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Impact of Front Line Demostration (FLD) on the Yield and Economics of Small Millet on Bastar District of Chhattisgarh, India

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A B S T R A C T

Millet has emerged as one of the most suitable alternative to minor millet and minor pulses in Bastar plateau zone of Bastar district at Chhattisgarh. However, the productivity of small millet in the Bastar plateau zone is very low. One of the major constraints of traditional millet farming is low productivity due to lack of recommended package of practices and high yielding varieties. To replace this inconsistency of practices, SG College of Agriculture and Research under AICRPSM, Jagdalpur conducted experiments in the farmer's field. Through frontline demonstration farmers were provided with all the basic inputs (improved practices). This resulted in higher yield than that obtained through the farmer's practices.

Introduction

Minor millets categorized as coarse cereals are staple food for the tribal people where cultivation of major cereals like rice, wheat and maize is either not popular or fail to produce substantial yield (Amadou1 *et al.*, 2013). India is considered as hub for these minor crops, according to the latest data, the world total production of millet grains at last count was 762,712 metric tonnes and the top producer was India with an annual production of 334,500 tonnes contributing 43.85% (http://faostat.fao.org/site/339/default.aspx).
Finger millet (*Eleucine coracana* (L.) Gaertn.) is a stable cereal food crop for millions of people in the semi-arid region of the world, particularly in Africa and India, and especially those who live by subsistence farming. This crop is cultivated in a wide geographical zone ranging from Senegal, Niger, Nigeria, across eastern and southern Africa, through the Middle East and into tropical Asia (Anonyms, 1996 and Burkill, 1985). Finger millet [*Eleusine coracana* (L.) Gaertn.] is among the most cultivated millets and belongs to the genus *Eleusine*, in the *Chloridoidae* subfamily (Clayton and Renvoze, 1986).

It is a native African crop which is also extremely important in South Asia (India and Nepal) (National Research Council, 1996). It has a 97 to 99% self-pollinating (Hilu and de Wet, 1980) and takes between 2.5 to 6 months to mature (Watson and Dallwitz, 1992). The

crop is adapted to a wide range of environments and can be grown in a variety of soils with medium or low water holding capacity (National Research Council, 1996), but requires rainfall of at least 800 mm per annum (Van Wyk and Gericke, 2000). In Africa and South Asia, finger millet is a staple food grain upon which millions depend however, finger millet straw also makes good animal fodder, containing up to 60% total digestible nutrients (National Research Council, 1996). There is a growing realization that millets, including finger millet would produce a more dependable harvest compared to other crops especially under marginal and sub marginal conditions of soil fertility and limited moisture (Seetharam, 1986).

In Bastar district of Chhattisgarh, which is one of the largest congregations of tribal population (67.4%), inhabitants mainly grow millets on upland situations and form major component of their daily food consumption. In addition to be nutritionally rich, the advantage of growing minor millets is that it is a rainfed crop which forms part of a multi-cropping system, in the sense that it is mostly grown along with legumes and oilseeds (Chopra and Neelam 2004; Pradhan *et al.*, 2010) On the darker side, these are underutilized and neglected crops owing to their lower preference driven by affluence, longer time and efforts involved in processing of the millets and the lower cooking quality. If these problems could be solved, their high nutritional value can make them doubly valuable as food for farming families and a potential source of income.

Materials and Methods

The present study was carried out by the SG college of Agriculture and Research Station under All India Co- ordinated Research Project on small millets (AICRPSM), Jagdalpur, Chhattisgarh during *Kharif* season during 2015. In finger millet cv. GPU28, nine farmers, in kodo millet cv. JK 439, 10 farmers and little millet cv. JK 8, five farmers were selected in Bastar and Dantewada district of Bastar Plateau Zone of Chhattisgarh. Total 24 front line demonstrations were carried out in an area 26 ha in different villages. The studies were under taken through farmers meeting, survey and diagnostic visit for selection of the farmers and villages. Orientation training programme was imparted to the beneficiaries related to crop before conducting demonstration. Farmers were getting lower yield due to local varieties, imbalanced fertilizer, broadcasting of seed, plant protection practices were not adopted and poor weed management. In improved package of practices, good quality seed, recommended balanced fertilizer, line sowing and timely sowing, effective plant protection and chemical and manual weed management and frequent monitoring the farmer's field during cropping season (Table 1). Yield data were collected from farmer's practices and improved practices. Cost of cultivation, gross return, net return and benefit cost ratio (B: C ratio) were computed and analysed. The technology gap and technology index were calculated using the following formula as given by Samui *et al.*, (2000).

Technology index = Potential Yield – Demonstration Yield/ Potential Yield x 100

Technology gap = Potential Yield - Demonstration Yield

Extension gap = Demonstration yield – Yield under Farmers Practices

B: C ratio = Net income (Rs. / ha) / cost of cultivation (Rs. / ha)

% increased over farmers practices = Improved practices – Farmers practices / farmers practices x 100

Results and Discussion

Yield

The average yield of millets under improved practices, 15.09 q ha^{-1} in finger millet, 14.57 q ha^{-1} in kodo millet and 5.85q ha^{-1} in little millet was much higher than as compared to average yield of farmer's practices (6.33, 6.29 and 2.75 q ha^{-1} in finger, kodo and little millet) (Table 2). The average percentage increased in the yield over farmer's practices was 140.12%, 148.64% and 115.64% in finger, kodo and little millet. The results indicated that the FLD (Tables 3 and 4) gives a better impact over the farming family of Bastar and Dantewada districts as they were encouraged by the new agricultural technology applied in the improved practices (Table 5). This finding is also observed by Tiwari and Saxena (2001), Dudhade *et al.*, (2009), Poonia and Pithia (2010), Poonia and Pithia (2011), Painkra *et al.*, (2012) and Raj *et al.*, (2013).

Extension gap

The average extension gap in the improved practices was 8.76 q ha^{-1} in finger millet, 8.28 q ha^{-1} in kodo millet and 3.11 q ha^{-1} in little millet. This gap shows that there is need to educate the farmers community by various adoption methods like improved agricultural production techniques. Subsequent change the low yielding local or old varieties and improved management practices is needed to increase the yield per capita and overcome the extension gap (Table 5). The findings of the present study are in line with the findings of Hiremath and Nagraju (2010).

Table.1 Particular showing the details of maize growing under Improved practices and farmers practices

S. No.	Operations	Farmer practices	Improved practices
01	Seed material used	Local variety or composite variety	Improved varieties
02	Sowing method	Broad casting	Line sowing
03	Fertilizer application	00:00:00 NPK (kg ha^{-1})	50:40:20 and 20:20:10 NPK (kg ha^{-1}) for finger millet, and kodo and little millet. Applied half dose of N as basal and half at tillering stage. Full dose of P and K was applied at the time of sowing.
04	Weed management	No weeding	Chemical weed control, Isoproturon @0.5 kg ai ha^{-1}as pre- emergence and need based weeding
05	Stem borer and aphid	No any control measures	Chlorpyriphos @ 1.5 ml per litre of water and imidacloprid

Table.2 Effect of FLDs at different farmers with improved practices (IP) and farmers practices (FP), percent increase over farmer's practices and economics in Finger millet

Finger Millet															
S No.	**Name of Farmer**	**Category**	**Village**	**Dist/ Block**	**Variety**	**Crop**	**Area (ha)**	**IP Yield (q ha^{-1})**	**FP Yield (q ha^{-1})**	**Net Income (₹ ha-1)**	**B:C Ratio**	**TI**	**TG**	**EG**	**IOFP**
1	Surjo/Lakhmu	ST	Kolawal	Bastar / Bakawand	GPU-28	Finger millet	1.00	14.90	6.10	13865.00	1.63	40.4	10.1	8.8	144.26
2	Ramsingh/Khusaro	ST	Kolawal	Bastar / Bakawand	GPU-28	Finger millet	1.00	16.45	6.10	16190.00	1.91	34.2	8.55	10.35	169.67
3	Sampat/Baijnath	ST	Kolawal	Bastar / Bakawand	GPU-28	Finger millet	1.50	17.80	6.10	18215.00	2.15	28.8	7.2	11.7	191.80
4	Kurso/Jagbandhu	ST	Kumhrawand	Bastar / Bakawand	GPU-28	Finger millet	1.00	13.90	6.85	12365.00	1.46	44.4	11.1	7.05	102.92
5	Banshi/Shivam	ST	Kumhrawand	Bastar / Bakawand	GPU-28	Finger millet	1.00	15.12	6.85	14195.00	1.67	39.52	9.88	8.27	120.73
6	Dumar/Rameshwar	ST	Kolawal	Bastar / Bakawand	GPU-28	Finger millet	1.00	17.30	7.65	17465.00	2.06	30.8	7.7	9.65	126.14
7	Fulchand/ Chaitan	OBC	Kumhrawand	Bastar / Bakawand	GPU-28	Finger millet	1.00	14.20	6.85	12815.00	1.51	43.2	10.8	7.35	107.30
8	Mosu/Gudru	ST	Bastanar	Bastanar/ Dantewada	GPU-28	Finger millet	1.50	12.60	5.25	10415.00	1.23	49.6	12.4	7.35	140.00
9	Bakanu/ Denga	ST	Bastanar	Bastanar/ Dantewada	GPU-28	Finger millet	1.00	13.56	5.25	11855.00	1.40	45.76	11.44	8.31	158.29

Table.3 Effect of FLDs at different farmers with improved practices (IP) and farmers practices (FP), percent increase over farmer's practices and economics in Kodo millet

Kodo millet															
S No.	**Name of Farmer**	**Category**	**Village**	**Dist/ Block**	**Variety**	**Crop**	**Area (ha)**	**IP Yield (q ha^{-1})**	**FP Yield (q ha^{-1})**	**Net Income (₹ ha-1)**	**B:C Ratio**	**TI**	**TG**	**EG**	**IOFP**
1	Santuram/Rupdhar	ST	Kolawal	Bastar / Bakawand	JK 439	Kodo millet	1.50	14.90	7.65	21067.00	3.24	25.50	5.10	7.25	94.77
2	Puru/Sukhdev	ST	Kolawal	Bastar / Bakawand	JK 439	Kodo millet	1.60	15.20	7.65	21622.00	3.33	24.00	4.80	7.55	98.69
3	Chandru/Sonu	ST	Kumhrawand	Bastar / Bakawand	JK 439	Kodo millet	0.50	14.56	7.65	20438.00	3.15	27.20	5.44	6.91	90.33
4	Chain/Puran	ST	Kumhrawand	Bastar / Bakawand	JK 439	Kodo millet	1.00	14.85	7.65	20974.50	3.23	25.75	5.15	7.20	94.12
5	Baman/Pandu	ST	Bastanar	Bastanar/ Dantewada	JK 439	Kodo millet	1.50	13.60	4.25	18662.00	2.87	32.00	6.40	9.35	220.00
6	Lakhmu/Masa	St	Bastanar	Bastanar/ Dantewada	JK 439	Kodo millet	0.50	14.00	4.25	19402.00	2.99	30.00	6.00	9.75	229.41
7	Sonadhar/Jagbandhu	ST	Kumhrawand	Bastanar/ Dantewada	JK 439	Kodo millet	0.50	14.56	7.65	20438.00	3.15	27.20	5.44	6.91	90.33
8	Arjun/Jagbandhu	ST	Kumhrawand	Bastanar/ Dantewada	JK 439	Kodo millet	0.50	15.90	7.65	22917.00	3.53	20.50	4.10	8.25	107.84
9	Talo/Mosu	ST	Bastanar	Bastanar/ Dantewada	JK 439	Kodo millet	1.00	13.89	4.25	19198.50	2.95	30.55	6.11	9.64	226.82
10	Chhadmo/Sukro	ST	Bodenar	Bastanar/ Dantewada	JK 439	Kodo millet	1.50	14.20	4.25	19772.00	3.04	29.00	5.80	9.95	234.12

Table.4 Effect of FLDs at different farmers with improved practices (IP) and farmers practices (FP), percent increase over farmer's practices and economics in little millet

Little millet															
S No.	**Name of Farmer**	**Category**	**Village**	**Dist/ Block**	**Variety**	**Crop**	**Area (ha)**	**IP Yield (q ha^{-1})**	**FP Yield (q ha^{-1})**	**Net Income (₹ ha^{-1})**	**B:C Ratio**	**TI**	**TG**	**EG**	**IOFP**
1	Chhirma/ Pandu	ST	Bastanar	Bastanar/ Dantewada	JK 8	Little millet	1.50	5.60	2.50	3360.00	0.60	78.57	4.40	3.10	124.00
2	Chetan/Paklu	ST	Bodenar	Bastanar/ Dantewada	JK 8	Little millet	1.00	5.90	3.12	3840.00	0.69	69.49	4.10	2.78	89.10
3	Balram/Sethi	ST	Bodenar	Bastanar/ Dantewada	JK 8	Little millet	1.50	5.75	3.12	3600.00	0.64	73.91	4.25	2.63	84.29
4	Pandu/Lachhu	ST	Mutanpal	Bastanar/ Dantewada	JK 8	Little millet	0.50	6.12	2.50	4192.00	0.75	63.40	3.88	3.62	144.80
5	Rukmani /Bijo	ST	Kilepal	Bastanar/ Dantewada	JK 8	Little millet	1.50	5.90	2.50	3840.00	0.69	69.49	4.10	3.40	136.00

Table.5 Exploitable productivity, technology index, technology gap and extension gap of minor millets as grown under improved practices and farmers practices

Crop	Variety	Sowing method	Area (ha)	yield (q ha^{-1})		% increased over FP	Technology index (%)	Technology gap (q ha^{-1})	Extension gap (q ha^{-1})
				IP	FP				
Finger millet	GPU-28	Line sowing	1.11	15.09	6.33	140.12	39.63	9.91	8.76
Kodo millet	JK-439	Line sowing	1.01	14.57	6.29	148.64	27.17	5.43	8.28
Little millet	JK-08	Line sowing	1.20	5.85	2.75	115.64	70.97	4.15	3.11

Table.6 Economic impact of demonstrated millets as grown under improved practices and farmers practices

Crop	Cost of cultivation (₹ ha-1)		Gross Income (₹ ha-1)		Net Income (₹ ha-1)		B:C Ratio	
	IP	FP	IP	FP	IP	FP	IP	FP
Finger millet	8485	5300	22638	11479	14153	6179	1.67	1.17
Kodo millet	6498	3600	26947	11637	20449	8037	3.15	2.23
Little millet	5600	3200	9366	4397	3766	1197	0.67	0.37

Technology gap

The average technology gap in the improved technology was recorded 9.91 q ha^{-1}, 5.43 q ha^{-1} and 4.15 q ha^{-1} in finger, kodo and little millet (Table 5). It might be due to different climatic and edephic conditions which increase the technology gap. Similar findings were reported by Mukharjee (2003) and Raj *et al.*, (2013).

Technology index

The technology index shows the feasibility of the evolved technology at the farmer's field and the lower the value of technology index more is the feasibility of the technology (Jeengar, *et al.*, 2006 and Singh, et. al 2007). The index was 39.63, 27.17 and 70.97 percent for the Finger, kodo and little millet (Table 5).

Economic return

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 6). The demonstration of small millets (Finger, kodo and little) under improved practices gave higher net return and B: C ratio of Rs. 14153.00 and 1.67 for the finger millet, 20449 and 3.15 for kodo millet and 3766 and 0.67 for the little millet. This might be due to higher yield obtained from improved technology as compared to farmer's practices. This finding is also reported by Mokidue *et al.*, 2011 and Raj *et al.*, 2013.

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