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Dissemination of Improved Production Techniques of Minor Millets Through Front Line Demonstrations for Productivity Enhancement in Theni, Madurai and Dindigul Districts of Southern Tamil Nadu

D. Thirusendura Selvi[1], S. Juliet Hepziba[2], S. Kanjana[3]

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ABSTRACT

Background: Nowadays, minor millets becoming more popular than other cereals due to its inherent properties of adaptability to a range of marginal growing conditions, nutritious and withstanding severe biotic and abiotic stresses. However, underutilized and neglected in the cultivation part in several areas. It is also a known fact that the Theni, Madurai and Dindigul districts of southern Tamil Nadu has major population of scheduled caste (SC) and scheduled tribes (ST),"Paliyansare" living near the foothills of the Western Ghats, which is largely rural. These populations are really vulnerable communities which need better agricultural system for livelihood improvement and nutritional security. Attempts were made to popularize and adopt the high yielding variety and scientific methods of crop management practices in the farmers holdings of Theni district of Tamil Nadu through Front line demonstrations (FLDs) during 2016-19. The results exhibited that the average higher grain yield of 1559 kg/ha in barnyard millet and 1004 kg/ha in little millet were recorded in demonstration plots compared to 1250 kg/ha and 860 kg/ha respectively in farmers practice with a yield advantage of 24.7 and 16.7 per cent respectively. In summary, FLDs on village level were carried out by insisting worth of seed selection at farmers field and adoption of new variety under scientific methods of minor millet cultivation among the farming community for higher yield and income.

Methods: The study was conducted in Western Ghats location of Theni, Madurai and Dindigul districts during 2016-19. The large-scale Frontline demonstrations were conducted in farmer's field of selected villages of Aundipatti block of Theni district of Tamil Nadu during 2016-17 and 2017-18 in which need-based interventions were made on millet cultivation among the farmers who comes under SC/ST category of under privileged section.

Result: The results of the Frontline demonstration confirmed that TNAU Barnyard millet varieties CO (Kv) 2 and MDU 1 and little millet variety CO (Sa) 4 with improved cultivation practices were found better than the local check at farmer's field. Yield of the frontline demonstration trials and potential yield of the crop variety was compared to estimate the yield gap. Thus, the demonstration improved the skill of the farmer as well as the interest of adoption of new variety.

Key words: Income, Interventions, Minor millet, Productivity, SCST farming community.

INTRODUCTION

India is the largest producer of many coarse cereals, because of its nutrient richness of grains now many kinds of minor millets considered being nutria-cereals from the point of food security at regional and farm level (Michaelraj and Shanmugam, 2013). Minor millets are the major food sources for millions of people, especially staple food for the tribal people those who live in hot and dry areas of the world (Amadou *et al*., 2013). Though they occupy relatively a lower position among food crops in Indian agriculture, they are quite important from the point of food security at regional farm level. Nowadays, minor millets becoming more popular than other cereals due to its inherent properties of adaptability to a range of marginal growing conditions, nutritious, few input requirements and withstanding severe biotic and abiotic stresses. These are astonishingly low water consuming crops. Currently promoted minor millets require minimum water when compare to the commercial crops which may be satisfied

[1]Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.

[2]Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625 104, Tamil Nadu, India.

[3]Department of Human Development, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625 104, Tamil Nadu, India.

Corresponding Author: D. Thirusendura Selvi, Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore- 641 003, Tamil Nadu, India.
Email: thirusenduraselvi.d@tnau.ac.in

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by even 25 per cent rainfall received during the monsoon season. Barnyard millet and little millet are often grown without fertilization, being eco-friendly crops; they are suitable for fragile and vulnerable ecosystems (Michaelraj and Shanmugam, 2013). In spite of these advantages, they are underutilized and neglected in the cultivation part in several areas. But with improved agricultural techniques this situation is rapidly changing in many developing countries. At present, there is a demand for barnyard millet due to its limited activity and high consumption. The demand of barnyard millet and little millet has risen drastically but the productivity of barnyard millet relatively low.

Out of 5,74,394 population 1,43,589 are Scheduled Caste population in Theni district (National census 2011, Theni district). Mainly in the Andipatti panchayat union, out of 1,10,000 population, 30,103 are SC population. This district is having maximum SC population (more than 25 percent of total population (1,10,000). Hence, the target population livelihood can be improved by addressing the agricultural production system. Further, it is also a known fact that the Theni district has major population of Paliyan in Western Ghats through the Varusanadu hill ranges. This tribe is also a vulnerable community which needs better agricultural system for livelihood improvement and nutritional security.

Focus will be given on individual farm which comes under SC/ST category of under privileged section of community that too with small and marginal farm holdings; where the vulnerability is very high. Landless farmers will be main focus, providing them access to modern technology is one of the key purposes of the theme. This study was designed to help the SCST population especially Paliyan community to enhance the farm income and to help for the improvement in the livelihood of the people by way of organized cultivation of minor millets such as barnyard millet and little millet.

However, the level of adoption of improved practices of the crop was less which needs a better dissemination among the farming community (Kiresur *et al*., 2001). Front line demonstration (FLD) is one of the important extension activities conducted by agricultural scientists in a systematic manner on farmers' field to show the impact of newly released crop varieties and to demonstrate the production potential of improved technologies on farmer's field (Sangwan *et al*., 2021) and the impact of front-line demonstration was explained by Jeengar *et al*. (2006) in maize; Poonia and Pithia (2011) in Chickpea and Hiremath Nagaraju (2010) in chilli. Therefore, need-based interventions will be attempted on millet cultivating farmers to increase the adoption of improved production technologies of suitable variety (Ranawat *et al*., 2011). Hence, to maximize the crop yield at farm level, frontline demonstrations were laid out to popularize the high yielding variety and to demonstrate the production techniques of minor millets to enhance the productivity over the local varieties and farmers practices.

MATERIALS AND METHODS

The present study was conducted in Western Ghats location of Theni, Madurai and Dindigul districts during 2016-19. Situation specific and need-based interventions were made on millet cultivation among the farmers who comes under SC/ST category of under privileged section that too with small and marginal farm holdings; where the vulnerability is very high.

Awareness training cum demonstration

Awareness activities on the nutritional importance of minor millets and their importance in food and nutritional security were carried out in detailed under the project to reach out different SC/ST farmers. One day awareness training programmes on "Seed production and value addition techniques in minor millets" were conducted in seven locations of Theni, Madurai and Dindigul districts of Tamil Nadu during the year 2017 and 2019 with the 350 target beneficiaries (*i.e*., 50 participants per training) to facilitate and educate the rural poor farmers on health benefits, seed production and value addition techniques of barnyard millet and little millet (Table 2).

Front-line demonstration (FLD)

The large-scale frontline demonstrations were conducted in farmer's field of selected villages of Aundipatti block of Theni district of Tamil Nadu during 2016-17 and 2017-18 in the way of FLD on "Popularization of high yielding barnyard millet and little millet varieties" for the popularization of TNAU varieties in Barnyard millet and little millet. The critical inputs of seeds, nutrients and plant protection measures comprising fungicides and bio-fertilizers, Neem cake and vermicompost at a total cost of Rs. 5000/- per ha for small millets were supplied to all the beneficiary farmers (Table 1). The selected progressive farmers were trained on all scientific minor millet cultivation aspects before starting of frontline demonstrations. These kits were supplied free of cost to the beneficiary farmers subject to maximum area of 2 hectare. The TNAU varieties like CO (KV) 2 in Barnyard millet and CO (Sa) 4 little millet along with other high yielding varieties of TNAU and local varieties were tested. Totally, 17 beneficiaries under SC/ST categories were selected in Ethakovil and Kandamanur villages, Aundipatti block of Theni districtin which thelittle millet CO (Sa) 4, Barnyard millet cv CO (Kv) 2 were raised and front-line demonstrations were carried out in an area 20 acres. Data were collected on FLDs conducted at farmer fields compared with the yields of improved variety and local variety and yield gap was calculated. The yield increase in demonstrations over farmers' practice was calculated by using the following formula:

$$\text{Percentage yield increase over farmers' practice (\%)} = \frac{\text{Average demonstration plot yield} - \text{Farmer's average yield}}{\text{Farmer's average plot yield}} \times 100$$

The extension gap, technology gap and technology index were also calculated based on the formula as mentioned by Samui *et al*. (2000).

Extension gap (kg/ha) =

Demonstration yield (kg/ha)-Local check yield (kg/ha)

Technology gap (kg/ha) =

Potential yield of a variety (kg/ha)-Demonstration yield (kg/ha)

Technology index (%) =

$$\frac{\text{Potential yield of a variety (kg/ha)} - \text{Demonstration yield (kg/ha)}}{\text{Potential yield of a variety (kg/ha)}}$$

RESULTS AND DISCUSSION

The awareness cum training programmes created increase in consumption and cultivation of small millets among the tribal community. During the training, the farmers were highly interactive, discussed about their traditional agricultural practices and problems faced by them in hilly areas.

Front line demonstration (FLD)

The study results presented in Table 3 showed that TNAU Barnyard millet varieties CO (Kv) 2 and MDU 1 and little millet variety CO (Sa) 4 with improved cultivation practices had a greater number of tillers (9). Similarly, the farmers harvested an average higher grain yield of 1559 kg/ha in barnyard millet and 1004 kg/ha in little millet in demonstration plots compared to 1250 kg/ha and 860 kg/ha respectively in farmers practice with a yield advantage of 24.7 and 16.7 per cent respectively over the existing local varieties cultivated by the farmers. The results of the present study are in conformity with Dhaka *et al.* (2011); Rai *et al*. (2015) and Gireesh *et al*. (2019). From this finding, it is evident that the performance of improved variety along with improved practices were found better than the local check at farmer's field. Yield of the frontline demonstration trials and potential yield of the crop variety was compared to estimate the yield gap. Further, it was categorized into extension gap, technology gap and technology index.

Technology index of an improved variety was used to study the transfer of technology through front line demonstrations. It is evident from Table 4 that in *kharif* season, technology index was 35.9% in little millet variety CO(Sa)4 followed by barnyard millet variety CO(Kv) 2 (42.4%). Similarly, in *Rabi* season the technology index was highest (94.1%) in barnyard millet variety MDU 1 when compared with CO(Kv) 2 (41.5%). Technology index showed the feasibility of the technology on the farmer's field. The lower the value of the technology index more is the feasibility of the technology. This was in conformity with Kumar (2014). The impact of new methods of field demonstrations indicated yield potential of high yielding variety is higher than the local variety.

Comparison between barnyard millet and little millet high yielding variety v/s and local variety under rainfed condition

The yield potential of high yielding improved varieties of TNAU were compared with the local variety (Table 4). The improved variety is a short duration variety suitable for double cropping with higher grain and straw yield and found suitable for rainfed situation. The wider adoption of

Table 1: Scientific interventions on improved cultivation practices demonstrated.

Interventions	Recommended improved practices
High yielding variety	Barnyard millet - CO (Kv) 2, MDU 1Little millet - Co (Sa) 4
Seed treatment	Treat the seeds withAzospirillum @ 60 g/kg
Seed rate	10 kg/ha
Sowing method	Line sowing
Spacing	30×10 cm
Manures and fertilizers	12.5 ton FYM, 40:20:0 kg (N:P: K)/ha
Weeding	Hand weeding on 15 and 30 days after sowing
Roguing	Removal of off type plants at flowering and maturity stages

Table 2: Awareness trainings conducted in the target areas.

Year of conduct	Name of the training	Place	Number and category of Beneficiaries
2017	One day awareness training programme on "Minor millets	Vadakaraiparai- hilly area of Kodaikanal (Dindigul district)	50 paliyans (ST) participants
2017	importance, health benefits and	Paliyankudi (Theni district)	50 paliyans (ST) participants
2017	production techniques	Ezhumalai (Madurai district)	50 paliyans (ST) and SC participants
2019	One day awareness training programme on "Seed production	Endapulli, Periyakulam block, Theni district	50 SC/ST participants
2019	and value addition techniques	Sirumalai, Dindigul district	50 SC participants
2019	in minor millets"	Parasurampuram, Dindigul district	50 SC participants
2019		Magamalai, Theni district	50 ST participants

Table 3: Yield performance of Barnyard millet CO (Kudiraivali) 2 and little millet CO (Samai) 4 high yielding variety and local variety under rainfed condition.

Season and Year	Crop/ Variety	No of FLD conducted	Area (ha)	Potential yield (kg/ha)	Demonstration yield (kg/ha)	Farmer's practice (kg/ha)	% Yield increase	Extension gap	Technology gap	Technology index
Kharif 2017	Little millet CO (Sa) 4	5	2	1567	1004	860	16.7%	144	563	35.9%
Kharif 2017	Barnyard millet CO(Kv) 2	3	2	2650	1527	1250	22.0%	277	1123	42.4%
Rabi 2018	Barnyard millet MDU 1	4	3	1700	1600	1250	28%	350	100	94.1%
Rabi 2018	Barnyard millet CO(Kv) 2	5	1	2650	1550	1250	24.0%	300	1100	41.5%
	Average yield of Barnyard millet			2333	1559	1250	24.7%	309	774	33.2%

Table 4: Comparison between barnyard millet and little millet high yielding variety and local variety performance under rainfed condition.

Character	Barnyard millet		Little millet	
	CO (Kudiraivali) 2	Local variety	CO (Samai) 4	Local variety
Tillering	High	Medium	High tillering ability	Medium tillering
Panicle type	Compact, pyrimidal	Compact	Open and loose	compact
Duration (Days)	95	180	75-80	120
Grain characters	Brownish grey	Brownish yellow	Greyish yellow	Black, white
Special features	Good grain quality	Long duration	Short duration suitable for the existing double cropped rainfed situation Western zones of Tamil Nadu.	Long duration

Table 5: Economic evaluation of improved crop management practices of minor millet cultivation.

Crop/Variety	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit cost ratio
Little millet				
CO (Sa) 4	15250	30120	14870	2.02
Local (farmers variety)	10350	25800	15450	1.67
Barnyard millet				
CO(Kv)2	17700	46155	28455	1.62
MDU 1	17450	48000	30550	1.57
Local (farmers variety)	11500	37500	26000	1.44

improved variety CO (Kudiraivali) 2 has undoubtedly increased production and productivity of barnyard millet and many farmers from adjoining villages showed their interest to cultivate the variety (*i.e* 19 farmers). The farmers have also convinced with the variety spreading to their area. The results are in confirmity with the findings of the Dhaka *et al*. (2011); Hiremath and Nagaraju (2009) and Rai *et al*. (2015). Thus, the demonstration improved the skill of the farmer as well as the interest of adoption of new variety.

The results (Table 5) clearly indicated that the average cost of cultivation for little millet CO(Sa) 4 in demonstrated field under crop management practices was Rs.15250/ha against an average cost of Rs. 10350 /ha in farmer's practice. The demonstrated field varieties showed the higher mean gross return of Rs. 30120/ha and net return of Rs. 14,870/ha with the high benefit cost ratio of 2.02. The average cost of cultivation for Barnyard millet CO(Kv)2 and MDU 1 under crop management practices was Rs.17700/ha and Rs.17450/ha respectively against an average cost of Rs. 11500/ha in farmer's practice. The demonstrated field showed the higher mean gross return of Rs. 46155/ha and Rs. 48000/ha and net return of Rs. 28455 /ha and Rs. 30550/ ha with the high benefit cost ratio of 1.62 and 1.57 respectively. The study findings are in conformity with the results of Hiremath and Nagaraju (2009) and Sreelakkshmi *et al.* (2012). Thus, the demonstrations of high yielding minor millet variety with improved crop management practices enhances the productivity that motivate the other farmers to adopt the recommended cultivation practices.

CONCLUSION

The study highlights that demonstration of high yielding variety and production practices enhances the productivity of minor millets and profitability can be improved even under

rainfed conditions. It is concluded that dissemination of improved variety, production practices and advanced approaches in post-harvest techniques would help the tribal community for adoption of improved technology and to motivate the other farmers, so as to improve the livelihood of under privileged farming community.

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Conflict of interest

The authors declare no conflict of interest.

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