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Production of Nutri-Cereals in India: A Decomposition Analysis

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SUMMARY

The study examines production of Nutri-cereals in India and the proportional contributions of area and productivity (yield) from 1950-51 to 2020-21. Production instability raises production risks and discourages farmers from investing. The Cuddy-Della Valle Index (1978) was employed in the study to address the issue of instability in Nutri-cereal production. Furthermore, it employs decomposition analysis to disassemble area, yield, and interaction effects across time. To assess decadal change, the study divided the entire era into seven sub-periods. From 1950-51 to 2020-21, the area under cultivation for jowar, bajra, ragi, and Nutri-cereals showed a negative growth rate of (-) 1.87, (-) 0.62, (-) 1.26, and (-) 1.00 percent per year, respectively. Despite this, production of all crops except jowar increased at a positive CAGR during the time. From 1950-51 to 2020-21, productivity for bajra increased at the fastest rate (2.28 percent per year), followed by ragi at 1.41 percent per year. The goal of the decomposition method is to understand the driving forces that cause changes in the impact variable. For the first three decades of jowar production, the yield effect was particularly strong. However, data over the last four decades suggests that the area impact influences jowar output. It is evidenced that yield effect has always been the driving force for producing bajra and Nutri-cereals.

Keywords: Indian agriculture; Nutri-cereals; Millets; Decomposition analysis; Instability index.

JEL Codes: Q01, Q10, Q15

1. INTRODUCTION

Millets belong to the cereal family and are very adaptable to growing in areas with low to moderate rainfall and high temperatures. Millets are also ideal for marginal and low fertile ground, requiring fewer inputs, particularly chemicals, and hence are environmentally beneficial. Millets have recently been regarded as super crops and smart crops because of their excellent nutritional benefits and hypoglycaemic properties, which may provide a promising solution to the problem of food security (Rao *et al,* 2017) (Bora *et al.,* 2019). Millets have a high tolerance for biotic and abiotic stress, as well as the ability to absorb CO2 from the environment (Bandyopadhyay *et al.,* 2017). It could be one of the solutions to the problems of overpopulation, starvation, and triple nutrition. In addition, to accomplish the Sustainable Development Goals (SDGs) of zero hunger, decent health and well-being, sustainable consumption and production, and climate action (United Nations, 2023).

Millets are a part of ancient traditional Indian cuisine;however, they have lost their relevance as a part of mainstream meals and are now often regarded as a low-income earner's diet. Furthermore, with the expanding influence of wheat and rice, particularly during the green revolution, millets have lost their importance in people's diets and are now considered supplemental foods. India is the world's largest producer of millets, accounting for approximately 15 percent of worldwide production. Millets rose to prominence after the Indian government designated 2023 as the 'International Millet Year' to promote a sustainable food system, encourage dietary diversification, and disseminate information about millets' health advantages to the public. The Government of India has designated ten millet crops as 'Nutri-cereals', including three major millets (sorghum, pearl millet, and finger millet (Jowar, Bajra, and Ragi, respectively), five minor millets (foxtail millet, proso millet, kodo millet, barnyard millet, little millet), and

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two pseudo millets (kuttu (buckwheat) and ameranthus) as small millets (Government of India, 2018).

Several efforts have been made to explore millet production, investigate the reasons behind the low demand, analyse supply chain challenges, and highlight the health benefits of these nutrient-rich cereals. Patra *et al.* (2023) discussed the health advantages of millets and analysed India's millet output from 2011-12 to 2020-21. The study advised techniques for increasing millet production while addressing issues such as low seed quality, low remuneration, a lack of storage facilities, limited market access, etc. Prabha Rani *et al.* (2023) studied pearl millet development in India and estimated production using regression analysis. They analysed the performance of pearl millet producing states in terms of area sown, yield, and production for 2020-21.

Gowda *et al.* (2022) emphasized each millet's health benefits and favourable impact in combating food poverty and malnutrition. The study did, however, find that processing techniques have a significant impact on millets' nutrient content and digestibility. As a result, they examined the impact of processing techniques on millet nutritional qualities, concluding that germination and fermentation improved while excessive dehulling, polishing, and milling reduced dietary fibre and micronutrients. Some studies analyse potential demand and supply gaps for millets. Sreekala *et al.* (2022) used NSSO data to study trends in output and consumption in India from 1969-70 to 2018-19 and 1970-71 to 2011-12, respectively. They also estimated future demand and supply circumstances based on growth rates in area, production, and productivity, and concluded that there would be a surplus for bajra and small millets, but a net deficit for jowar and ragi in the coming years. According to Kondala *et al.* (2022), farmers farming millets confront obstacles such as a weak supply chain, low productivity, a lack of customer knowledge, and insufficient processing techniques. Vennila and Murthy (2021) conducted a survey on ragi production and productivity trends from 2007-08 to 2018-19. The acreage and production of ragi in India have grown at a negative rate, which is attributable to crop diversification. The introduction of traditional types resulted in a minor decline in productivity. The study found positive instability indicators for area, production, and productivity because of replacing ragi-cultivated areas with other competitive crops.

According to Gowri and Shivakumar (2020), there has been a decline in millet cultivation area and productivity from 1950-1955 to 2018-2019. However, productivity has seen a rising trend since 2005. The study also analysed and discussed the differences in market crop prices and Minimum Support Price (MSP) for bajra (sorghum) and ragi. Market crop market prices for bajra were greater than MSP from 2010 to 2019, whereas for ragi, they were lower between 2018 and 2019. Das *et al.* (2019) evaluated millet production in relation to production and productivity from 2001-02 to 2016-17 and determined that while the area under cultivation of pearl millet declined, output and productivity increased. In the case of ragi, both cultivation and production areas have decreased while productivity has increased. Instability analysis for production and productivity revealed significant variation in both jowar and ragi.

Rao *et al.* (2017) discussed the nutritional content of millet food and its significance as a smart crop in the hard period of climate change. The comparative picture of Indian and global millet production and consumption is shown from 2010-11 to 2018-19. The study identified several challenges such as low yields, lack of end-product specific cultivars and their seed chains, inefficient primary processing machinery, lack of grades and standards, low shelf life of products, R&D on diversification of value addition, lack of clinical evidence for bioavailability and efficacy of nutrients, lack of awareness in public and capacity building channels, slower incubation of start-ups, and lack of policies for inclusion in public distribution. To increase demand, the study stressed the importance of changing people's attitudes toward millets by emphasizing their health benefits. The study indicated a need for new ways to improve the texture and long-term nutritional value of millets. The report also called for greater coordination and collaboration among various departments of the central and state governments, R&D institutes, agricultural colleges, private sector, and professional groups to close the demand-supply gap in millet production-consumption. Using primary data, Munasib *et al.* (2015) concluded that the ineffectiveness of farmer groups, mass media, and a lack of public extension services were the causes of low hybrid pearl millet adoption rates in Rajasthan.

Against this backdrop, the study attempted to examine India's production of Nutri-cereals, particularly

Jowar, Bajra, and Ragi, in terms of area sown and yield. The goal of this research is to understand the driving causes behind changes in the impact variable, i.e. productivity. Section Two discusses technique and data sources. Section Three covers the empirical findings and results. The last section contains concluding observations and policy implications.

2. DATA SOURCES AND METHODOLOGY

The decomposition method is used to determine relative contribution of area, yield, and their interaction effect on production. The study used a decomposition method introduced by Minhas and Vaidhyanathan (1965) and improved by Sharma and Subramanyam (1984). The method is applied by various studies to diagnose area effect, yield effect and their interaction effect on agriculture production (Roy *et al.,* 2022, Singh and Bansal 2020, Baishali *et al.,* 2019, Singh *et al.,* 2014, Tayade *et al.,* 2013, Kalamkar *et al.,* 2002). The Decomposition technique between two periods is as follows.

The method states that A_0, P_0, and Y_0 are area, production, and yield in the base year and A_n, P_n and Y_n represent respective variables in the current year.

$$P_o = A_o * Y_o$$

$$P_n = A_n * Y_n \quad (1)$$

$$P_n - P_o = \Delta P,$$

$$A_n - A_o = \Delta A$$

$$Y_n - Y_o = \Delta Y \quad (2)$$

From equation (1) and (2) we can write,

$$P_o + \Delta P = (A_o + \Delta A)(Y_o + \Delta Y)$$

Hence,

$$P = \frac{(A_0 \Delta Y)\, x100}{\Delta P} + \frac{(Y_0 \Delta A)\, x100}{\Delta P} + \frac{(\Delta A \Delta Y)\, x100}{\Delta P} \quad (3)$$

The total change in production is decomposed into, yield effect, area effect and an interaction effect due to change in area and yield (Tayade *et al.,* 2013). To measure degree of variation in area, production and yield, the study used coefficient of variation using formula below;

$$\text{Coefficient of variation} = \frac{\text{SD}}{\text{Mean}} * 100 \quad (4)$$

where,

SD = Standard deviation of Area/Production/ Yield of the crop for the period

Mean = Mean value of Area/Production/Yield of the crop for the period.

The simple coefficient of variation (CV) overestimates the level of instability in time series data characterized by long-term trends, whereas the Cuddy-Della Valle Index corrects the coefficient of variation (Deb, *et al.,* 2005). Hence, the study used Cuddy-Della Valle Index (CDVI) to compute instability in the production. CDVI was originally developed by Cuddy and Valle (1978) for measuring the instability in time series data that is characterized by trend. Cuddy-Della Valle index attempts to de-trend the CV by using coefficient of determination ($\bar{R}^2$) hence portrays clear picture about instability in agricultural production (Ochoche *et al.,* 2022, Shabana and Madhulika 2018). A low CDVI signals the low instability in farm production and vice versa. The index is as calculated as follows;

$$CDVI = CV\sqrt{1-\bar{R}^2} \quad (5)$$

where,

C.V. = Coefficient of Variation

$\bar{R}^2$ = coefficient of determination from a time series trend regression adjusted by the number of degrees of freedom. ESS/TSS i.e., ratio of explained variation to total variation. (Ochoche *et al.,* 2022)

The study is based on time series data on area, production, and yield for Nutri-cereals, jowar, bajra and ragi covering the period from 1950-51 to 2020-21. The data is retrieved from various sources of agriculture statistics published by the Government of India (2022). The study is divided into seven decadal sub-periods. Due to unavailability of data at disaggregated level for small millets study is restricted to bajra, jowar and ragi.

3. RESULT AND DISCUSSIONS

In this study, the growth in area, production, and productivity of Nutri-cereals, jowar, bajra and ragi is estimated using the CAGR and Instability Index. In this analysis, the general growth performance of crops was examined pertaining to seven decadal sub-periods.

Beginning in 1971-72, the area under cultivation for Nutri-cereals has shown a negative growth rate. However, productivity and yield increased steadily during the era. Between 2001-02 and 2011-12, Nutri-cereals production and yield increased at a remarkable rate of 3.10 and 3.62 percent per year, respectively (Table 1). Since 1961-62, the area under cultivation for jowar has grown at a negative rate. Despite this, productivity for jowar increased due to the availability of new improved varieties from 1991-92 to 2011-2021. Between 2011-12 and 2020-21, the growth rates for area under cultivation and jowar production were (-) 4.35 and (-) 4.27 percent each year, respectively. The area under cultivation for bajra showed a positive CAGR across the first two sub-periods of the study. Except for the period from 1971-72 to 1981-82, bajra production increased significantly. Ragi exhibits a negative CAGR for area under cultivation beginning in 1971-72. The green revolution introduced fertilizer-responsive varieties/hybrids that were supported by irrigation systems. Rice and wheat have replaced coarse grains and pulses in the agricultural landscape. This shift in farming occurred from low-water-required traditional crops to water-intensive cropping. The green revolution has also been critiqued for leading to a monocropping technique in India (Nandhini and Pushparaj, 2018). However, a growth rate in output and yield is observed across the entire study period. According to the findings, one of the possible explanations for the slow growth rate in yield observed between 2011-12 and 2020-21 is a decrease in agricultural area.

From 1950-51 to 2020-21, the area under cultivation and production of jowar decreased at a quick rate of (-) 1.87 and (-) 0.64 percent per year. Nonetheless, the yield showed a growth rate of 1.25 percent every year. The area under cultivation for bajra, ragi, and Nutri-cereals demonstrated a negative CAGR during the study period. Nonetheless, from 1950-51 to 2020-21, their production and productivity increased by 2.28, 1.41, and 2.13, respectively (Table 1).

Food management and macroeconomic policy both place a premium on stability. Agriculture expansion has always been difficult in India due to increasing volatility. Increased volatility has a negative influence on agricultural output. It increases production risk, reduces farmer revenue, and inhibits them from investing and adopting new technology.

Table 1. Decadal Growth rate (CAGR) for Jowar, Bajra and Ragi during 1950-51 to 2020-21 (In Percent)

Period	Financial Year	Jowar (Sorghum) (Great millet)			Bajra (Pearl millet)			Ragi (Finger millet)			Nutri-Cereals		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
I	1950-1961	1.10*	4.45***	3.31**	1.52***	2.45	0.94	1.54***	3.75***	2.20*	1.24***	3.50***	2.23***
II	1961-1971	-0.12	0.42	0.52	1.71***	6.03*	4.25*	-0.23	-0.12	0.10	0.71***	2.44***	1.72**
III	1971-1981	-0.12	4.96***	5.10***	-1.20	-0.18	1.01	1.21**	3.70*	2.47	-0.65	1.96***	2.62***
IV	1981-1991	-1.55***	0.18	1.76	-0.92	1.35	2.29	-1.52***	-0.94	0.57	-1.49***	0.72	2.24
V	1991-2001	-3.11***	-3.14	-0.02	-0.99	1.58	2.57	-2.00*	-0.35	1.67*	-1.59***	0.36	1.98
VI	2001-2011	-3.20***	-0.22	3.05*	0.12	2.15	2.03	-2.71*	0.68	3.50	-0.51***	3.10**	3.62**
VII	2011-2021	-4.35**	-4.27*	0.07	-1.25	0.09	1.35	-2.61*	-2.40	0.04	-1.13**	2.07**	3.24***
Total	1950-51 –1920-21	-1.87***	-0.64***	1.25***	-0.62***	1.65***	2.28***	-1.26***	0.13	1.41***	-1.00***	1.12***	2.13***

Note: * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

Table 2. Instability Index for Nutri-Cereals, Jowar, Bajra and Ragi during 1950-51 to 2020-21 (In Percent)

Period	Financial Year	Jowar (Sorghum) (Great millet)			Bajra (Pearl millet)			Ragi (Finger millet)			Nutri-Cereals		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
I	1950-1961	3.61	10.18	8.22	6.57	15.53	10.99	1.97	7.99	7.80	3.93	8.52	5.34
II	1961-1971	2.16	9.10	7.65	2.59	18.41	17.29	6.64	13.40	13.26	1.67	7.39	6.89
III	1971-1981	2.50	9.12	8.27	6.61	22.53	18.21	3.15	12.95	10.12	2.51	6.77	5.39
IV	1981-1991	2.11	9.60	10.13	7.89	25.99	21.33	2.66	8.71	6.18	2.29	9.84	9.22
V	1991-2001	3.35	15.18	12.10	3.96	19.18	15.81	4.46	7.32	5.17	2.16	8.61	7.02
VI	2001-2011	2.28	4.93	6.78	7.56	22.30	16.57	7.50	17.75	12.61	3.35	10.12	8.38
VII	2011-2021	7.96	9.51	12.18	5.10	8.73	5.61	7.05	13.67	9.45	2.88	5.46	4.31

Table 3 shows the relative contribution of several components to the aggregate growth of crop output for Nutri-Cereals, Jowar, Bajra, and Ragi. Jowar output had a greater impact on Nutri-Cereals from 1950-51 to 1960-61. Nonetheless, the bajra and ragi area effect is more powerful than the yield and interaction effects. In the case of jowar, the area effect was negative throughout the second era (1961-62 to 1970-71).

The yield effect significantly increased the productivity of bajra, ragi, and nutritional cereals. During the third period, the yield impact was a stronger factor for boosting production of jowar, bajra, ragi, and Nutri-Cereals. With Negative Area effect values of (-)16.47, (-)248.60, and (-)22.47 for jowar, bajra, and Nutri-Cereals, respectively. The introduction of a high-yielding rice and wheat variety as part of India's green revolution program is one possible explanation for the drop in agricultural area. Between 1981-82 and 1990-91, the area effect outweighed the yield

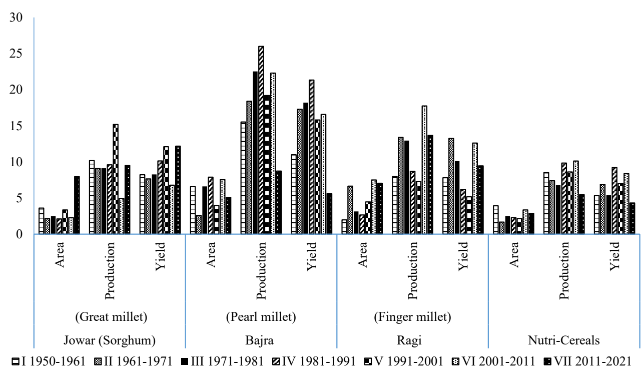

Fig. 1. Instability Index for Nutri-cereals, Jowar, Bajra and Ragi during 1950-51 to 2020-21

effect in terms of growing jowar and ragi production. Nonetheless, the yield effect is more important in raising output of Bajra and nutria-cereals. The interaction effects of bajra, ragi, and Nutri-cereals were unfavourable, with contributions of (-) 18.02, (-)3.96, and (-) 63.94, respectively.

In the fifth period (1991-92 to 2000-01), jowar output was influenced by the area effect. On the other hand, it appears that the yield effect is a driving force in the differential production of bajra, ragi, and nutria cereals. During the sixth period, it was observed that the yield effect for jowar and ragi was negative (-)309.89 and (-)239.53, respectively. On the contrary, the area effect increased production of jowar and ragi. From 2001-02 to 2010-11, the yield effect dominated area effect in the production of bajra and Nutri-cereals. The subsidized rice and wheat distribution through the Public Distribution System (PDS) boosted demand for rice and wheat and adversarial effect on area under cultivation of Nutri-cereals. This eventually shifted farmers' cultivation patterns in favour of rice and wheat. The proportion of Nutri-cereals in the diet has decreased dramatically in both urban and rural areas (Eliazer *et al.* 2019). However, the converse is true for jowar and ragi production. The area impact is promoting the increased production of jowar and ragi. It has been observed that there is currently an upsurge in demand for millets, and pandemics have shown to be blessings in disguise, with many people returning from cities to their hometowns. In rural areas, most people resorted to traditional farming, increasing the area under cultivation (Government of India, 2023).

Table 3. Contribution of area, productivity (yield) and their interaction for Nutri-Cereals, Jowar, Bajra and Ragi during 1950-51 to 2020-21

Period	Decomposition Effect	Jowar	Bajra	Ragi	Nutri-Cereals
I 1950-51 to 1960-61	Yield Effect	64.89	-3.03	43.01	53.96
	Area Effect	23.28	103.85	50.73	35.60
	Interaction Effect	11.84	-0.82	6.26	10.44
II 1961-62 to 1970-71	Yield Effect	613.59	72.31	126.91	88.93
	Area Effect	-484.00	14.83	-24.89	8.64
	Interaction Effect	-29.59	12.87	-2.02	2.43
III 1971-72 to 1980-81	Yield Effect	123.61	351.89	54.45	128.13
	Area Effect	-16.47	-248.60	43.31	-22.87
	Interaction Effect	-7.15	-3.29	2.24	-5.26
IV 1981-82 to 1990-91	Yield Effect	-379.46	163.31	23.47	442.80
	Area Effect	428.26	-45.29	80.48	-278.85
	Interaction Effect	51.20	-18.02	-3.96	-63.94
V 1991-92 to 2000-01	Yield Effect	-234.95	106.58	482.61	163.76
	Area Effect	287.43	-4.46	-298.78	-48.28
	Interaction Effect	47.52	-2.13	-83.83	-15.48
VI 2001-02 to 2010-11	Yield Effect	-309.89	95.87	-239.53	118.03
	Area Effect	333.37	3.33	287.27	-13.32
	Interaction Effect	76.52	0.80	52.26	-4.72
VII 2011-12 to 2020-21	Yield Effect	-88.83	399.29	-98.69	160.82
	Area Effect	160.26	-244.26	182.80	-45.06
	Interaction Effect	28.57	-55.03	15.89	-15.77

4. POLICY IMPLICATIONS AND CONCLUSIONS

The study examined the growth in area, production, and productivity of Nutri-cereals (including Jowar, Bajra, and Ragi) over seven decades (1950-51 to 2020-21) using the CAGR and Instability Index. The findings reveal a significant shift in India's agricultural landscape, particularly regarding the declining area under cultivation for Nutri-cereals, while productivity and yield showed a positive trend. The key insights from the analysis indicate that, starting from 1971-72, the area under cultivation for Nutri-cereals has consistently declined. Despite this, productivity surged, with production and yield growing at moderate rates during certain periods, especially between 2001-02 and 2011-12. Jowar experienced a sharp decline in cultivated area and production, while yield improved marginally due to new improved varieties. Bajra and Ragi followed a similar trend, with significant gains in productivity despite reduced cultivated area.

The decline in area can be attributed to the green revolution, which shifted focus to water-intensive crops like rice and wheat, replacing traditional coarse grains and pulses. Additionally, subsidized supply of rice and wheat through PDS have contributed to change in farming patterns in India. This transformation, while increasing overall food production, led to monocropping and the marginalization of less resource-demanding crops like Jowar, Bajra, and Ragi. The study highlights decreased agricultural land has led to slower growth in crop yield in recent years (2011-12 to 2020-21), despite technological advancements. The instability in agricultural output due to this decline has also contributed to increased production risk, reduced farmer income, and a reluctance to adopt new technologies. However, productivity gains have been achieved, the shrinking cultivation area poses challenges for the future of Nutri-cereals. Increase in the consumption of rice and wheat resulted an over consumption of carbohydrates rather than pulses, legumes, vegetables, nuts, and milk, all of which could provide nutrition. The shift towards rice and wheat as staple foods has often resulted in reduced consumption of nutrient-rich traditional grains, such as Nutri-cereals, which are crucial for a balanced diet. Excessive carbohydrate intake can lead to an imbalance between calories consumed and calories burned, contributing to weight gain and obesity, cardiovascular issues, type 2 diabetes, nutrient deficiency and metabolic syndrome etc. At the same time, India faces the issue of food insecurity with millions of people struggling to access sufficient and nutritious food. Inadequate access to food, driven by poverty and socio-economic disparities and malnutrition due to inadequate dietary intake, poor quality of food, and limited access to essential nutrients.

To tackle problem of food insecurity, hunger, and malnutrition in India, Nutri-cereals is the solution. It is time to adopt nutrient-dense diets by modifying consumer preferences and increase demand for them. Since Nutri-cereals have nutritional benefits, policies should be encouraging millet consumption through awareness campaigns, dietary programs. Additionally, incorporating Nutri-cereals in PDS, Mid-Day meal programs, other government schemes, and food fortification initiatives to combat malnutrition. There are some challenges to incorporating Nutri-cereals into the PDS system due non availability of procurement for them, low social status, a short shelf life, a weak value chain, limited access to high-quality seeds, low profitability, and insufficient availability of infrastructure such as processing units, among other things. The large distance between fields and processing units, limited local production and increased the cost of processing Nutri-cereals.

To deal with this government can incentivize farmers by providing subsidies on seeds, fertilizers, and other inputs specifically for Bajra, Jowar and Ragi cultivating farmers. This will reduce the cost of production and encourage them to cultivate these crops. Other direct financial incentives such as cash rewards, interest-free or subsidised loans to farmers who allocate their land to produce Nutri-cereals especially to Bajra, Jowar and Ragi cultivation. To address the issue of decreasing in the area under cultivation, farmers should be encouraged to adopt intercropping systems where Bajra, Jowar and Ragi are grown with other high-value or complementary crops, ensuring risk mitigation and increasing land use efficiency. Moreover, educating farmers on soil health benefits, programs at a community level would be helpful and this will also be reducing dependency on cash crop. Training session to inform farmers about the economic and ecological benefits of cultivating Nutri-cereals, including the potential for high yields with modern agronomic practices.

Government can boost investment in research to develop high-yielding, drought-resistant, and diseaseresistant varieties of Jowar and Ragi, making them more attractive to farmers. Through seed distribution programs where improved seeds of Bajra, Jowar and Ragi varieties are made available to farmers at affordable rates. Promote water-efficient farming techniques such as rainwater harvesting, drip irrigation, and water conservation methods specifically for millets which are drought-tolerant crops. Due to drought resilient feature of millets Indian government is promoting them as climate-smart crops. Policies should be focusing on their suitability in extreme conditions and supporting farmers in semi-arid regions where these crops can thrive with minimal water to combat climate change and ensuring long-term food security for future grains. At the same time, private entrepreneurs are unaware of existing government policies and programs that allow them to obtain credit and other assistance in procuring and processing millets using technology into ready-to-eat/ready-to-cook (RTE/RTC) value-added millet products, limiting the marketing of Nutri-cereals. Providing financial support and incentives to small and medium enterprises (SMEs) involved in processing of millets into value-added products, helping to create a market pull for farmers. Incentivise starts up by setting up incubation centres for entrepreneurship providing funding for start-ups focusing on millet-based value-added products such as ready to cook products. Simultaneously, facilitate domestic and international market linkages for millets by promoting value-added products like millet-based snacks, flour, and health foods by supporting processing units and certifying them as organic or health-conscious food products, enhancing their global appeal. Government should undertake proactive steps in effective planning and rigorous joint research and development for Nutri-cereal conservation and manufacturing. Sustainable growth strategies focusing on land management, technological adoption, and market incentives will be crucial for reversing these trends and ensuring long-term stability in millet production.

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