

Promising millet production and processing technologies in rainfed areas

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Many millet production technologies are available with research organizations which need to be evaluated in farmers' fields for their wider adaptability. For this, an initiative was taken by the ICAR-IIMR, Hyderabad under farmer FIRST project wherein improved practices gave substantially higher yields and net returns compared to existing farmer's practices especially from de-hulled finger millet and little millet grains which fetched up to 2–5 times more profit. Backyard farming with improved breed of poultry birds and goat gave additional income. Diversification of millet-based farming should be encouraged to reach targeted productivity and profitability with support from government policies. Latest knowledge, timely input support and promotion of value-addition of millets through group approach were found to be the key elements in millets value-chain development.

Keywords: Crop module, Enterprise module, Farmers' income, Livestock module, Millets

MILLETS cultivation in India covers an area of 17 million ha with an annual production of 18.66 million tonnes (Mt). They are grown in different seasons, offering food for human consumption, fodder, feed for livestock and industrial raw material. They are climate smart, versatile and highly adaptable to harsh weather conditions. Millets are one of the cheapest sources of energy which possess higher content of digestive fibres, proteins, vitamins and minerals, popularly referred as “nutri-cereals”. They play a major role in the agricultural gross domestic product (GDP) of major growing states of Maharashtra, Karnataka, Telangana, Rajasthan, Tamil Nadu, Gujarat, Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Odisha, Uttarakhand and Haryana. Millets are pre-dominantly grown by small and medium farmers which account for 90% of the sorghum and pearl millet area in the country. With the threat of climate change looming large, millet crops productivity, area under cultivation and consumption are declining due to low remunerative price, low productivity, high drudgery involved in their processing, fine cereals negative perceptions as a poor's food and policy neglect when compared to other crops. Furthermore, sorghum productivity is low as compared to other cereals due to lack of marketing facilities, buy back assurance, reliance on monsoon rains, lack of use of soil type-based high yielding varieties (HYVs),

non-adoption of soil moisture conservation practices and improved production technologies, and rapidly changing food habits of people.

Although, lots of millets production technologies have been developed by the research organizations, there exists a wide gap between the potential yield of the improved technologies and yield obtained by the farmers in their fields due to several reasons such as lack of knowledge and skill, and input support at grass-root level, etc. Therefore, promotion of millets has a large scope to mitigate the productivity risk in agriculture unlike other food crops in drought-prone and rainfed regions. Suitable intercropping of pulse crops with these millets and allied farming is a viable option towards nutritional and economical security in sustainable way.

There are four key pathways to achieve the goal of enhancing farmer's income which are, (i) by increasing productivity; (ii) by reducing cost of cultivation; (iii) by increasing market opportunities and; (iv) by developing sustainable value chain. For this, millet technologies along with allied enterprises were demonstrated and evaluated in the farmer's fields by ICAR-Indian Institute of Millets Research (IIMR), Hyderabad which has taken an initiative through millets-based modules, viz. (i) crop module, (ii) livestock module, and (iii) entrepreneurship module. Total 6 villages in Nyalkal and Raikode mandals of Sangareddy district of Telangana state were

selected to test above modules along with existing farmer's practices for comparison and provided primary processing and secondary processing facilities at village through participatory approach during three years (2017–18, 2018–19 and 2019–20). Under crop module, high yielding varieties of redgram, *rabi* (winter season) sorghum, *kharif* (rainy season) sorghum, foxtail millet, little millet and brown-top millet and intercropping of pigeon pea with foxtail millet were undertaken in farmers' fields. In the livestock module, poultry birds of improved variety were introduced. Moreover, post-harvest processing facilities on millets were also introduced by establishing primary and secondary processing units including roti making machines at a village under entrepreneurship module to enhance millets consumption and farmer's income.

Crop module

Keeping millets cultivation related problems of the project area in view, a total of 7 crop production technology related and 1 horticulture related interventions were evaluated. The crop-based

interventions gave better net returns than the farmers' practices; redgram variety ICPL 87119 (29.9%), *rabi* sorghum varieties; Phule Suchitra (176.9%), little millet; DHLM 36-3 (23.3%), brown-top millet (24.7%), *kharif* sorghum variety; CSV 27 (26.3%), foxtail millet; SiA 3088 (24.7%), intercropping of pigeonpea with foxtail millet in *kharif* season gave net profit of ₹47,248/ha. Improved millet crop interventions gave substantially higher yield and resulted into higher net returns ranging between 23–176% (Table 1 and 2).

Livestock module

Intervention of improved backyard poultry technology: In view to enhance farmer's income through millets farming system, improved poultry technology was introduced in the project area. It has link with millet production system as millet by-products (broken grains) were major feed support to this enterprise. Vanaraja poultry breed developed by ICAR–PDP, Hyderabad was introduced in these villages to 80 families, and 10 birds were supplied to each family. In an average

Table 1. Performance of different cultivars of millets under farmer's practice and improved practice

Crop cultivar	Cultivation practice	Yield (q/ha)	Cost of cultivation (₹/ha)	Gross income (₹/ha)	Net income (₹/ha)	Difference between IP and FP income (₹)
Red gram (ICPH 87119)	IP	14.1	26,000	80,370	54,370	12,500
	FP	13.7	28,000	69,870	41,870	
<i>Rabi</i> sorghum*	IP	22.35	24,258	94,525	70,268	44,887
	FP	9.75	20,527	45,908	25,381	
<i>Kharif</i> sorghum	IP	29.4	10,700	1,15,248	1,04,548	21,748
	FP	26.20	10,210	93,010	82,800	
Little millet	IP (with de-hulling)	9.03	18,010	52,374	34,364	4750 (without de-hulling)
	IP (without de-hulling)	13.9	8,980	34,750	25,770	
	FP	12.5	9,100	30,000	20,900	
Brown-top millet	IP (with de-hulling)	11.95	26,400	3,34,600	3,08,200	40,590 (without de-hulling)
	IP (without de-hulling)	23.9	7,800	2,12,710	2,04,910	
	FP	22.7	8,200	1,72,520	1,64,320	
Foxtail	IP (with de-hulling)	15.33	21,930	93,513	71,583	9,660 (without de-hulling)
	IP (without de-hulling)	21.9	6,600	52,560	45,960	
	FP	18.00	6,900	43,200	36,300	

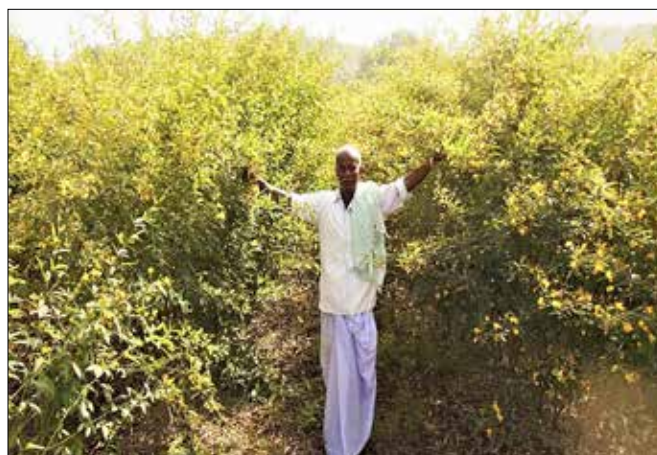
*Phule Suchitra and Phule Anuradha as *rabi* varieties; IP- Improved practice; FP- Farmer's practice.

Table 2. Performance of intercrop of redgram with foxtail millet indicator

	foxtail millet	Redgram
Yield (q/ha)	9.5	10.2
Cost of cultivation (₹/ha)	3,900	29,792
Gross income (₹/ha)	22,800	58,140
Net return (₹/ha)	18,900	28,348
Net profit from the intercropping in <i>kharif</i> season: ₹47,248/ha.		



Pearl millet (HHB 67) crop at harvesting stage



Redgram (ICPH 2740) at harvesting stage in project village

120–150 eggs were produced by each bird annually and farmers sold these eggs at ₹10/egg which helped them to earn additional income of ₹13,000/year (Table 3). Most of the beneficiaries enhanced their income, as well as achieved partial nutritional security of their family by using sorghum feed and by-product wastage.

Table 3. Income obtained from improved Vanaraja poultry breed

Indicator	Intervention output
Average no. of eggs/year/bird	130
% of birds mortality	20
No. of eggs produced from 10 birds/year (in ₹)	130*10 = 1300
Market rate (₹/egg)	10
Additional income/year/family (₹)	13,000

Entrepreneurship module

Intervention of primary processing facilities for millets: To address the problem of low remuneration and drudgery reduction, millets processing facilities were established at village namely Gangapur in Raikode mandal where, machineries like de-huller, grader, pulvarizer, shifters were placed. Due to this intervention, farmers obtained additional returns up to



Primary processing facilities at Gangapur village, Sangareddy district, Telengana

11 times more than un de-hulled grains of finger millet and little millet sold in the market (Table 1). Therefore, a primary processing centre of millets was run on the basis of custom hiring for millet farmers of accessible distance of surrounding villages. Skill development programs as well as exposure visits were organized for women and for other local entrepreneurs in view to promote value-added products through entrepreneurship development.

Benefits of improved millet technologies

Although, adoption of improved millet technologies was proven to be profitable under crop module in this study, millets and allied enterprise like, livestock and enterprise module could also assure the enhancement of farmers' income to a substantial level in rainfed areas. Millets-based farming like backyard poultry enabled to earn additional income utilizing by-products and farm-waste which could be an imperative move for optimum output. Marketing of de-hulled small millet grains fetched up to 2–5 times more profit to the farmer. Skill development programmes could raise entrepreneur confidence for business in secondary processing of millets especially, preparation of value-added food products. However, there were a few challenges which were realised in promotion of these interventions.

Challenges in millets cultivation

Even though diversified millet-based farming enhances farmer's income to substantial level, it needs to be supported at policy level, viz. support for buy back arrangements with fixed MSP, crop insurance, inclusion of millets in MDM and Public Distribution System (PDS), infrastructure for farm gate processing and warehouses to encourage farmers to sustain millet cultivation. Farmers with more market opportunities and standard facilities would let them reach the goal of enhancing their farm income. The factors for decline in consumption of nutri-cereals need to be addressed such as easy availability of millet grains like fine cereals, rice and wheat at a cheaper price to that of nutritious cereals under PDS. Nutritious cereals are socially less valued which accelerates the decline in their consumption on

rising of capita income therefore, awareness needs to be created.

SUMMARY

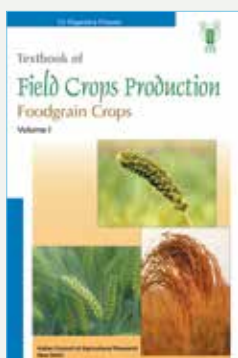
Overall, the demand for sorghum and millet in India is projected to increase from 8.1 Mt in 2010 to 10.1 Mt in 2050. Further, the demand for millets utilization is expected to increase from 9.9 Mt in 2010 to 11.06 Mt in 2050. The demand for feed and other industrial uses of sorghum and other millets are the main driving forces for increase because of vibrant livestock sector and industrial growth. Increase in demand for feed and nutrition prompts it critical to increase the productivity

of these crops from the current level of 1 tonne/ha. The increasing demand for animal-based products in India with increasing population and rising incomes is another driving force for increasing the productivity. However, the targeted productivity increase should come from the area that is continuously shrinking under these crops over last few years. So, it is important to make best use of the available genetic, natural resources and markets to enhance the productivity and profitability from millet cultivation in India.

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(Volume I)



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TECHNICAL SPECIFICATIONS

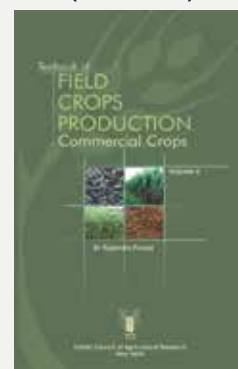
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