International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(1): 842-844

Received: 04-11-2018
Accepted: 08-12-2018

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Yield gap analysis of finger millet through front line demonstration

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Abstract
A study was conducted in 8 villages of Ganjam district during kharif season of 2017 and 2018 under the jurisdiction of KVK, Ganjam-II. The purpose was to analyse the yield gap of finger millet through front line demonstration. Results of demonstration have shown that under demonstration plots of finger millet yield was found to be substantially more than that under local check during both years. The average yield performance of finger millet through demonstration was 20q/ha, average yield of local check was 12.7q/ha and average increase of demonstration yield over local check yield was 57.2 per cent. The average technology gap for two finger millet varieties demonstrated found to be 3.5q/h a, extension gap was 7.3q/ha and technology index was 14.9 per cent. Regarding economics of front line demonstration, the average cost of cultivation for demonstration and local check was Rs 23497.5 and Rs 18920.5 respectively. The farmers have incurred average higher net return Rs 16502.5/ha under the demonstration. The B:C ratio was also higher i.e 1.7 in case of demonstration as compared to local check which was 1.34.The front line demonstrations on finger millet helped farmers to get higher yield and income there by increased standard of living.

Keywords: yield gap, finger millet, front line demonstration, extension gap, technology gap

Introduction
Finger millet (*Eleusine coracana* L.) is the most widespread minor millet and an important staple food in many parts of India and Africa. Across southern India, finger millet, locally known as ragi, traditionally played a central role in agriculture and diets. Matures quickly and are better able to withstand climatic extremes conditions. It is Iron rich food, with low fat diet and other minerals, has therapeutic value for persons suffering from diabetic disorder, where in, large population in India are suffering from it. As to make prescriptive diet there is need to produce voluminous quality bulk to meet the huge demand. Small millets are the traditional crops and they are agronomic ally more adopted to impoverished soil and climatic conditions. They can be cultivated where no other food crops can be profitably grown. Among them, finger millet is the most important one. It is the richest source of P, Fe, Ca, S and minerals.

Agricultural research, development and policy continues to place a strong emphasis on increasing production of the three main staple crops (rice, wheat and maize) whilst public and private investment in other crops remains low. There is a need for increased diversification of crop production to better address the issues of climate change, land degradation and sustainable diets. The combined potential of millets as both resilient crops for resource-constrained farmers and as a nutritious foodstuff for growing populations is huge across Asia and Africa. Hence, millets are slowly being rediscovered by the agricultural research and development community. Minor millets are particularly neglected in terms of research and development. Their potential for climate smart agriculture and enhanced nutrition is also underexploited. Minor millets are adapted to a range of growing. They also offer a greater variety of vitamins, contain more antioxidants and have more usable protein than wheat, rice or maize.

Standardization of suitable varieties for a particular location is paramount importance to realize the yield potential of finger millet. Therefore, an attempt was made to study the performance of different finger millet varieties the yield of finger millet is very low. It is also coupled with negligence in adoption of improved package of practices *viz.*, variety, use of balance fertilizer, proper sowing time, spacing etc.

Finger millet tastes good and is nutritionally rich (compared to cassava, plantain, polished rice and maize meal) as it contains high levels of calcium, iron and manganese while the finger

Millet straw is highly valued as feed for livestock and fuel. It contains a low glycemic index and has no gluten which makes it suitable for diabetics and people with digestive problems. The most striking feature, which made finger millet an important crop is its resilence and ability to withstand adverse weather conditions when grown in soils having poor water holding capacity.

By conduction of front line demonstration on farmer's field there was significant increase in knowledge level of the farmer and majority of farmer's showed high level of satisfaction about demonstrated technologies.

Keeping in view such problems and after detailed survey the KVK, Ganjam-II made an attempt with an objective to substitute existing finger millet variety local Budha Mandia with new promising varieties like Bhairabi and Arjun. Therefore, it was considered important to evaluate the yield gapt of front line demonstration on yield and economics of finger millet for its suitability in the existing farming situation for higher productivity and income. FLD was effective in changing the attitude, skill and knowledge of improved / recommended practices of high yielding variety including adoption. KVK Ganjam-II have taken demonstrations on finger millet to reduce the time gap between technology generated and its adoption and to transfer the improved technologies to increase productivity. This helps field functionaries to elucidate production constratints and limitations in the adoption of technologies in the farmers field and scientists to reorient their research accordingly.

Materials and Methods

Krishi Vigyan Kendra, Ganjam-II conducted frontline demonstrations during the *kharif* season for consecutive two years from 2017 to 2018 on finger millet in farmer's field with an emphasis on Integrated Crop Management. A total of 10 demonstrations covering a 5 ha field with an emphasis on Integrated Crop Management. And having similar number of traditional or local check were carried out in 8 villages in the district. The finger millet varieties namely Bhairabi, Arjun were introduced to farmers in different villages. The district of Ganjam lies in two agro climatic zones i.e East & South Eastern coastal plain zone and North Eastern Ghat Zone of Odisha extending from $18^0$13'N to $19^0$10' North latitude to $82^0$5' to $83^0$23' East longitude. The Average Normal Rainfall of this district is 1276.2 mm and more than 75% of the precipitation is received over five months i.e. June- October. Agriculture is the primary occupation of inhabitants of this district. The maximum and minimum temperature of this district is 39^0C and 18.9^0C respectively.

Scientific interventions under frontline demonstrations under frontline demon starvation were taken as mentioned in Table 1. The selected progressive farmers were trained on all scientific finger millet cultivation aspects before strating of frontline demonstrations. The demonstrated fields were regularly monitored and periodically observed by the scientists of KVK. At the time of harvest yield data were collected from both the demonstrations and farmers practice. Cost of cultivation, net income and benefit cost ratio were worked out.

Table 1: Improved crop management practices demonstrated in frontline demonstrations

Sl. No	Intervention points	Recommended improved practices
1	High yielding variety	Bhairabi**,** Arjun
2	Seed treatment	Treat the seeds with pseudomonas Fluorescence@ 10gm/kg seed. Followed by the seeds are treated with 600 gram of Azospirillum Culture
3	Spacing	22.5x 10cm
4	Manure and fertilizers	10t FYM, 60:30:30Kg NPK/ha
5	Weeding	Hand weeding on 15 and 30 days after sowing
6	Irrigation	Critical stages: Tillering and pre flowering
7	Stem borer and aphid	Chloropyriphos@1.5ml per litre of water and Imidachlorprid

To study the impact of frontline demonstrations data from FLD and farmer practices were analyzed. The extension gap, technology gap and the technology index were work out with the help of formulas given by Samui *et al*., (2000) [4] as mentioned below:

1. Benefit cost ratio= Gross return/Cost of cultivation.
2. Technology gap= Potential yield –Demonstration yield.
3. Extension gap=Demonstration yield-Local check yield.
4. Technology index= [(Py-Dy)/Py] x100. Where Py=Potential yield and Dy=Demonstration yield

Results and Discussion

The data presented in Table 2 revealed that under demonstration plots the finger millet yield was found to be substantially more than that under local check during both years. Similarly the farmers harvested an average grain yield of 20q/ha with a yield advantage of 57.2 percent over the existing variety cultivated by the farmers. The findings of the present study are in line with Dhaka *et al* (2011) [1] and Rai *et al* (2015). From the results it is evident that performance of improved variety along with improved practices was found better than the local check under local conditions.

Table 2: Productivity, technology gap, Extension gap and technology Index in finger millet varieties under front line demonstration

Year	Varieties	Yield(q/ha)			% of increase over local check	technology gap(q/ha)	Extension gap(q/ha)	Technology imdex (%)
		potential	improved technology	local check				
2017	Bhairabi	22	18.6	12.2	52.4	3.4	6.4	15.4
2018	Arjun	25	21.4	13.2	62.1	3.6	8.2	14.4
Mean		23.5	20	12.7	57.2	3.5	7.3	14.9

Yield of front line demonstration trials and potential yield of crop was compared to estimate the yield gap further it was categorized into extension gap, technology gap and technology index. The extension gap shows the gap between the demonstration yield and local yield and it was 6.4q/ha and 8.2q/ha in both the years with an average of 7.3q/ha. The technology gap shows the gap between the potential yield of the crop over demonstrated yield and it was 3.4q/ha and 3.6q/ha respectively in both the years 2017 & 2018 with an average of 3.5q/ha. The observed extension gap and

technology gap may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in this region. Hence, to narrow down the yield gaps location specific technologies needs to be adopted. Technology Index shows the feasibility of the variety at the farmer field. The lower the value of the technology index more is the feasibility. Table 2 revealed that the technology index values were 14.9 per cent. The findings of the present study are in line with the findings of Dhaka *et al* (2011) [1], Hiremath and Nagaraju (2009) [2] and Zala *et al*. (2013) [5].

The inputs and outputs prices of produce prevailed during the study of demonstration were taken for calculating cost of cultivation, gross return, net return and benefit cost ratio. (Table 3).

Table 3: Economics of finger millet varieties under front line demonstration

Year	Varieties	Yield (q/ha)		Cost of cultivation(Rs/ha)		Gross return(Rs/ha)		Net return(Rs/ha)		B :C ratio	
		DP	FP	DP	FP	DP	FP	DP	FP	DP	FP
2017	Bhairabi	18.6	12.2	22653	17965	37200	24400	14547	6435	1.64	1.35
2018	Arjun	21.4	13.2	24342	19876	42800	26400	18458	6524	1.76	1.33
Mean				23497.5	18920.5	40000	25400	16502.5	6479.5	1.7	1.34

DP- Demonstrated practice, FP-farmer practice

The economics of demonstration in Table 3 indicates that average gross return for demonstration and local check was found to be Rs 40000/- and Rs 25400/- per hectare. An average increase of gross return of demonstration over local check was 57.48 per cent. This might be due to higher yields obtained in demonstrations due to the intervention of scientists the adoption of high yielding varieties, proper seed rate, use of bio fertilizers for seed treatments, proper nutrient management practices and need based plant protection measures were also contributed to increase in gross return in demonstration plots.

The farmers had incurred average higher net return is Rs16502.50 /- per hectare under the demonstration where as in local check it was Rs 6479.50/- per hectare. Considering all the frontline demonstrations the highest benefit cost ratio was found in average 1.7 and 1.34 in demonstration plot and local check in both years respectively. Hence there is a wide scope to increase the area and production of finger millet crop by providing need based training and demonstration on improved production technology to the farmers.

Conclusions

The results of front line demonstrations convincingly brought out that the yield of finger millet could be increased by 57.2 per cent with the intervention on balanced nutrition coupled with the improved finger millet variety and proper management of insect pest. In demonstration plot improved production technology of finger millet performs better than control plot. His adoption of recommended practices advocated by scientists helped in getting increased income and better the standard of living of the farm families. The demonstrations reassured the fact that finger millet is economically viable crop if farmer adopt demonstrated technologies which otherwise neglected crop. The productivity gain under FLD over farmer's practices created awareness and motivated the other farmers to adopt improved production technology of finger millet in the district. Favourable benefit cost ratio itself explanatory of economic viability of the demonstration and convinced the farmers for adoption of intervention imparted.

Acknowledgement

Krishi Vigyan Kendra Ganjam-II is thankful to the Director, ICAR-ATARI, Zone-V, and Kolkata for providing funds for conducting the CFLDs and farmers who always show faith in the Krishi Vigyan Kendra Ganjam-II.

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