



POLICY BRIEF

Conservation of Crop Diversity and Utilization in Tribal Areas



1. Background

India is home to about 18 percent of the world's population, 15 percent of the world's livestock, 4.2 percent of freshwater resources, 1 percent of the forests and 0.5 percent of pasture land. It is gifted with rich natural biodiversity of indigenous crops. During the 20th century, India had more than 100,000 varieties of rice, now, only 6,000 varieties survive. With this, it is visible how we are losing our indigenous varieties of crops. In Rajasthan, the indigenous crop diversity had a rich menu of more than 200 crop-types. However, some of those forgotten crops are still cultivated by some farmers, in limited areas like in the tribal areas of Banswara, Dungarpur and Pratapgarh districts of Southern Rajasthan, for their household consumption mainly due to their passion. In the situation if major crops face threat due to climate-change induced weather extremities in terms of reduced production, it becomes necessary for diversification of crops which can help small land holding farmers to sustain their livelihood.

Significance of traditional crops and varieties

Traditional crops and its landraces of maize, paddy, black gram, gram, cotton, small millets and other fruit and vegetable crops are being cultivated over the past several years by local farmers who have their own land races and seeds. These seeds are highly adapted to the local climatic and geographical conditions and do well under sustainable agriculture by the small and marginal farmers. The land races are known to have a limited potential of yields but do well under sustainable farming conditions. Due to agriculture improvements, several high yielding varieties were developed and recommended over the years but they have limitations for its suitability in various climatic conditions. The landraces, because of their broad genetic base, nutritional value and adaptability, need support for its conservation, utilization and value

addition. Furthermore, the tribal farmers (mainly confined to the tribal belt of Rajasthan), due to their beliefs and belonging are more attached with their own seeds. Henceforth, it requires some needful support in the specific area for small and marginal farmers. According to the tribal communities in Southern Rajasthan, there has been a considerable change in the food habits, over the past several years. The diet pattern has gradually moved away from traditional cereals and locally available vegetables to modern-day staples like wheat.

Following are some of the traditional crops and its local varieties that have nutritional value to the local natives. These landraces or genotypes are now at the verge of extinction over a period of time due to changing agricultural scenarios.

A. Crops:

1. Maize landraces – Gangdi Makka, Dudh Mogar, Peeli Makka, Sathi Makka, etc
2. Paddy landraces –Kali Kamod, Pathariya, Jeera, Mota Dhan, Mota Dhan Safed, Malkamod, Basmati, Panidham, etc
3. Black Gram landraces –Desi Urad
4. Cotton landraces –Kapi (herbaceium spp.)
5. Gram landraces – Desi Chana, Bhura chana and Kala chana
6. Wheat landraces –Wajia
7. Arhar landraces – Safed Tuar, Peeli tuar and Lal Tuar

B. Vegetable crops –

1. Brinjal landraces –Desi Baingan (Kantewale)
2. Tomato landraces –Desi Cherry Tamatar (juicy)
3. Sponge gourd landraces –Desi Gilki
4. Ridged gourd landraces – Jhumka Turai
5. Gourd landraces –Desi lauki
6. Beans landraces – Kali, Safed valor papdi, Toli papdi, Jhalar ghasini papdi
7. Cucumber landraces –Kachri, Dangra
8. Leafy vegetables landraces – Methi, Rajan, Luniya, Dhimdi, Sheol

C. Fruits –

1. Lemon landraces –Godada Nimbu
2. Mango landrace –Juicy Kerry

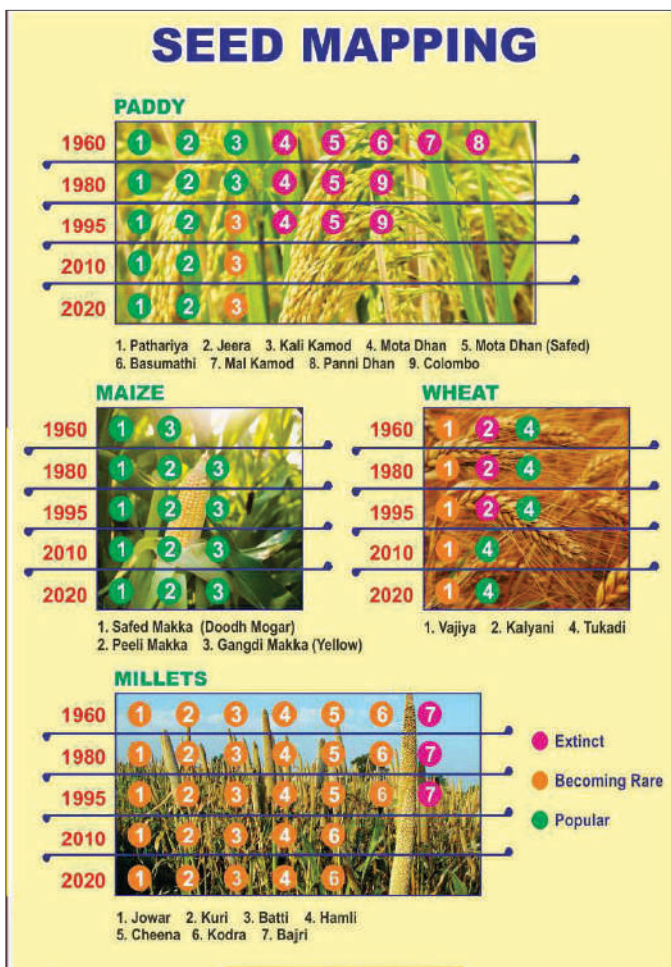


Photo: Mapping of Indigenous varieties of crops which have extinct or on the verge of extinction

2. Small millets and its utility in sustainable agriculture

Small millets are a group of small grained cereal food crops which are highly nutritious and are grown under marginal / low fertile soil with very low inputs such as fertilizer and pesticides. They are also known as nutri-cereals and provide most of the nutrients required for normal functioning of the human body. These minor millets generally have a shorter growing duration (2-4 months) and thus do well under rain fed conditions. It also fits under a wide range of cropping systems and is adopted well under changing environments thus resume greater importance for sustainable agriculture and food for livelihood security. It is a traditional crop of various districts of Rajasthan and is majorly covered by tribal communities and cultivated under sustainable farming conditions.

2.1. Nutritional aspects availability of small millets

Millets are a natural source of iron, zinc, calcium and other nutrients that are essential for curbing the problem of malnutrition in India. They have higher content of niacin, B6 and folic acid, and calcium, iron, potassium, magnesium and zinc. Small millets are more nutritious compared to fine cereals. They contain higher protein fat and fibre content. The dietary fiber, due to higher viscosity and water holding capacity, plays a key role in reduction of blood glucose level as well as insulin response. It also lowers the level of cholesterol and decreases the risk of bowel disorders. Millets contribute to antioxidant activity with phytates, polyphenols, tannins, anthocyanins, phytosterols and pinacosanols present in it having an important role in aging and metabolic diseases. Millet grain possesses high antioxidant activity in vitro relative to other cereals and fruits.

Finger millet is the richest source of calcium (300-350 mg/100 g) and other small millets are good sources of phosphorus and iron. Millets are easy to digest, contain a high amount of lecithin and are excellent for strengthening the nervous system. For fulfilling the nutritious requirement of small and marginal farming communities with poor social economic conditions, the enormous use of this forgotten crop, thus is a powerful way to contribute to nutritional security.

Millets are grown in the area and conditions where other cereal crops do not stand well (Paterson et al., 2009). The productivity of millets is affected due to change in climatic conditions. There are many factors which affect the area under cultivation millets and decline in consumption due to lesser remunerative price, limited productivity, high labour involved in

their processing, negative perceptions as a food of the poor and policy neglect when compared to other crops (Karthikeyan, 2016).

The millets have the potential to emerge as a potential alternative food, feed, and fodder crop as it is highly resilient towards high temperature and drought which makes it a climate-ready crop. The nutritional aspects of small millets in comparison to other cultivated crops like wheat and rice is very high. Finger millets have very high calcium (364 mg) when compared with wheat and rice while finger millet, porso millet and sorghum have high content of magnesium i.e., 146 mg, 153 mg and 133 mg respectively comparing to wheat flour (125 mg) and rice (19 mg). When iron content is compared, it is 4.6 mg in finger millet while 6.4 mg in pearl millet while it is 3.9 mg in wheat flour and 0.6 mg in rice.



Finger Millet – Ragi



Foxtail Millet - Kangni



Porso Millet - Cheena



Kodo Millet



Little Millet – Kutki



Barnyard Millet - Sama

2.2. Utilization as cattle fodder

Annually, millets account for 11% of the 30 million tonnes crop residues produced in India. The decision of the farmer to select the crop and variety are greatly influenced by the ability of the crop/variety to meet their fodder requirements from stover, although stovers are poor in nutrition compared to green fodder. Stovers contain less protein, total digestible nutrients and less palatable than green forages.

Finger millet, kodo millet and little millet may also be used as sole forage crops as they provide good quality forage. Finger millet straw is used in many parts of the country for feeding all categories of animals, such as working animals, milch animals and dry animals. This serves as an important source of dry fodder which is a must in the daily ration at least in small quantities. It is said that for all kinds of cattle, finger millet straw is superior to that of rice.

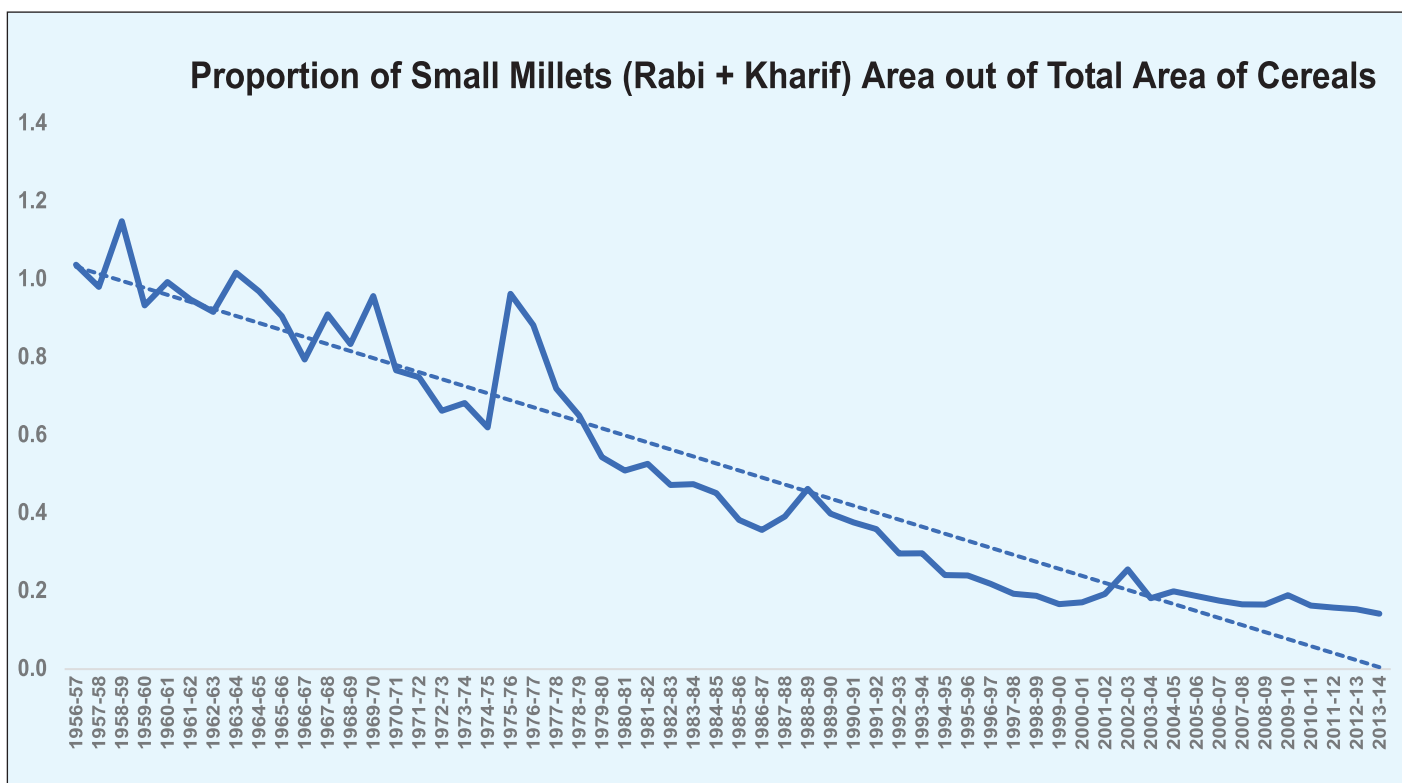
Barnyard millet has an important place in dairy due to the high palatability of its fodder. Its fodder can also be used for making hay or silage. Porso millet green plants and teffs are good fodders for cattle and horses, also used as hay. However, forage from porso millet, foxtail millet are of lower quality. Green fodder from most of these millets can also be made into silage and used during off-season feeding.

3. Preferability of Millets in Tribal Areas

1. Small millets are grown in a variety of agro ecological situations viz. plains, coast, hills as well as in diverse soils and varying rainfalls, widely differing in thermo and photo periods.
2. They are known for resilience and drought enduring capacities and are less prone to major pests and diseases.
3. These are indispensable in tribal and hill agriculture where the crop substitution is difficult.
4. It meets their nutritional requirements.

Utilization of small millets as a food product Millets are traditionally consumed as staple foods in the Indian diet in various forms like:

- Finger Millet (Ragi) is used for cooking Mudde in Karnataka and parts of Tamil Nadu, Andhra Pradesh while for cooking Roti in Uttarakhand.
- Barnyard and little millet found place for niche use, as a bhagar food, consumed during fasting. Also, the traditional foods such as idli, dosa and murukku cooked with these millets are very popular in parts of southern India.
- Kodo millet and little millet used in tribal area of MP and Chhattisgarh,
- Finger millet and Barnyard millet as paleu or chenchu, a savoury porridge cooked in buttermilk in Uttarakhand and Tamil Nadu etc.
- The de-husked grain of small millets is cooked like rice and eaten.
- Foxtail millet grain is usually cooked whole like rice (millet rice) or made into meal. It is also consumed as stiff porridge called sargati, or as leavened bread known as roti, after the de-hulled grain has been milled into flour.
- In parts of South India, the grain of small millets is processed very similar to the parboiling of rice. Often, roti and porridge are made and consumed. It is also made into flour, used for making puddings or cakes.
- In some regions minor millets remain cultivated only on a small scale but are culturally important for particular food stuffs, such as ritual breads made from brown top millet in restricted districts of South India.



The trend of proportion of small millets out of total cereal production in Rajasthan shows a gradual decrease in 57 years from 1956 to 2013. From the above-mentioned graph it can be depicted that the area of small millet production out of total cereal production has decreased gradually. The area of small millet crops of various districts of Rajasthan can be referred from table 2 indicating the scenario and various trends as mentioned below:

The area of small millets in Rajasthan has shown drastic reduction of about 58% from 2007-08 to 2019-20. The available data indicates the following:

1. The decreasing trends in area of small millets from approx. 15580 to 6562 in the last 13 years have been observed in the state of Rajasthan, indicating its extinction.
2. The same trend can also be seen for individual districts whereas in some districts (Rajsamand, Pali and Pratapgarh) has even reached to nil area for cultivation.
- 3 Area of Udaipur has a continuous decreasing trend i.e., from 1031 to 164 ha
4. Area of Jalore is having constant trend through the

period indicating its suitability.

5. Banswara and Dungarpur cumulative share of small millet area compared to Rajasthan is increasing from 67% to 80% in the last 13 years, indicating its acceptability in the tribal community.

Further considering the area productivity of small millets in two tribal districts of southern Rajasthan i.e., Banswara and Dungarpur (in comparison to Rajasthan), various following trends have been observed (refer Table 3)

1. No definite trend is observed in the production and productivity in both the districts indicating its higher dependency on climatic factors including rainfall pattern.
2. Rajasthan as well as these tribal districts are having a sizable quantum and capability to produce small millets indicating possibilities for its value addition.

Table3: Area, Production and productivity of Small Millet crops of Banswara and Dungarpur in comparison to Rajasthan

Year	Area(ha)			Production(mt)			Productivity(kg/ha)		
	Banswara	Dungarpur	Rajasthan	Banswara	Dungarpur	Rajasthan	Banswara	Dungarpur	Rajasthan
2007-08	4677	5664	15580	1390	4502	9630	282	795	618
2012-13	3780	5648	12962	564	3588	7125	149	635	550
2019-20	2341	2817	6562	209	173	955	89	61	146

Source: Rajasthan Agriculture Statistics at a Glance, Directorate of Agriculture, Rajasthan.

4.1. Reasons for Declining Area of Millets

The major reasons for declining the millets crops are as follows:

1. Low priority due to its coarse nature and environmental dependency.
2. Low remunerative as compared to other competitive crops (Maize, Cotton, Soybean, etc).
3. Lack of input subsidy and price incentives.
4. Subsidized supply of cereals through Public Distribution System (PDS).
5. Change in consumer preferences and acceptability.

Considering the extent of acreage of small millet crops, it is apparent that it is ignored by the policy makers. However, these crops are of local importance and are suitable for small and marginal areas under sustainable agro-environments. Following are the key features of small millets crops:

They are highly resilient in adopting to different ecological conditions and are ideal for climatic change and contingency planting. Being C4 plants, these are more environmentally friendly with high water use efficiency and low input requirements, but are equally responsive to high input management. Due to their short duration, low water requirement and high drought tolerance, small millet fits in contingency planning to mitigate drought.

Their resistance against pest attacks is a characteristic that comes in very handy when planning a mixed crop

cultivation using non-pesticide management techniques. A few rows of millets separating rows of more susceptible leguminous crops is a common practice that can be adopted. There is a need for innovative processing technologies for value addition of millet grains so that it can be consumed by large populations in rural and urban areas.

Policy Recommendations

- **Conservation and value addition of traditional crops**

Traditional food items and uncultivated crops which are viable should be brought in the seed system. The farmer's varieties should be notified and conserved so as to bring them in the crop plan. Package of Practices needs to be developed for strengthening of traditional crops.

- **Crop diversification**

In order to improve food security, soil health and livelihood of small and marginal farmers, government agriculture policy should focus and promote 'crop diversification' instead of monocropping. A policy of 'Crop Diversification' needs to be developed wherein the forgotten seeds and crops be brought in the government programme.

- **Promotion of traditional crop varieties in Government Safety Net Programs**

Traditional crops including small millets need to be promoted through its increased cultivation and value addition for supplying it in government

safety net programmes like Integrated Child Development Services, Mid-Day Meal and Public Distribution System. Various states like Odisha, Chhattisgarh and Telangana have demonstrated successful models of incorporating these traditional crops into government nutrition programmes, which are improving the nutritional status of children.

- **Improving Crop Diversity through supplying mini kits**

Distribution of mini kits is a popular methodology to demonstrate the productivity of improved varieties among farmers. In tribal areas, mixed cropping keeping the maize and paddy as a main crop is a popular technology being followed by the small and marginal farmers within the rainfed ecosystem. For inter-cropping farmers generally use the seeds of their traditional crops which helps to suffice their nutritional requirements such as carbohydrates, proteins, vitamins and

minerals. It is therefore recommended to supply seeds of traditional crops along with mini-kits to the resourceful farmers.

- **Methodology for multiplication of traditional crop ariety seeds**

The multiplication of locally available traditional crop seed can be done at the banner of Rajasthan State Seed Corporation Ltd. A mechanism to multiply the truthful level seed of these nutritional rich traditional crop varieties needs to be developed for tribal areas by the Government of Rajasthan. The responsibility to multiply these seeds can be given to FPOs working in the tribal area. Those FPOs, after getting needful seed production training from the state agriculture universities and agriculture department may produce truthful level (TL) category of seeds. The seed will be multiplied in supervision of the RSSCL who are going to procure the seeds and will be made available to farmers along with the mini kits.





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