Journal of Applied and Natural Science
11(1): 130-133 (2019)
ISSN : 0974-9411 (Print), 2231-5209 (Online)
journals.ansfoundation.org

Productivity enhancement in Finger millet through Frontline demonstration in Dharmapuri district of Tamil Nadu, India: A case study

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Abstract
Frontline demonstration was taken up in farmers' holdings of Dharmapuri district, Tamil Nadu, India during *kharif* 2015 to create awareness among the farmers and demonstrate the improved production technologies in finger millet. The integrated crop management practices including cultivation of drought tolerant and short duration finger millet variety ML 365, integrated nutrient management, integrated pest and disease management practices were demonstrated and compared with the existing farmers practice followed in Finger millet cultivation. Results showed that demonstration of finger millet variety ML 365 with integrated crop management practices recorded higher grain yield of 2100 kg/ha and farmers practice recorded lower yield of 1730 kg/ha. Adoption of integrated crop management practices increased the grain yield of finger millet to the tune of 21.7 per cent compared to farmers practice. Farmers earned higher net income of Rs.14244/ha through the demonstration and Rs.10018/ha with farmers practice. Besides, farmers realized higher benefit cost ratio (1.58) through the demonstration compared to farmers practice (1.46). Thus, the frontline demonstration of improved variety with crop management practices increased the grain yield and net income of the farmers growing finger millet under rainfed condition. In the present study, potential of the improved variety and technologies were demonstrated systematically and scientifically in the farmers field along with farmers practice for further adoption by farming community in large scale.

Keywords : Benefit cost ratio, Demonstration, Finger millet, Grain yield, Net income

Article Info
DOI:10.31018/jans.v11i1.1946
Received: November 12, 2018
Revised: February 12, 2019
Accepted: February 15, 2019

How to Cite
Sangeetha, M. *et al.* (2019). Productivity enhancement in Finger millet through Frontline demonstration in Dharmapuri district of Tamil Nadu, India: A case study. *Journal of Applied and Natural Science*, 11(1): 130-133

INTRODUCTION

Finger millet (*Eleusine coracana* L. Gaertn) is one of the important millets grown extensively in Dharmapuri District. It is a hardy crop, has good adaption to wide range of environment especially heat, drought, marginal and degraded soils (Okalebo *et al*., 1991). It is mainly grown for its grains and it is highly nutritious. Its grains contain carbohydrate (65-75%), protein (5-8%), dietary fibre (15-20%), minerals (2.5-3.5%) and vitamins (Chethan and Malleshi, 2007). It is superior to rice and wheat, in respect of crude fibre, amino acids and minerals like calcium (344 mg/100g) and potassium (408 mg/100g). It also contains anti nutrients such as phytates, polyphenols, tannins and trypsin inhibitory factors. Regular consumption of whole grain of finger millet and its products helps in managing diabetes and its complications by regulation of glucose homeostasis and prevention of dyslipideamia. It also gives protection against the risk of cardiovascular disease, gastrointestinal cancers and other health issues. It has health beneficial effects, such as anti-diabetic, anti-diarrheal, antiulcer, anti-inflammatory, anti-tumerogenic, atherosclerogenic effects, antioxidant and antimicrobial properties (Devi *et al*., 2014). Hence, there is a great demand for improving finger millet production.

Finger millet is being cultivated in an area of about 28,500 hactares in Dharmapuri District. About 60 per cent of the area under Finger millet is being

cultivated under rainfed condition during *kharif* season. Under rainfed condition, farmers facing the problem of moisture stress at various crop growth stages thereby experiencing low yield and crop loss to some extent. Besides moisture stress, lack of knowledge on the availability of drought tolerant varieties, non adoption of improved cultivation practices, prevalence of nutrient deficiency, pest and disease incidence also lowers the finger millet productivity. Hence, the productivity of finger millet might be increased by growing suitable variety along with improved crop management practices. Similar studies on crop yield increase by adoption of improved crop management practices were reported by Subhashree *et al*. (2017) in Finger millet; Sharma *et al*. (2016) and Singh (2017) in Wheat; Jat and Gupta (2015) in Pearl millet; Meena *et al*., (2014) in Maize.

Considering the above facts, a frontline demonstration was proposed and conducted in the farmers' holdings to demonstrate the improved package of practices for higher productivity in finger millet under rainfed condition.

MATERIALS AND METHODS

Frontline demonstration was conducted to demonstrate the potential of the drought tolerant, short duration variety with the improved package of practices in comparison with the existing farmers practice in the farmers' holdings of Dharmapuri district during *kharif* 2015 under rainfed condition. Demonstration was conducted in 20 locations spread over in Pennagaram, Palacode, Karimangalam, Nallampalli, Morappur and Pappireddipatty blocks of Dharmapuri District. The soils of the demonstration fields were collected and analysed for its initial soil nutrients status. The results showed that the soils were slightly alkaline in soil reaction, non saline, low in nitrogen, medium in phosphorus and potassium nutrient content. Each demonstration was conducted in an area of 0.4 ha and with an adjacent area of 0.4 ha selected for farmers practice. In the demonstration, the improved practices including cultivation of finger millet variety ML 365, integrated nutrient management, integrated pest and disease management practices were demonstrated along with the farmers practice. Finger millet variety ML 365 was released from University of Agricultural Sciences, Bengaluru during 2008. It has 100-105 days duration, high yielding variety, tolerant to drought and blast disease. In farmers practice, finger millet variety GPU 28 was grown with the existing farmers practices such as broadcasting of seeds, basal application of complex fertilizers, etc. The details on the technological interventions followed in the demonstration and farmers practice were given in Table 1. Before initiating the demonstration, the beneficiary farmers were trained in all the improved practices in finger millet cultivation and followed in the demonstrations. Demonstration field were periodically observed by the scientists of Krishi vigyan kendra, Dharmapuri and advisory recommendations given in Crop Production Guide 2012, Tamil Nadu Agricultural University were followed.

At the time of harvest, the data on plant population (number), plant height (cm), number of tillers per plant (number), days taken for 50% flowering (number) and grain yield (kg/ha) of finger millet crop were recorded from both the demonstration and farmers practice. Based on the cost of inputs and market price of the produce, economic parameters such as net return (Rs/ha) and benefit cost ratio were worked out.

RESULTS AND DISCUSSION

Results of the study indicated that demonstration

Table 1. Technological interventions followed in finger millet cultivation under demonstration and farmers practice in Dharmapuri district during 2015.

S.N.	Technological interventions	Existing Farmers practice	Improved practices demonstrated through frontline demonstration
1	Farming situation	Rainfed	Rainfed
2	Variety	Cultivation of GPU 28	Cultivation of ML 365
3	Time of sowing	First week of August	First week of August
4	Method of sowing	Broadcasting of seeds and thinning operation was not followed	Broadcasting of seeds and spacing of 30 x 10 cm was followed by thinning and gap filling operation
5	Seed treatment practice	Not followed	Seed treatment with *Pseudomonas fluorescens* @ 10g/kg followed by biofertilizers *viz*., *Azospirillum* and *Phospho bacteria* each @ 25g/kg
6	Nutrient management	Basal application of 20:20:20 complex fertilizer @ 125 kg/ha	Basal application of FYM @ 12.5 t/ha; Recommended dose of NPK @ 40:20:20 kg/ha; Soil application of TNAU millet micronutrient mixture @ 7.5 kg/ha
7	Weed management	Not followed	One hand weeding on 25-30 Days after sowing
8	IPDM practices	No prophylactic or control measures for managing pests and diseases	Need based usage of plant protection chemicals and IDM practices for blast disease was followed

Table 2. Growth parameters of finger millet varieties GPU 28 and ML 365 as influenced by farming practices .

Treatments	Plant population at harvest (No./m^2)	Plant height (cm)	Number of tiller per plant	Days to 50% flowering
Farmers practice (GPU 28)	26.1	65.8	2.41	64
Demonstration of improved practices (ML 365)	35.3	76.4	4.56	70

Table 3. Yield and economics of finger millet varieties GPU 28 and ML 365 as influenced by farming practices.

Treatments	Grain yield (kg/ha)	Percent yield increase over farmers practice	Gross Cost (Rs./ha)	Net income (Rs/ha)	Benefit Cost Ratio
Farmers practice (GPU 28)	1730	-	21723	10018	1.46
Demonstration of improved practices (ML 365)	2100	21.7	24405	14244	1.58

of drought tolerant finger millet variety ML 365 with integrated crop management practices recorded the higher plant population (35.3/m^2), plant height (76.4 cm) and higher number of tillers per plant (4.56). Lower plant population (26.1/m^2), plant height (65.8 cm) and number of tillers per plant (2.41) were recorded in farmers practice during 2015 (Table 2). The demonstrated variety attained maturity one week earlier than the existing local variety.

Cultivation of drought tolerant finger millet variety ML 365 with integrated crop management practices recorded higher average grain yield of 2100 kg/ha (Table 3). Farmers practice recorded lower average grain yield of 1730 kg/ha. Adoption of improved practices increased the yield of finger millet to the tune of 21.7 per cent compared to the farmers practice under rainfed condition. The increased yield under demonstration might be due to the combined effect of high yielding, drought tolerant variety and adoption of improved crop management practices. The similar results of yield enhancement through front line demonstration of improved technologies has been reported by Kumar *et al*. (2010) in bajra; Solanki *et al*. (2014) in maize and Anand Naik *et al*., (2016) in sorghum. Besides, the incidence of blast disease was not reported in the demonstrated variety and it was 8 per cent in the farmers practice.

The data on economic indicators indicated that, the cost of production was higher in demonstration (Rs. 24,405/ha) and lower in farmers practice (Rs. 21,723/ha) (Table 3). Farmers earned the net income of about Rs.14,244/ha through the cultivation of ML 365 variety with integrated crop management practices and Rs.10,018/ha with farmers practice. On an average Rs. 4226/ha as additional income is attributed to the higher yield obtained in demonstration. Hence, farmers realized the higher benefit cost ratio (1.58) through the cultivation of ML 365 variety with integrated crop management practices compared to farmers practice (1.46). It might be due to the higher grain yield recorded in demonstration compared to farmers practice. Similar results of increase in net income and benefit cost ratio due to adoption of improved technologies in the demonstrations were reported by Jat and Gupta (2015) in pearl millet; Dhaka *et al*., (2010) in maize and Anand Naik *et al*., (2016) in sorghum.

Conclusion

Results of the demonstration revealed that cultivation of finger millet variety ML 365 with integrated crop management practices increased the yield and income of the farmers under rainfed condition. In addition, the introduced variety has satisfied the farmers preferences such as high tiller production, early maturity and tolerance to grain shattering or dusting. Hence, the farmers were convinced with the performance of the variety with regard to its yield potential and tolerance to biotic and abiotic stresses under rainfed condition.

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