right to use for adequate, covered, and healthful food that assembles their dietary requirements and food choices for an active, healthy, and balanced lifestyle. Due to its high quality bendiness in crowded habitats, particularly during dry times, millets are an excellent source of product in these areas [2]. According to Taylor et al. [3], Millets are one of the grain plants that can withstand drought the best, according to extensive testing. Millets are less impacted by numerous natural agricultural limitations because they are no longer merely subject to some abiotic factors like climate variability, which severely restricts their development requirements. They are also less affected by nutrient-depleted soils and limited and inconsistent precipitation [4, 5]. Sharma and others [6, especially in organising nations, stressed the need to instantly improve the plants that are acceptable for small-scale farmers and customers who are financially challenged. By putting in sincere effort during the growth of those plants that weren't excluded, this significant aim can be achieved. However, there could not be much resource rivalry because their production is focused in areas that aren't good for growing many other cereals. A decision [7] addressing the possible nutritional value of these plants was made in 1996 by the Food and Agriculture Organisation (FAO) and the International Crops Research Institute for the Semiarid Tropics (ICRISAT). Security and defence in several of the world's agro-ecological zones with food insecurity. This objective may be met in these agro-ecological areas by raising the output and productivity of these forgiving plants. Taylor [8] emphasised the potential of millets for the development of residential food safety and environmental protection due to their amazing adaptation to such situations and provided additional evidence for this viewpoint.

In semi-arid areas of India, millets have the potential to increase household food security and safeguard disadvantaged pastoral producers. One of the most underserved regions in the United States, the Medak Area of Andhra Pradesh (India), for instance, has been tasked with ensuring food security as well as demonstrating food self-sufficiency by cultivating sorghum and millet as the main component of their strategy [9]. These communities are underserved because they are predominantly made up of women and practise subsistence farming in the Deccan Plateau, one of the driest and most desolate parts of the world. However, they grow sorghum and millet, which are ecologically friendly and suited for semi-arid areas, to ensure residential food safety. They provided domestic food security and were therefore immune from receiving government benefits [10]. A study was carried out in Japan's Kenya's semi-arid areas. Unexpectedly, it was found that dwellings with more adaptive plant cultivation, such as sorghum and millet, had superior domestic food protectionOn the other side, farmers who cultivated less ecosystem-adaptable crops like beans and maize saw an increase in food unpredictability as a result of unexpected precipitation.

©IJRASET: All Rights are Reserved 

At this point, it is sufficient to describe the importance of these adaptable plants to food protection in areas of the arena where there is a sprinkler deficit [11]. Because of their high degrees of adaptability to African concerns and their significance as cereals for food safety, Taylor [8] concentrated on these millets in the context of Africa. Using FAO's [12] assertion that these grains are the solution to intermittent food shortages affecting pastoral populations in semi-arid regions, particularly the sub-Saharan region, the genuine concept is maintained. Millets are a great source of healthy protein for Africans, accounting for approximately 50% of the total grain production in the continent. Alumira and Rusike [11] conducted the actual equal tracking, and they discovered that specific millet and sorghum stages can reduce the likelihood of zero yields. Because of this, those plants could play a significant role in residential food protection during dry spells [11]. When compared to a number of typical cereal plants, millets, according to Taylor, still need more investigation. He came to the conclusion that millets' higher bendability, as compared to maize, is a requirement for considerably healthier long-term food protection [8]. Rohrbach [13] made similar considerations when he emphasised that many developing semi-arid cultures use millet and sorghum as main staple foods. The argument that tiny grain plants can perform much better than maize in terms of drought resilience, particularly in semi-arid environments, is well supported by literary worksDuring dry seasons, maize is prone to spoiling, but tiny grain cereals that can withstand drought, like millet, may be able to supply some food for survival [14]. As a result, tiny grains (millet) have the ability to perform much better than maize under a green, beneficial treatment in specific regions of the field [14].

Although maize uses harmful organophosphate protectants, which can only be stored for a maximum of eight months, Van Oosterhout [15] noted a few benefits that small grains have over maize for farmers: Compared to maize, a smaller amount of flour is needed to prepare the most popular dish; Little grains provided covered strength and guaranteed starvation for a mile longer; Compared to maize, which cannot be stored for more than eight months, the garage treatment of small grains is much higher. There is no need to purchase specific cereals' seeds because their developmental phases are sufficient. These seeds may be swapped with members of your own family, friends, and neighbourhood, so they don't need to be purchased. A multi-cropped system with much fewer grains will primarily produce a few harvests in years with quick precipitation.

## II. MILLET PEARL OR BAJRA

Pennisetum glaucum is known by various names around the world, including Bajra, Bajri, Cumbu and Sajje in India. In English, it is also called candle mild millet, pearl millet, bull rush, and bull rush. Bazira pearl millet (Pennisetum glaucum (L.) R. Br.) is a plant that usually grows in dry soil. It usually grows in semi-arid and arid regions with low rainfall, fertile sandy soils and high air, where many other hardy crops like sorghum and maize cannot provide accurate yields. This strain is diploid (2n=14) and is mainly cultivated for its grain. However, the sediments or slabs of this plant are an important food source, especially in areas with lower precipitation. It was calculated that this particular plant could provide between forty and fifty percent of the entirely dry problem feeding feed for cattle during the arid season. In the semi-arid and desert sections of the arena, the pearl millet persona functions as both food and fodder protection. Pearl millet grains offer a greater net concentration of nutritious protein (10.6%), many stabilised amino acids, and other minerals. They provide around one-third of one's daily needs for iron and zinc. On nutritional security and protection, these nutritional elements have a big influence. A tiny amount of grain is also used in bird feed. The grains of this millet are also gaining importance as a low-cost source of starch for premium brewers [20, 21]. The largest producer of this plant in terms of land is India (9). The findings of 856 kg ha-1 were average on three million acres) and produced 97 facts tonne). 3,9 percent of the general meals grain produced in India and 7,8 percent of it are produced by this factory. About 50% of the land and 42% of the world's pearl millet are grown in India's Rajasthan area. Uttar Pradesh, Gujarat (production, 8% and 7%), Maharashtra (13 percent manufacturing, five percent and 16 percent manufacturing). Maize may be a complete failure when produced in a system with other crops. Due to their promise of high yields, the production of wheat, rice, and maize continues to outpace that of millet and other minor grains in India's semi-arid areas. Low millet yields constitute a difficulty for conventional farmers and a number of substantial hurdles, claim Sukume et al. [16]. Macgarry [17] mentioned a few of the frequent problems farmers have to cope with when growing millet. The drawback is that the food is of lesser quality, which is largely the result of farmers' negligence when it comes to ecological testing [18]. The quelea bird's preference for sorghum and millet over wheat, rice, and maize is one of the bigger problems that farmers must deal with. The setback of harvesting and successfully refining harvested grains, as well as the growing number of team members with within the production of millets have overemphasised many cultivators, exhausting land preparation work, the removal of unwanted weeds, bird protection, and the setback of harvesting are all factors that contribute to limited production [7]. Currently, all of these components—wheat, rice, and maize—are affordable. This is only one of the primary causes for why wheat rose to such prominence in India during the indigo transition [11]. According to Sukume et al. [16], the absence of refining advancements is essentially the sole factor preventing the expansion of millet's premium professional markets.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

Traditional refinery methods take a much longer to process millet than they do maize, especially during harvest [16]. These reasons eliminate the need for the most hideous of the ugly conventional dwellings. Alumira and Rusike [11] go into further depth regarding the problems, pointing out that even in semi-arid settings, it might be very difficult for tiny grains to compete with maize. This is a result of millet's low production of plant debris, which is a crucial quality for regular farmers in terms of dog food and plant manure. Animals need plant deposits to survive the winter, usually from maize fires, according to Mapfumo [19]. According to the FAO [7], when consumers' earnings increase, they are more inclined to spend money on wheat, rice, and maize as opposed to typical standard grains. A further important factor that has constrained millet output is changing dietary preferences. Standard farmers are therefore likely to consider millet farming to provide below-average profits in compared to a number of other unstable plants. In comparison to cash plants, prices for millets and safe-to-eat legumes dramatically dropped once the career liberalisation programme was put into place. Additionally, this poses the possibility of impeding American farmers' ability to produce millet. The purpose of this study was to highlight the production power of millet using all pertinent data that were at hand.

## III. MILLET FINGER (THE RAGI)

Coracana Eleusine (L.) Gaertner Although Eleusine coracana is referred to by several names around the world, ragi is the name by which it is most frequently used in India. In English, it is known as finger millet. Eleusine Coracana lives in a pattern resembling tufts. The development has a diameter of 45–125 centimetres and is growing annually. Maturation typically takes between five and six months.

Fallen leaves from this cultivar generally resemble tightly packed grass. The development has a lot of tillers and branches. On the skull, a series of dignifiedly arranged spikes are visible.

It has a chromosomal count of x = 9. One species in this genus is E. coracana subs. The uncultivated diploid subspecies africana, which is tetraploid in nature, is whence coracana originates [16]. Rarely does Eleusine coracana, often known as finger millet, become extinct. Undoubtedly, this is only one of a handful of unique varieties that now contain the local food supply. This common plant in India offers nourishment for countless numbers of people. The majority of the world's producers, or around 2 million of the 4 million loads generated annually worldwide, are in Africa. In India, a total of 1587.15 thousand hectares were anticipated to be under cultivation.

Thus, irrigation was used to irrigate over 13.30 percent of the crop. As an irrigated plant, it grew increasingly prevalent in places like Gujarat and Tamil Nadu. Ragi grains are thought to weigh an average of 2282.84 million tonnes, with irrigated Ragi accounting for 20.58 percent of that weight. However, when including high-producing types, the total production was anticipated to reach 1614.53 million tonnes, or 70.73 percent. This ballpark figure highlights the necessity to persuade HYV to work with the adversarial global marketing organisation [17]. The development is successful and effective in a range of ecological contexts. In India, finger millet is cultivated in rows with the proper management practises, much like many other grains. However, in most African countries, it is handled differently [10].

In India, the last harvest is often done by hand. Personal growth goings, which normally have several centimetres of stem, are cut out using a blade. Following that, they are stretched out in rows for a few days, resulting in fermentation, heat production, and hydrolysis, which makes the grains simpler to thresh. Weevils can't enter the small seeds of finger millet because of their size. In fact, because they are so efficient at keeping pests away from garages, their unthreshed goings can be kept there for up to 10 years without risk from insects [18].

Despite the many advantages, the smaller size of the grains is a serious drawback. Due of the plant's tiny size, it is quite challenging to manage it during the full flora's life cycle. In order to convert finger millet grains into flour using standard techniques, high-quality cap potential and primary duties are required. Additionally, existing hammer generators have a few problems to solve in order to do it.

Generators must be configured with great shows in order for them to run at broadband. Design innovations that made it easier to produce flour led to the creation of a remarkable mill for millet. However, the practise of dispersing seeds is still fraught with problems. Bird attacks are possible, which lowers the quality of the final output. The flora is often resistant to pollution and many bugs, but a severe fungal illness known as "blast" that may wipe out entire regions is still difficult to treat [19–21]. The majority of nations no longer produce finger millet, yet almost 30 years ago it was thought to be one of the largest plants. Yes, if prompt action is given, the barriers that caused the rejection may be eliminated. For the long-term food security and safety here, duties are really being developed.

©IJRASET: All Rights are Reserved 

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue IV Apr 2023- Available at www.ijraset.com*

## IV. NUTRITIONAL INFORMATION

PEARL MILLET

| Nutrients | Per 100g |
|---|---|
| Protein(g) | 12 |
| Carbohydrate(g) | 68 |
| Fat(g) | 4 |
| Minerals(g) | 1.9 |
| Fibre(g) | 2.5 |
| Calcium(mg) | 43 |
| Phosphorus(mg) | 238 |
| Iron(mg) | 11.5 |
| Energy (Kcal) | 365 |
| Thaimine(mg) | 0.37 |
| Niacin(mg) | 2.5 |

FINGER MILLET

| Nutrients | Per 100g |
|---|---|
| Protein(g) | 7.6 |
| Fat(g) | 1.5 |
| Carbohydrate(g) | 88 |
| Calcium(g) | 370 |
| Vitamin (A) | 0.48 |
| Thiamine(B1) | 0.33 |
| Riboflavin(B2) | 0.11 |
| Niacin(B3) | 1.2 |
| Fibre | 3 |
| Minerals(g) | 2.5 |
| Phosphorous(mg) | 280 |
| Iron (mg) | 4 |
| Energy | 338 |

## V. MODERNIZATION OF LIFESTYLE

Millets are frequently referred to as "smart food," meaning that they are "good for the individual" (nutritious and healthy), "good for the planet" (sustainable in the environment), and "good for the farmer" (resilient). Millets are known for their toughness, ability to survive in degraded soils and high temperatures, and low need for fertilizers, pesticides, and water. Their farming practices have a smaller impact on the environment than those of the major staples that are grown with more fertilizers and pesticides.[34] Millets are used in place of legumes that are commonly used in India, like chickpeas and pigeon peas. Their amino acid content makes them a complete protein that is easier to digest when cooked . Aside from protein, contingent upon the assortment and species millets are likewise plentiful in minerals, like iron, zinc, and calcium, which convey medical advantages to all progress in years gatherings and sexual orientations.

Millets outperform other foods with comparable nutritional value in terms of their high nutritional content; It is particularly high when compared to polished rice, maize, and refined wheat flour, which were the primary staples of the post-green revolution. Urban areas typically have access to cutting-edge millet processing technologies that offer safe, simple-to-handle, ready-to-cook, and ready-to-eat meals on a commercial scale, where refined wheat flour and rice are the most common ingredients and are significantly less expensive.

The utilization of refined grains, to be specific, refined white rice, is demonstrated to be related with non-transferable infections, for example, type II diabetes mellitus and weight. Whole grain consumption has become increasingly popular worldwide as a result, highlighting the significance of mainstreaming and promoting nutritious smart food crops as a staple. [34]According to Singh and Raghuvanshi (2012), this is one of the Smart Food initiative's primary goals. Traditional whole grain and multigrain alternatives to refined carbohydrates that are more nutritious and healthier can be an important part of therapeutic dietary diversity and modification.Expanding urbanization and per capita livelihoods are changing shopper tastes and inclinations.Inconvenience, low social status, and a lack of traditional knowledge in the preparation of millets Shorter shelf life of milled grainsThe PDS includes wheat and rice on a larger scale.Millets haven't been consistently remembered for the PDS.

Among the supply-side factors are:

Farmers are discouraged from cultivating millets because there is no industrial demand for millet products with added value.Profitability is low.

The Green Transformation has leaned toward the development of rice and wheat, including yield value motivations and info endowmentsAbsence of admittance to quality seeds inadequate infrastructure to address the entire value chain, including cutting-edge processing technologies and milling machinery.[35]

©IJRASET: All Rights are Reserved 

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue IV Apr 2023- Available at www.ijraset.com*

## VI. CURRENT USAGE OF MILLETS

The only primary method of learning about millets was by word-of-mouth; either family members, friends, or neighbours shared the information. There were hardly any further awareness sources.[11] Millets were thought to be “good for health,” “easy to digest,” “good for people who have deficiencies in them,” and “good for weight loss,” but very little was known about them. Not only was there a lack of diversity, but there was also a lack of “availability” and “knowledge of what to do with the millet.” Some of the primary health advantages highlighted included “good for health,” “easy to digest,” “gives needed nutrition,” “makes bones/body strong,” “reduces body weight,” “keeps you warm in winter,” and “good for diabetics.” The main obstacle to eating is its "availability" first, then "very little knowledge on how to cook" or "what to cook," which are the next two biggest obstacles. Last but not least, "children / family members do not like the taste" limits its use as a grain for cooking to infrequently.

## VII. MILLET CONSUMPTION TRENDS

Nearly all the households mostly ingested rice and wheat.The two most important considerations for considering eating millets were "Easy/light to digest" and "Healthy to eat" across all the cities where interviews were performed.For "once a week" consumption, only pearl and finger millet were taken into consideration. It was "less often than once a month" for the other Millets kinds.[17]
The justifications for beginning millet intake at home The main justifications for beginning millet consumption were "Good for health," "body become Strong," and "reduces body weight."[17]

| | |
|---|---|
| Good for health | 14% |
| Body becomes strong | 12% |
| Reduces body weight | 10% |
| Has vitamins/ gives nutrients | 6% |
| Makes bone stronge | 5% |
| Has a good taste | 5% |
| Easy to digest | 3% |
| Reduces cholesterol | 3% |

## VIII. ADVANCEMENTS IN MILLETS

Since the outbreak of the Russia-Ukraine conflict, the demand for different varieties of millets, particularly finger millet and barnyard millet, has increased dramatically across the globe. This is because Russia and Ukraine have outlawed the export of millets and their byproducts. Therefore, now is the perfect time for India to address the problems with the millet value chain in order to increase millets’ production, consumption, and exports, as well as their by-products.
Economically speaking, millets’ demand in India until relatively recently was primarily in low-income areas, with sporadic occurrences in the middle-to-high income segment. Most millet crops continue to sell for modest costs, keeping them affordable for the poor.[17] Millets may be grown in a variety of climates, including those with scarce water resources, mountainous terrain with rocky and gravelly soil, sandy soils, etc., making it a source of income and food security for many who cultivate and eat it. A premium market for the crop has been established by the growing demand for millet among higher income people in India, Europe, and the US due to its health benefits. The income level of farming communities that live in difficult terrain in different regions of the country is anticipated to change as a result of this market demand.[29],

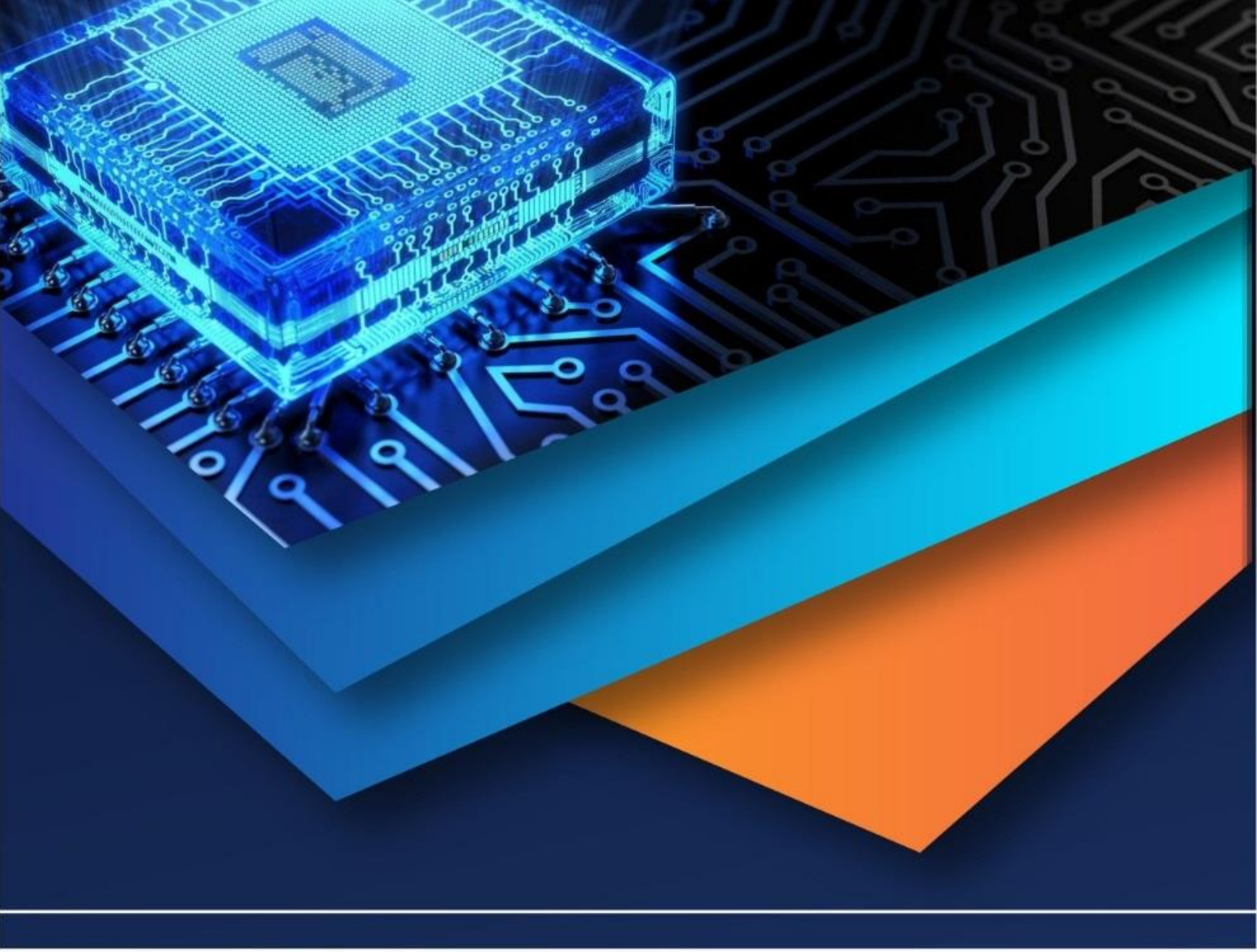
## IX. CONCLUSION

It is challenging to comprehend why millet is being rejected given the high-quality qualities described above. There have been very few attempts to research these beneficial but understudied plants in compared to the countless studies that have been done on wheat, rice, and maize. This essential herb continues to be misunderstood by the general populace of little nations as well as a few major nations, causing it to be referred to as a "awful person's plant" globally. a "meals for famine" or, even worse, officially labelled as a "fowl seed" [12].Despite the component's simplicity, many ignore it since they are drawn to sorghum and maize. In actual honesty, cultivating is taxing, which contributes to the plants' lower produce. The reality is that millets have a great chance of supplying the world's growing population with the wholesome nourishment they need. The cultivation of such plant for a substantially longer period of time and at a significantly greater price demand commitment and the right techniques. Millets may also be made into quick items in the age of instant meals, such as instant millet pellets, millet drink, and millet snacks.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

## REFERENCES

[1] The authors are grateful to Prof. Aditya Shastri, Vice Chancellor, Banas thali University, Rajasthan (India) for providing necessary support. REFERENCES [1] Food and Agriculture Organization (FAO). 2001. FAO ‘s State of Food Insecurity 2001. Rome, Italy.
[2] Dicko, H., Gruppen, H., Traore, A, Voragen, J. and Berker, J. 2005. Sorghum grain as human food in Africa. Relevance of content of starch and amylase activities. African Journal of Biotechnology, 5 (5): 384-395.
[3] Taylor, J.R, Schober, T.J and Bean, S. 2006. Novel and non-food use for sorghum and millets. Journal of Cereal Science, 44: 252-271.
[4] Sharma, K.K. and Ortiz, R. 2000. Program for the application of genetic transformation for crop improvement in the semi-arid tropics. In vitro Cell Developmental Biology—Plant 36: 83-92.
[5] Maqbool, S.B., Devi, P. and Stickle, M. 2001. Biotechnology: genetic improvement of sorghum (Sorghum bicolor). In vitro Cell Developmental Biology-Plant 37: 504-515.
[6] Sharma, K.K., Crouch, J. H, Seetharama, N., and Hash, C. T. 2002. Applications of biotechnology for crop improvement: Prospects and Constraints. In vitro Cell Developmental Biology—Plant 163: 381-395.
[7] Food and Agriculture Organization (FAO). 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13-17 November 1996, Rome, Italy.
[8] Taylor, J. R. N. 2003. Overview importance of sorghum in Africa [Online]. Available from: http://www.sciencedirect.com/science.
[9] Mukarumbwa P. and Mushunje A. 2010. Potential of sorghum and Finger millet to enhance Household food security in Zimbabwe ‘s semi-arid regions: A review contributed
[10] Food and Agriculture Organization (FAO) & International Crops Research Institute for The Semi-Arid Tropics (ICRISAT). 1996. The World Sorghum Economies: Facts, Trends and Outlook. FAO, Rome, Italy and ICRISAT, Andhra Pradesh, India.
[11] Almira, J. and Rusike, J. 2005. The Green Revolution in Zimbabwe. Journal of Agricultural and Development Economics, 2 (1):50-66.
[12] Food and Agriculture Organization (FAO) & Food Insecurity and Vulnerability Information and Mapping Systems (FIVIMS), 2008.
[13] Rohrbach, D. 1991. The impact of new sorghum and millet technologies in the evolving grain market of Southern Africa, pp:51-60. Proceedings of the International Sorghum and Millet Conference, 8-12 July 1991.Corpus Christi, Texas, USA.
[14] Rukuni, M.,Tawonezvi, P., Eicher, C.,Munyuki-Hungwe, M. and Matondi, P. 2006. Zimbabwe ‘s Agricultural Revolution Revisited, University of Zimbabwe Publications. Harare, Zimbabwe. 22.
[15] Van Oosterhout, S. A.M. 1995. Excerpts from Zimbabwe's communal areas: International Development Research Centre [Online]. Available from: www.idrc.ca/en/ev- 85113-201-1-DO_TOPIC.html - 2008-07-29 [Accessed 4 Nov 2013].
[16] Sukume, C., Makudze, E., Mabeza –Chimedza, R. and Zitsanza, N. 2000. Comparative Economic Advantange of Crop Production in Zimbabwe. Technical Paper No.99 Department of Agricultural Economics and Extension. University of Zimbabwe, Harare.
[17] McGarry, B., 1990. What Are We Promoting? A case study of the Introduction of a New Milling Technology in a Rural Area in Zimbabwe. Journal of Social Development in Africa, 5(1): 73-81
[18] Food and Agriculture Organization (FAO), 1995. Sorghum and Millets in Human Nutrition. Rome, Italy.
[19] Mapfumo, P., Mtambanengwe, F., Giller, K. E., and Mpepereki, S. 2005. Tapping indigenous herbaceous legumes for soil fertility management by resource-poor farmers in Zimbabwe. Journal of Agriculture Ecosystems & Environment 109: 221-233 [Online]. Available from: http//www.sciencedirect.com [Accessed 9 April 2009].
[20] Khairwal, I.S. 2003. Coordinator ‘s review. All India Coordinated Pearl Millet Improvement Project. Agricultural Research Station, Mandor, Jodhpur.
[21] Khairwal, I.S., Rai, K.N., Rajpurohit B.S. and Nirwan, B. 2006. Pearl millet cultivars for drought prone environments. All India Coordinated Pearl millet Improvement Project, Indian Council of Agricultural Research, Mandor, Jodhpur, India.
[22] Manga, V.K. and Kumar, A. 2011. Cultivar options for increasing pearl millet productivity in arid regions. Indian Journal of Fundamental and Applied Life Sciences, 1 (2): 200-208.
[23] Arya, H.C. and Kumar, A. 1976. Diseases of bajra- A serious problem of Rajasthan desert economy. Transactions of Indian Society of Desert Technology & University Center of Desert Studies 1:177-182.
[24] Singh, S.D. 1995. Downy mildew of pearl millet. Plant Disease. 79: 545-550.
[25] Singh, S. D. 1994. Recycling of pearl millet cultivars for the control of downy mildew. Indian Journal of Plant Protection. 22: 164-169.
[26] Rao, P.K., Nambiar, A.K. and Madhav Menon, P. 1951. Maximization of production by the cultivation of hybrids strains with special reference to cumbu (pearl millet). Madras Agriculture Journal. 38: 95-100.
[27] Chavan, V.M., Patil, J.A. and Chowdhury, B.B. 1955. Hybrid bajri in Bombay State. Poona Agriculture College Magazine. 46: 148-150.
[28] Burton, G.W. 1958. Cytoplasmic male sterility in pearl millet (Pennisetum glaucum (L.) R. Br.). Agronomy Journal. 50: 230.
[29] Burton, G.W. 1965. Pearl millet Tift 23A1 released. Crops and Soils 17:19.
[30] Athwal, D. S. 1965. Hybrid bajra makes a new era. Indian Farming 15: 6-7.
[31] Athwal, D.S. 1966. Current plant breeding research with special reference to Pennisetum. Indian Journal of Genetics and Plant Breeding. 26A: 73-85.
[32] Govila, O.P., Ray, K.N., Chopra, K.R, Andrews, D.J. and Stegmeier, W.D. 1996. Breeding pearl millet hybrids for developing countries; Indian experience. International Conference on Genetic Improvement of Sorghum and Pearl Millet. September 22-27, 1996, Holiday Inn Plaza, Lubbock, Texas. pp:97-118.
[33] Rai, K.N., Anand Kumar, K., Andrews, D.J., Gupta, S.C. and Quendeba, B. 1996. Breeding pearl millet for grain yield and stability. International Conference on Genetic Improvement of Sorghum and Pearl Millet. September 22-27, 1996, Holiday Inn Plaza, Lubbock, Texas.
[34] Anitha, S., Kane-Potaka, J., Botha, R., Givens, D. I., Binti Sulaiman, N. L., Upadhyay, S., et al. (2021c). Millets can have a major impact on improving iron status, haemoglobin level and in reducing iron deficiency anaemia - a systematic review and meta-analysis. Front. Nutr. Submitted.
[35] Anitha, S., Kane-Potaka, J., Tsusaka, T. W., Botha, R., Rajendran, A., Givens, D. I., et al. (2021a). A systematic review and meta-analysis of the potential of millets and sorghum for managing and preventing diabetes mellitus. Front. Nutr. doi: 10.3389/fnut.2021.687428



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)