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Performance of improved pearl millet var. ABV-04 in Alfisols of Ananthapur district of Andhra Pradesh

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Abstract
Pearl millet (*Pennisetum glaucum*) is one of the oldest millet used by our ancestors and is one of the most important cereal grow in tropical semi-arid regions of Andhra Pradesh. Due to its wider adaptability to various agro climatic conditions which play a major role in income of small and marginal farmer in dry land regions of Anantapur district of Andhra Pradesh. Front line demonstrations (FLD's) were conducted by Agricultural Research Station, Anantapur in *kharif* season during three consecutive years of 2018, 2019 and 2020 under rainfed Alfisols of Anantapur. The demonstration plots cover 16.4 ha with 41 locations by the active participation of farmers with objective of varietal replacement with improved Variety (ABV-04). At each demonstration plot improved variety with high yield potential is compared with local/farmer saved seed. The yields of pearl millet under demonstration plots is higher than the farmers practice plots in all three years. The per cent increase in grain yield over farmer's practice was about 17.45, 17.32 and 22.64 during the year 2018, 2019 and 2020 respectively with average increase of 19.14 per cent was observed in demonstration plots. The same trend was followed in fodder yield also. The front line demonstration on pearl millet revealed 19.41% increase in yield over local check. This increase was with an extra expenditure of Rs.500/ha. Present results clearly show that the yield of pearl millet can be boost up by adoption of improved Variety (ABV-04). By conducting front line demonstrations of proven variety the yield potential of pearl millet crop could be enhanced to a great extent with increase in the income level of the farming community.

Keywords: Pearl millet, front line demonstrations, varietal replacement, ABV-04

Introduction
Pearl millet (*Pennisetum glaucum*) is one of the oldest millet used by our ancestors and is one of the most important cereal grow in tropical semi-arid regions of the world primarily Asia and Africa. It is rich in dietary fibre, photochemical and micronutrients hence; they are termed as "Nutri-cereals". Pearl millets are rich in vitamin B, potassium, phosphorus, magnesium, iron, zinc copper and manganese. It is gluten free grain and is the only grain that retains its alkaline properties after being cooked which is ideal for people with wheat allergy (Chauhan *et al.*, 2015) [3]. Pearl millet is a rich source of energy (361 kcal/100 g) which is comparable with commonly consumed cereals such as sorghum (349 kcal/100 g), wheat (346 kcal/100 g), rice (345 kcal/100 g) and maize (325 kcal/100 g). Protein and fat contents of pearl millet varieties vary from 8.0 to 14.0% and 6.0 to 10.0%, respectively and protein digestibility ranges from 53.0 to 68.0% (Ritu Kumari *et al.*, 2018) [11]. The amino acid profile of pearl millet is better than that of sorghum and maize and is comparable to that of wheat, barley and rice (Hadimani *et al.*, 1995, Abdalla *et al.*, 1998) [6, 1]. Niacin content is comparatively higher in pearl millet (Pradeep *et al.*, 2013) [10]. Among major producing states of India, Andhra Pradesh is major producer of pearl millet. In Anantapur the area under pearl millet is 2240 ha with 3430 Mt of production in 2020 and productivity of 1530 kg/ha (Anon., 2020) [2]. It indicates that the productivity of pearl millet in Anantapur is comparatively low due to unavailability of suitable variety and erratic rainfall. Keeping this in view front line demonstrations was done to popularize the variety and this is concept of field demonstration with main objective to demonstrate newly released varieties with improves practices technologies and its management practices at farmer's field under different agro-climatic regions of the country with varying farming situations in which the favourable effect on crop yields will be popularized among the farming community and extension workers through field visits, capacity building programmes for the horizontal spread of various technologies.

Materials and Methods

The frontline demonstrations were conducted by Agricultural Research Station, Rekulakunta in Anantapur district during three consecutive years *kharif* 2018, 2019 and 2020, a total 41 front line demonstrations on pearl millet variety ABV-04 were conducted at farmer's field in the Anantapur district. The yield and economic performance of frontline demonstrations, the data on output were collected from FLD's as well as farmer plots and finally the grain yield, cost of cultivation and net returns with the benefit cost ratio was worked out. The selection of participatory farmer's for conducting cluster demonstration including farmer plots selection, farmers selection, layout of demonstration, farmers participation etc. were followed (Choudhary, 1999) [4]. On preliminary survey through Participatory Rural Appraisal (PRA) techniques and identified the major production constrain was cultivation age old desi variety, farmer to farmer seed, which is having very low yielding potential and susceptible to many diseases and pests. The yield data recorded from 5m x 5m plot in FLD plot and farmer's practice plot separately at each demonstration site and average grain weight taken and converted into kilogram per hectare (kg/ha). The field days at harvest were conducted with neighbouring farmers and extension officials for horizontal spread of the technology to other areas at large scale. The yield data, cost of cultivation, gross returns, net returns and B:C ratio, additional income, effective income, increase in B:C ratio of FLD plot and farmer's plot were recorded at each location, tabulated and analysed the data year wise. Different parameters as suggested by Yadav *et al.* (2004) [13] and Verma *et al.* (2014) [12] were used for calculating gap analysis, costs and returns. The analytical tool used for assessing the performance of the FLD on pearl millet is as follows

Technology gap = Potential yield – Demonstration yield
Extension gap = Demonstration yield – Farmer's yield

$$\text{Technology index} = \frac{(\text{Potential yield} - \text{Demonstration yield})}{\text{Potential yield}} x\ 100$$

$$\%\ \text{Yield Increase} = \frac{(\text{Demonstration yield} - \text{Farmer's practice yield})}{\text{Farmer's practice yield}} x\ 100$$

Additional return (Rs./ha) = Demonstration return-Farmers' practice return
Effective gain (Rs.) = Additional return-Additional cost
Incremental B:C ratio = Additional return/Additional cost

Results and Discussions

Grain yield

Three years pooled data of 41 demonstrations revealed that the use of high yielding variety (ABV-04) gave average of 17.45% more yield of pearl millet as compared to farmer practices (745 kg/ha). The yield of the front line demonstration plots and farmers practice plots are presented in Table 1. The results indicated that the average grain yield was 875 kg/ha (590 kg/ha -1250 kg/ha) and 745 kg/ha (570 kg/ha – 900 kg/ha) during *kharif*, 2018. The yield of 1416 kg/ha (1256 kg/ha -1587 kg/ha) and 1207 kg/ha (1100 kg/ha – 1350 kg/ha) during *kharif*, 2019 and 1793 kg/ha (1375 kg/ha - 2375 kg/ha) and 1461 kg/ha (1125 kg/ha – 1882 kg/ha) during *kharif*, 2020 respectively under front line demonstration plots and farmers practice plots. The per cent increase in grain yield under front line demonstration is lowest (17.32%) during *kharif*, 2019 and highest (22.64%) during *kharif*, 2020 with an average of 19.14 per cent yield increase in front line demonstration plots over farmers practice plots. The results are in similarity with results reported by Mohan *et al.* (2021) [8] in Cluster FLD's in chickpea.

Similarly, the average fodder yield was 1106 kg/ha (800 kg/ha -2250 kg/ha) and 934 kg/ha (350 kg/ha – 2076 kg/ha), during Kharif 2018, 1634 kg/ha (1450 kg/ha - 1875 kg/ha) and 1415 kg/ha (1250 kg/ha – 1625 kg/ha), during Kharif 2019 and 2501 kg/ha (2125 kg/ha -3000 kg/ha) and 2145 kg/ha (1875 kg/ha – 2625 kg/ha), during Kharif 2020 respectively under front line demonstration plots and farmers practice plots. The per cent increase in fodder yield under front line demonstration is lowest (15.48 per cent) during Kharif 2019 and highest (18.31 per cent) during Kharif 2018 with an average of 16.8 per cent yield increase in front line demonstration plots over farmers practice plots. Lokesh Kumar Jain (2018) [7] have also observed that improved package of practices along with high yielding variety have shown positive effect on yield potentials of different crops. Overall, the yield of front line demonstration plots exceeds over farmers practice plots in all FLD.

Gap analysis

Extension gap is a parameter to know the yield differences between the demonstrated technology and farmers practice whereas technology gap is the difference between potential yield and yield obtained under improved technology demonstration. Technology gap is of greater significance than other parameters as it indicates the constraints in implementation and drawbacks in our package of practices, these could be environmental or varietal. An extension gap ranging from 130-332 kg/ha was found between FLD demonstration and farmers practices during the different years and on average basis the extension gap with respect to yield was observed to be 224 kg/ha (Table 1). The extension gap was lowest (130 kg/ha) in *kharif*, 2018 and highest (332 kg/ha) in year 2020. The gap might be attributed to adoption of improved varieties in demonstrations which resulted in higher grain yield than that in the farmer's practices.

Wide technology gap were observed during these years and this was lowest (207 kg/ha) during 2020 and was highest (1125 kg/ha) during kharif 2018. On average basis the technology gap of all the 41 demonstrations was found to be 639 kg/ha (Table 1) which further indicates that there is greater scope of productivity enhancement in forth coming years through improved varieties and best management practices. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. Higher technology index emphasized the need to educate (insufficient extension services in transfer of technology) the farmer's through various means for the adoption of improved varieties and recommended production technology to decrease the gaps.

Economic analysis

The cost incurred during cultivation of pearl millet including land preparation, procurement of critical inputs *viz*. seeds, fertilizers, pesticides, intercultivation etc. harvesting and threshing and seed selling price prevailed in that year were considered for computing the cost of cultivation, gross income, net income and benefit cost ratio for front line demonstration plot and farmers practice plot separately and presented in Table 2. Grain yield, cost of production and sale prices of produce determine the economic returns and those

vary from year to year with the variation in cost of inputs, labour charges and sale price of the produce.

It is observed that an additional investment of 500 per ha was made under FLD demonstrations for obtaining the improved variety seed. All the three years highest gross returns, net returns and B:C ratio were recorded in front line demonstration plots than farmer practice plots, mainly due to increase in grain and fodder yield. On an average 19.25 per cent higher gross returns was realised with average gross returns of three years Rs. 35600 per ha in front line demonstration plot than farmers' practice plot Rs.29582 per ha. The net returns of Rs. 17516 per ha was recorded under front line demonstration plot and it was 42.8 per cent higher than farmer practice plot. The mean benefit cost ratio of three years demonstration is higher (1.92) than farmer practice plots (1.66). The lowest and highest incremental benefit: cost ratio (IBCR) were 6.15 & 17.41 in 2018 and 2020, respectively (Table 2). The results are in conformity with the findings of Dayanand *et al.* (2012) [5] and Meena, *et al.* (2012) [9]. The front line demonstration on pearl millet revealed 19.41% increase in yield over local check. This increase was with an extra expenditure of Rs.500/ha which is very less and even small and marginal farmers could also afford.

Table 1: Performance of pearl millet in crop technology demonstrations (Kharif 2018 to 2020)

Particulars	Kharif 2018		Kharif 2019		Kharif 2020	
	Demo	farmer	Demo	farmer	Demo	farmer
Area(ha)	4.8		4		7.6	
Number of Demonstrations	12		10		19	
Mean Yield(kg ha-1)	875	745	1416	1207	1793	1461
Fodder yield(kg/ha)	1106	934	1634	1415	2501	2145
Per cent increase in grain yield over farmer's practice	17.45%		17.32		22.64	
Per cent increase in fodder yield over farmer's practice	18.31%		15.48		16.62	
Potential yield (kg/ha)	2000		2000		2000	
Technology gap(kg/ha)	1125		584		207	
Extension gap(kg/ha)	130		209		332	
Technology index	56.25		29.2		10.35	

Table 2: Economic analysis of front line demonstrations of pearl millet on farmers field kharif 2018 to 2020

Year	Cost of Cultivation (Rs/ha)		Additional cost in demonstration (Rs/ha)	Gross return (Rs/ha)		Net Return (Rs/ha)		B:C ratio		Additional return in demonstration (Rs/ha)	Effective gain (Rs)	Incremental B:C ratio (BCR)
	Demo	Farmer		Demo	Farmer	Demo	Farmer	Demo	Farmer			
2018	15000	14500	500	20587	17513	5587	3013	1.37	1.21	3074	2574	6.15
2019	17750	17250	500	37470	32006	19720	14756	2.11	1.86	5464	4964	10.93
2020	21500	21000	500	48742	40038	27242	19038	2.27	1.91	8704	8204	17.41
Mean	18083	17583	500	35600	29852	17516	12269	1.92	1.66	5748	5248	11.50

Conclusion

Front line demonstration in pearl millet with improved varieties (ABV 04) results in increased gross returns, net returns and B:C ratio. It reduces technology gap to a considerable extent, thus leading to increased productivity of pearl millet in Anantapur district of Andhra Pradesh. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology. Productivity enhancement under FLDs over farmer practices of pearl millet cultivation created a greater awareness, and motivated other farmers not growing improved pearl millet to adopt improved varieties in the pearl millet.

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