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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(9): 86-89

www.thepharmajournal.com
Received: 13-07-2021
Accepted: 15-08-2021

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Participatory varietal selection through front line demonstration and impact Assessment on value addition in foxtail millet in Ramanagara district Karnataka

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Abstract
There is a vast gap between productivity of millets in field demonstrations vs. farmers' field pointing to the need for robust extension activities and transfer of improved farming practices, as well as access to high yielding varieties to the farmers. In contrast, subsistence farmers growing millets in unfavourable environments use low levels of inputs and have not been benefited by high yielding variety (HYV) technology. In the present study, the usefulness of the participatory approach through front line demonstrations for identifying cultivars that is acceptable to resource poor farmers and in the local market and can be adopted for consumption is need of an hour. With this background, a study was conducted with two foxtail millet varieties, *viz.*, DHFT 109-3 and HMT 100-1 for testing on farmers fields. Demonstrations were conducted at 78 farmers field for five years (2013 to 2018) in Ramanagara district of South Karnataka. "DHFT109-3" variety met the criteria of farmer's requirement and opined that the new variety has more number of productive tillers per plant, better grain and fodder yield potential and lodging resistance and they would adopt them in future. The percent increase in grain yield over 5 years is 68 % over local. On creating awareness on value addition to farmers and farm women, the additional benefit obtained is Rs.21,459 and farmers expressed many consumable food items prepared in fox tail millet rice, during training is easy and highly acceptable.

Keywords: DHFT-109-3, foxtail millet, front line demonstration, HMT-100-1, participatory approach, value addition

Introduction
Millet cultivation is the mainstay of rain-fed farming on which 60% of Indian farmers depend. They provide food as well as fodder. These crops are grown in diverse soils, varying rainfall regimes and in areas widely differing in thermo- and photo-periods. Beside, millets are C4 crops and hence are climate change compliant. Millets have been called nutri-grains since they are rich in micronutrients like minerals and B-complex vitamins. Additionally millets are also rich in health promoting phytochemicals, and can be used as functional foods. That is why it is important to enhance production and productivity of these crops to ensure food and nutritional security. The promotion of these crops can lead to efficient natural resource management and holistic approach. Despite these attributes, millets are losing their pride of place in production and consumption in India.

In recent years, estimated demand for millets by 2025 is 30 million tonnes. This has to be met by creating awareness to the farmers on steps followed to increase the productivity through choice of better varieties, adopting good agronomic practices and effective extension initiatives. The advantages of cultivation of these crops include drought tolerance, crop sturdiness, short to medium duration, low labour requirement, minimal purchased inputs, resistance to pests and diseases. Millets mature in 60-70 days; yet providing reasonable and assured harvests even under most adverse conditions.

Small millets grown in India are finger millet, Kodo millet, Foxtail millet, Little millet, Proso millet, Barnyard millet and recently added to millet list is Korale (Brown top Millets), which account for about 2.7 million ha. These crops are grown in diverse soils, varying rainfall regimes. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and have made them quite indispensiable to rainfed, tribal and hill agriculture where crop substitution is difficult. That is why it is important to enhance production and productivity of these crops to ensure food and nutritional security.

Although, many varieties have been released for cultivation in these crops their adoption by farmers is minimal. In vast dry land areas where these crops are grown, situations are differing from the areas prevailing as the research station are encountered. As a result, improved varieties found superior well in research stations may not perform upto the expectation in farmer's field [3, 5, 6]. This situation has lead to farmers not showing preference to new varieties leading to negligible coverage by them in farmer's field. Hence, farmers continue to cultivate local varieties having lower genetic potential as a consequence the grain yield productivity is low.

Keeping these things in view, the study was conducted by providing high yielding cultivars acceptable to farmers through participatory varietal selection implemented through front line demonstrations (FLD) in the similar lines [4]. This gives closer farmer involvement from the initial stages of varietal evaluation and selection and help in identification of better varieties suitable for a given situation. This paper discusses the results of a case study on farmer participatory varietal selection through front line demonstrations (FLD) and value addition in foxtail millet.

Materials and Methods

The study was conducted at Ramangara district in three taluks where millets were grown and farmer were aware about its importance in daily diet. The details of the villages and the area covered under demonstration are given in Table 1.

PRA (Participatory Rural Appraisal) was part of the study to understand the needs and preference of farmers on varietal choice. This was done by individual farmer survey using proforma developed for this purpose. Survey was conducted in project villages during summer 2013 to 2017 in the villages where study would be conducted. Participatory Rural Appraisal showed that for all small millet growing farmers' grain and fodder yield were the main consideration.

Based on the farmers requirement from the basket of varieties available, recently developed two varieties of foxtail millet crop DHFT 109-3 and HMT 100-1 were selected for testing with farmers from those released for Karnataka

The number of demonstrations is equal to the number of farmers involved to take up the demonstration. In each demonstration, two varieties along with the local were grown in an area of one acre. The number of demonstration varied from 12 to 23 numbers in different years of participatory varietal selection implemented through front line demonstrations (FLD), to determine the comparative performance of two varieties.

With the adoption of new scientific farm technology of crop production at a large scale on farmers field, the concept of adoption of inputs like improved variety, line sowing through seed drill, seed treatment with biofertilizers and recommended dose of fertilizers. As a result of which the share of purchased inputs in the total cost of production has increased substantially. The farmers are, therefore, concerned about the cost-returns of crop enterprises that they are growing, this enable them to take decisions regarding selection of crops with low cost of cultivation and high net returns [1, 3]

In each demonstration, farmers were given seeds of improved variety (DHFT 109-3 and HMT 100-1) and asked to grow selected variety along with local in area of one acre. The improved technologies imparted to farmers in comparison to farmers practice in cultivation of fox tail millet are presented in Table 2. Regular visit by the scientists during the crop growth period were made to keep up the continuous interaction with the farmers. This enabled proper execution of demonstrations as well as gathering farmer's perception on improved varieties.

Results and Discussion

The performances of the varieties in each FLD demonstrations in each village were judged qualitatively as well as quantitatively by farmers who took demonstrations, so that the final judgment and ranking of varieties were solely made by the farmers themselves. The group visited all the demo plots. Scientists, extension officers and Agriculture department key officials also accompanied the group.

The farmers were asked to make qualitative observations visually on varieties, crop duration, panicle length, disease resistance, drought tolerance, and yield. After harvest, grain and fodder yield data were collected from all demonstrated plots for a more critical comparison.

In FLD, fox tail millet mean grain yield data for five years (2013 to 2018) indicated, that the cultivar DHFT 109-3 was superior compared to HMT 100-1 variety. Local variety performance was poor during all the five years of study (Table 2). Variety DHFT 109-3 recorded an overall mean yield of 20.6 q/ ha with the yield increase of 68.68% over local. The next performing variety was HMT 100-1 which ranked second with overall mean yield of 15.4 q/ ha, accounting to the tune of 25.8% increase in yield over local (Table 4).

Participatory rural appraisal showed that the main consideration of the farmers under FLD was grain and fodder yield. Based on yield, the variety "DHFT 109-3" was found significantly superior to HMT 100-1. DHFT 109 -1 variety was preferred by the farmers because of high tillering, more number of productive tillers, longer panicle length, non-lodging and drought tolerant, thin stems and healthy foliage even at harvest and superior than the tested HMT 100-1 variety. The variety "DHFT 109-3" in foxtail millet came very near to the farmers requirements and were keen to bring more areas with this variety in the ensuring season.

The improved varieties are prone for genetic deterioration as they have a very carefully built up genetic constellation/ gene combination for higher productivity, regional adaption and inbuilt genetic resistance for biotc and abiotic stresses. In a well managed crop improvement programme, maintenance of released variety becomes very important in order to prolong the consistency of performance. In this context training was given for production and supply of good quality seeds and also to adopt proper procedure for maintaining the genetic architecture of the variety for the farmers who have been involved in conducting Frontline Demonstrations. They were identified as resource persons for production and distribution of seeds in future.

Impact Assessment on value addition of fox tail millet

Unlike cereals, processing of millets was done traditionally by pounding, which is laborious, tedious and time consuming. With advent of technology, primary processing machineries of millets has come to market. The processing machinery directly removes the seed cover and rice obtained called as Millet Rice" can be readily used for consumption.

Farmers in order to get acquaint with the processing machineries visit to processing unit was organized to farmers and farm women. They were trained on preparation of varieties of millet processed food.

The cost of processing millet to rice is Rs.10/kg. Millet grain price (unprocessed) in the market is Rs.27/kg. On processing the cost of fox tail millet rice is Rs.60/kg. From the study it is noted that by processing to millet rice an additional income of Rs.21, 459/ha. is gained. (Table 5). The Millet rice can be used just like normal rice for preparing local dishes similar to rice like Payasam, Bisibelebath, Diabetes mix, Chakali, Kodubale, Hurihittu, Mixture, Millet nutri chikki. The farmers opined that fox tail millet as good alternative to Ragi, Products prepared were highly accepted and can be included in daily diet which can be easily prepared and consumed daily.

Table 1: Study area and number of demonstrations for participatory variety selection in fox tail millet

Year	Area (ha)	No. of Demos	Variety under trial	Study Area – Taluk & Villages
2013-14	6	15	HMT 100-1 – Promising variety at Station Trial and DHFT-109-3- New Variety under multi location trial	KanalapuraTaluk - Gangainadoddi and Hosadoddi villages
2014-15	6	15		Chanpatna Taluk –H.Mugenahalli
2015-16	6	23		Chanpatna Taluk –H Mugenahalli & Malluru Patna
2016-17	6	12		Chanpatna Taluk- Annigere
2017-18	6	13		Chanpatna Taluk - Thimmasandra, Araluru ; Magadi Taluk- Soluru
Total	30	78		

Table 2: Details of the technological interventions followed under farmers practice and demonstration on fox tail millet

No.	Technological interventions	Farmers practice (Ragi)	Demonstration (Recommended integrated crop management practices for fox tail millet)
1	Farming situation	Rainfed	Rainfed
2	Variety	Local fox tail millet (ancestors preserved variety)	Fox tail millet (DHFT 109-3, HMT 100-1)
3	Time of sowing	June -July	June -July
4	Seed treatment	Seed treatment practice not followed	Seed treatment with *Azatobacter* and *Phospho solubilising bacteria* @ 25g/kg seed
5	Method of sowing	seed drill or broadcasted.	Under FLD, line sowing through seed drill was demonstrated
6	Fertilizer application	Non authentic method of Basal application of fertilizers No addition of micronutrient mixtures.	Recommended INM practices, Soil application of FYM @ 12 t/ha and recommended dose of NPK based on soil test values.
8	Weed management	On 20-25 days after sowing one intercultivation with Cycle weeder	On 20-25 days after sowing one intercultivation with Cycle weeder. Farmers never practiced earlier.

Table 3: Mean performance of two FAMPAR (Farmers Managed Participatory Rural) foxtail millet varieties over five years in five different locations

Parameter	2013-14			2014-15			2015-16			2016-17			2017-18		
	Demo		Check			Check	Demo		Check	Demo		Check	Demo		Check
	DHFT 109-3	HMT 100-1	Local	DHFT 109-3	HMT 100-1	Local	DHFT 109-3	HMT 100-1	Local	DHFT 109-3	HMT 100-1	Local	DHFT 109-3	HMT 100-1	Local
Plant height (cm)	148	93.4	92.3	145	94.6	93.7	146	112	95.2	110.4	101.4	92.8	135.1	113.6	92.3
Productive tillers (No.)	10	4	4	8	5	3	9	4	4	8	4	4	7	4	4
No. of panicles /plant	10	3	3	8	3	2	9	4	3	8	4	3	7	4	3
Panicle length (cm)	21	12	10	18	12	10	19	12	10	18	8.5	11	13.2	12	10
Seed Yield (q/ha)	21	13.72	11.3	20	15.2	11.3	23	16	13.1	20	14.2	12.1	19.23	17.9	13.4
% increase over local	85.8	21.4	--	77.0	34.5	--	75.6	22.1	--	65.3	17.4	--	43.5	33.6	--
Straw Yield (t/ha)	4.11	3.9	3.1	4	3.6	3.1	4.3	3.7	3	1.2	3.7	3.1	4.2	3.9	3.3
Gross cost (Rs./ha)	10295	10295	9784	11234	11234	10121	11324	11324	10412	11874	11874	10125	12524	12562	10231
Gross return (Rs./ha)	56700	37044	30510	54000	41040	30510	62100	43200	35370	54000	38340	32670	51921	48330	36180
Net income (Rs./ha)	46405	26749	20726	42766	29806	20389	50776	31876	24958	42126	26466	22545	39397	35768	25949
B:C ratio	5.5	3.6	3.1	4.8	3.7	3.0	5.5	3.8	3.4	4.5	3.2	3.2	4.1	3.8	3.5

Table 4: Mean performance of fox tail millet varieties during study period

Varieties	% increase in grain yield over 5 years
DHFT 109-3	68.68
HMT 100-1	25.85
Local	68.68

Table 5: Economics of value addition in Fox tail millet

Parameters	Demo	Check
Seed Yield (Kg/ha)	924.5	791.6
Gross cost (Rs/ ha)	12562	12524
Gross return (Rs/ha) @ 27/kg	24962	21374
Processing (kg/ha) (78% recovery)	721	-
Processing cost (Rs/ha) @ 10/kg	9245	-
Gross cost with processing (Rs/ha)	21807	-
Gross return @ 60/kg	43266	21374
% increase	102.43	-
Additional income (Rs/ha)	21459	-
BCR	1.98	1.71

Conclusion

From the farmers participatory varietal selection, it is concluded that among the variety tested, DHFT 109-3 performed out rightly well as desired by the farmers need. The percent increase in yield was 68 % over the local variety, On educating and creating awareness to the value addition, farmers expressed, fox tail millet on processing and adding value as Millet rice fetches more profit (Rs.21,459/ha) and millet based consumable products can be prepared which are easily acceptable by the farming community.

Future Line of Work

Almost 50% area under millets has been diverted largely to other remunerative and market driven crops like maize, Babycorn Mulberry and vegetable cultivation in Ramangara district. In Karnataka, these grains are mainly used as food for human consumption. The straw is a precious fodder for bovines. The grain is processed and consumed in traditional way. To create more demand and to enhance the farmers socio economic condition, the following programme is a need of an hour

The Demand for millets can be increased by: (i) Creating awareness regarding their environmental sustainability, nutritional and other health benefits, (ii) Making them available through Public Distribution System (PDS) (iii) Value addition, and (iv) Inclusion under feeding programmes like mid-day meal, Integrated Child Development Services (ICDS) feeding, and adolescent girls nutrition scheme (now under consideration of Ministry of Women and Child Welfare)

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