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Impact of Front-Line Demonstration on Pig Farming and Farmers' Adoption Level in Three Districts of Arunachal Pradesh, India

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Abstract

Impact of Front-Line Demonstration on Pig Farming and Farmers' Adoption Level in Three Districts of Arunachal Pradesh, India" was studied w.e.f. August, 2018 to July, 2020, and compared with traditional pig farming (Farmers Practice i.e., FP). Study revealed 57.60 percent farmers had primary level education with medium size (47.50%) families having sources of income from agriculture, livestock and off farm activities (30.00%). Earlier, farmers had poor pig farm hygienic condition (65.00%), while under FLD (61.67%) farmers-maintained hygiene and sanitation. The age at puberty, first conception, first farrowing were lower (P<0.05) in FP (7.02±0.30, 8.34±1.34, 12.47±1.14 months) than in FLD (9.72±0.25, 11.56±0.52 and 15.20±0.27 months). Inter- farrowing interval recorded higher side (p<0.05) in FP (7.82±17 months) than in FLD (6.93±89 months). Higher (P<0.05) litter size at birth and at weaning were recorded in FLD pigs (9.85±0.14 and 8.06±0.42) over FP (6.24±0.23 and 4.12±0.30). Higher pre weaning mortality rate (2.12±0.12%) under FP over FLD (1.79±0.17%) was also recorded. Factors, namely knowledge improvement, spreading of knowledge among the farmers, livelihood improvement, social and financial security, confidence in scientific pig farming, risk taking ability, participation in group activities, information utilization ability and overall satisfaction were highly significant (as œ =0.000<0.05) indicating FLD had a great impact. Higher value of (p<0.0001) Benefit Cost Ratio (BCR) in FLD (2.39:1) also recorded than in FP (1.54:1). Under FLD, farmers get 142.89±7.68 day's food security, whereas it is 51.29±0.8 days under FP.

Keywords: Front Line Demonstration, Farmers Practice, Food Security, Livelihood Improvement, Piggery

Introduction

Ethnically and culturally the eight states of North East (NE) India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) are analogous to South East Asia and majority tribal population of this area is engaged in mix farming where animal husbandry, especially pig rearing is an integral part of their lives. With 3.8 million pigs (over one quarter of the pigs in India), NE Region is sharing 28 percent of the country's total pig population (Patra *et al*., 2016). In the global context, India is sharing 5.23 percent of pork production, 50 percent of which is consumed mostly by the tribal flock of this region. (Halder *et al*., 2017). Due to above reasons, almost every tribal rural household is rearing 2 to 3 pigs (either local or crossbred) under a typical backyard system (Kumaresan *et al*., 2007; Kadirvel *et al*., 2017 and Singh *et al*., 2020). These resource poor farmers are developing their own sustainable production system, which consists of a simple pig sty made up of locally available materials and feeding comprises locally available grains, vegetables and agricultural by-products along with kitchen waste (swirls). Families usually keep these pigs for fattening purpose with low or zero inputs in terms of their feeds, shelter and healthcare (Moanaro *et al*., 2011). The tribal societies of this region not only rear pigs for consumption but also use them in their various religious activities. This underlines the importance of backyard swine farming. Studies indicate that the pig farmers of this region face lots of problems in pig rearing, namely non availability of quality germplasm which forced them to rare indigenous breeds, non-availability of quality balanced feeds in reasonable price, lack of knowledge about the production and marketing systems (Kumaresan *et al*., 2009). Under this situation, any attempt to solve the problems of farmers will be a boon to boost the farmers income and socio-economic status. Keeping the above point in view a Front-Line Demonstration (FLD) was conducted by *Krishi Vigyan Kendra* (KVK), West Siang, Indian Council of Agricultural Research (ICAR), Arunachal Pradesh Centre, Basar on backyard pig farming with improved crossbreed pigs along with low-cost scientific housing and feeding. FLD is a concept of field demonstration evolved by ICAR, with an objective of demonstrating newly released production technologies and their management practices in the farmers' field under different agro-climatic situations and farming situations (Baruah *et al*., 2018). Hence, the present study was designed to evaluate the management practices followed by the tribal pig farmers and also the impact of interventions made through FLD in the backyard pig farming in particular and the socio-economic status of the farmers in general.

Materials and Methods

Before designing the actual experiment, a SWOT (Strength, Weakness, Opportunity and Threats) analysis was conducted as per the method described by Groenendijk (2002) and after that, a FLD was designed to execute an improved package of practices of backyard pig farming *w.e.f.* August, 2018 to July, 2020 at three districts, namely West Siang, Leparada and Lower Siang of Arunachal Pradesh, India. The study areas were located between $82^0$86.277′E to $94^0$42.903′E latitude and $27^0$19.078′N to $27^0$44.127′N longitudes with an altitude range from 180 to 1250 meters above the mean sea level. The average annual rainfall of the study area was 2467 mm with the highest during July (469.7 mm) and lowest during December (22.0 mm). Average relative humidity of the study area was 70 percent in the morning and 61 percent in the evening and temperature range from 15.9^0C to 24.2^0C. From the selected districts six blocks were selected and from the selected blocks, ten villages were chosen randomly. From each village, six farm families totalling 60 were selected for FLD based on the criteria that the said families were involved in pig farming for not less than five years. Another 60 farm families from the same localities having minimum of 3 pigs were also selected randomly by snowball sampling techniques that raised pigs under existing low input backyard system from the same locations that are practicing pig farming traditionally for not less than 5 years (Farmers Practice *i.e.,* FP). All the selected farmers under FLD were given hands on training in different groups at ICAR- KVK, West Siang, Arunachal Pradesh. The training topics were covered mostly on breeding, feeding of pigs with low-cost feed formulations, making of low-cost pig sty with locally available materials, pig farm management systems including disease prevention strategies, first aid treatment both for animals and farm workers, record keeping and calculation of farm economics. The selected farmers under FLD were also given hands on training at their farm site as and when visited the farmers' field. The farmers were assisted both financially and technically for changing their attitudes towards construction of pig sty from non scientific housing to low cost scientific housing with locally available materials. Vaccination against swine fever and deworming against parasitic infestation were done as per the standard protocol. Medical care was given to the pigs as and when required or when the farmers were complaining for any disease occurrence. The crossbreed stocks of improved breeds were procured from the pig farm of ICAR Research Complex for NEH Region, Arunachal Pradesh Centre, Basar and College of Veterinary Science, Khanapara, Guwahati, Assam and were distributed to the each farm families with a ratio of one male and two females. The pigs were maintained in the low-cost pig sheds constructed with locally available

materials. The animals were fed with the ration as mentioned in Table 1 and 2.

Table 1: Feeding schedule followed for the pigs under FLD

Body weight (kg)	Balanced feed (kg) per pig	Cooked swill (Kg) per pig
Below 10	0.5	1
10-20	1	1.5
20-30	1.5	2
30-60	2	2.5
>60	2.5	3

Table 2: Composition of balanced feeds given to the pigs under FLD

Ingredients	Grower ration (15-17% Protein)
Maize	58
Wheat bran	20
Fish Meal/ Soya Meal	5
Mineral Mixture	1.5
G. N. Cake	15
Salt	0.5
Total	100

The breeding was done through natural service following double mating on 2nd and3rd day after onset of puberty. All necessary care and management were done during piglet birth, iron supplementation at 4th and 14th day, neonatal diarrhoea etc. as per the standard management practices. Weaning was performed at 45 days post farrowing. Initially data was collected from all 120 pig rearing farmers by using a pre-designed, semi structured questionnaires along with personal interview of the farmers by visiting their farm premises. One adult member (above 18 years of age) of either sex, actively engaged in the management aspects of the pigs was chosen as the respondent for the study. An ex-post facto and exploratory research design with a semi structured pretested interview schedule was used for generating the data on the various aspects of backyard pig farming by the tribal farmers. Questionnaires were prepared in such a way that, besides generating the data on various aspects of pig farming it also generate data on socio-economic profile of the farmers both under FLD and FP. Data was also collected bi-monthly after initial data collection on impact of training, breed introduction, shelter management, health care management including socio-physiological factor. Reproductive performance of pigs both in FLD and FP were calculated by recording age at puberty (months), age at first conception (months), age at first farrowing (months), inter farrowing interval (months), farrowing rate (%), average litter size at birth and litter size at weaning. Growth performance traits *viz*., birth weight, weaning weight; 2, 4, 6, 8, 10-month body weight were also recorded from both FLD and FP. Farmers attitude towards pig farming was recorded based on the statements which were classified as “yes=1" or "no=2". Economic analysis *i.e.*, gross income, net income and Benefit Cost Ratio (BCR) of pig farming were calculated based on the prevailing market price of feeds, selling price of fattener pigs and piglets. A unit of one male and two females pigs were considered for calculating the daily feed cost and their selling price as fattener pigs at the end of 10 months. Weight of pig during the study was recorded in kilogram by using the formula {Heart Girth^2 (Meters) x Length (Meters)} x 69.30 (reference).The data generated were tabulated and subjected to statistical analysis (wherever required).

To determine the effect of intervention data on economic benefits were analyzed by doing t-test. The Perception Index (PI) of technological intervention on backyard pig farming was calculated by multiplying the frequency count of each cell of a degree of change with its corresponding weigh. By adding the values of each cell together the PI score and simultaneously ranking was given. Range of PI kept from 0 to 100, where 0 indicates no improvement and 100 indicate maximum improvement due to the technological intervention. Technological impact on backyard pig rearing over different factors was assessed using the nonparametric Wilcoxon Z Statistic.

Zoonotic Diseases Management

Risk of zoonotic diseases always persists for the pig farmer or handler if proper hygiene practices are not followed in the farm. Hygienic practices, such as hand washing after handling the pigs or their excrement, avoiding consumption of food or water within the farm premises, were strictly followed throughout the study.

Ethical Approval

The study was conducted without affecting the pigs' general wellbeing. Approval was taken from concerned authority.

Results and Discussion

Results of Strength, Weakness, Opportunity and Threats (SWOT) of backyard pig farming by the tribal farmers are presented in Table 3.

Table 3. Strength, Weakness, Opportunity and Threats (SWOT) analysis of backyard pig farming

S. No.	Particulars	Findings
1	Strength	a. Ability of the pigs to survive and produce under adverse husbandry practices.
		b. Increased demand for pork and pork products like sausage, bacon *etc*.
		c. Pig by-products, namely bristle and inedible offal are strength to support allied industries.
		d. Commercialization and organic pork production are considered strengths to give a meat revolution to the country and thereby provide employment to a large section of the rural poor.
2	Weakness	a. Absence of sufficient numbers of breeder farmers.
		b. Tendency of the pig grower to raise pig to marketable age on zero to negligible inputs.
		c. Preference of the consumers for pork from the local pig.
		d. Non availability of quality pig feeds at affordable price and lack of adequate support from the development and financial bodies to establish pork-based industries.
3	Opportunity	a. Self-employment as a pork retailer and pork product processor.
		b. Self Help Group (SHG) personnel to be engaged in service delivery like Artificial Insemination, Vaccination *etc*.
4	Threat	a. More than 60 percent deficiency in concentrate feed sources in the pig industry.
		b. Non availability of by-product utilization facility, particularly in areas where pig slaughter is maximum, leads to creation of negative views for the general public.

From the SWOT analysis it was found that besides having so many hindrances in pig farming, it can be used as a live source of insurance particularly for the weaker section of the community, and also as a medium for doubling farmers' income. Socio economic profiles of the pig farmers were presented in Table 4. The majority of the beneficiaries (57.60%) had education up to the primary level whereas, 6.67 percent were illiterate. Similar types of socio-economic structures of the pig farmers were also reported earlier in many South East Asian countries like India (Nath *et. al.*, 2013). Adoption of non-scientific practices of pig farming observed in the present study by the farmers might be due to the education level and economic status of the farmers which compel them to raise pigs in minimum inputs (Riedel *et al*., 2012). In the study it was found that the majority (47.50%) of the families were of medium size, while 61.67 percent of the respondents had a nuclear type of family. About 53.33 percent families had land holding between 1 to 2 hectors and major source of income of the respondents were crop, livestock and off farm activities (30.00%). Among the responded 70.00 percent were of medium income group while, only 16.67 percent were in the high-income group. Smaller family size of nuclear type, limited land holding and income might be the reasons for the farmers to rely on family laboursto continue with the backyard pig farming system with few pigs (Mutua *et al*., 2010). Besides this, the pig farmers were also engaged with crop production as well as off-farm or non-farm activities which forced them to raise their pigs in backyard in traditional manner (Devendra and Thomas, 2002). The impact of scientific management in backyard piggery is presented in Table 5.

Table 4: Socio-economic profiles of the pig farmers (N=120)

S. No.	Socio-economic profile	Numbers	% over the total
1	**Level of Education**		
i.	Illiterate	8	6.67
ii.	Primary level (class I to IV)	48	57.6
iii.	Secondary level (class X)	43	35.83
iv.	Higher secondary level (class XI, XII) and above	21	17.5
2	**Family size**		
i.	Small (4 members)	12	10
ii.	Medium (5 to 6 members)	57	47.5
iii.	Large (more than 6 members)	51	42.5
3	**Family type**		
i.	Joint family	46	38.33
ii.	Nuclear family	74	61.67
4	**Cultivable land holding in Hectare**		
i.	Up to 1	51	42.5
ii.	Between 1 to 2	64	53.33
iii.	More than 2	5	4.17
5	**Source of income**		
i.	Agricultural crops + livestock	30	25
ii.	Agri. crops + livestock + off-farm activities	36	30
iii.	Agri.crops + livestock + non-farm activities	21	17.5
iv.	Agri. crops + livestock + off-farm + non-farm activities	33	27.5
6	**Annual Income in INR**		
i.	Low (up to 50,000/-)	16	13.33
ii.	Medium (50,000/- to 1,00,000/-)	84	70
iii.	High (above INR 1,00,000/-)	20	16.67

Table 5: Impact of scientific management in backyard piggery

S. No.	Measurable indicators	Criteria	Farmer's practice (n=60)		FLD (n=60)	
			Numbers	% Over the total	Numbers	% Over the total
1	Housing	Scientific housing	10	16.67	48	80
2	Type of pigs varieties reared	i. Indigenous	45	75	0	0
		ii. Crossbreed	15	25	60	100
3	Reason of rearing	i. Fattening	52	86.67	12	20
		ii. Breeding	8	13.33	48	80
4	Periodical deworming, vaccination, Seeking veterinary aid	i. Deworming	11	18.33	60	100
		ii. Vaccination	11	18.33	60	100
		iii. Seeking veterinary aid	8	13.33	60	100
5	Hygiene and sanitation maintenance in and around the pig farm	i. Poor	39	65	2	3.33
		ii. Good	18	30	21	35
		iii. Very good	3	5	37	61.67

Technological intervention through FLD had a great impact in the study area. Earlier, only 16.67 percent of the farmers had scientific piggery with 25.00 percent crossbreed pigs. After interventions, 80.00 percent farmers under FLD made scientific housing either with half wall and roof with corrugated galvanized iron sheet, or low cost with cemented floor and bamboo. Earlier, the majority of the farmers (65.00%) had poor condition of the surrounding area where the pigs were housed. After the FLD intervention, the majority of the farmers (61.67%) maintained hygiene and sanitation in and around the pig shelter. Comparative reproductive and growth performance of pigs

under FLD over FP is presented in Table 6.

Table 6: Comparative growth performance (Mean±SE) of pigs in FLD over the FP

S. No.	Performance traits (Average)	Farmers Practice	FLD	P value
1	Age at puberty (months)	7.02±0.30	9.72±0.25	0
2	Age at first conception (months)	8.34±1.34	11.56±0.52	0.04
3	Age at first furrowing (months)	12.47±1.14	15.2±0.27	0.03
4	Inter-farrowing interval (months)	7.82±17	6.93±89	0.04
5	Litter size at birth	6.24±0.23	9.85±0.14	0
6	Litter size at weaning	4.12±0.30	8.06±0.42	0.02
7	Body wt. at birth (Kg)	0.82±0.04	1.35±0.32	0.01
8	Body wt. at 2 months (Kg)	5.36±0.23	9.78±1.42	0.03
9	Body wt. at 4 months (Kg)	12.76±0.41	18.52±0.92	0
10	Body wt. at 6 months (Kg)	20.3±0.22	32.93±0.12	0.01
11	Body wt. at 8 at months (Kg)	32.74±2.01	53.54±1.28	0.02
12	Body wt. at 10 months (Kg)	43.06±2.03	65.39±1.98	0
13	Pre weaning mortality per litter (%)	2.12±0.12	1.79±0.17	0

Significant if $p < 0.05$

The age at puberty was recorded almost significantly (P<0.05) one month shorter in the pigs of FP (7.02±0.30 months) than in FLD (9.72±0.25 months) in the present studywhich were also observed in Meishan pigs (Devendra and Thomas; 2002). This might have been due to breed and breeding environment of the pigs (Brooks and Cole, 1970). The age at first conception (11.56±0.52 months) of pigs under FLD was within the optimal range (220 to 240 days) for crossbreed pigs (Koketsu *et al*., 1999). Age at first farrowing in pigs under FLD (15.20±0.27 months) was found significantly (P<0.05) lower in FP (12.47±1.14 months) which is in agreement with the earlier findings (Phookan, 2002, Kadirvel *et al*., 2019, Huyen *et al*., 2005, Phengsavanh *et al*., 2011, Kalita, 1995, Kumaresan *et al*., 2011, Kadirvel *et al.*, 2017). However, inter farrowing interval was recorded significantly ($p < 0.05$) on the higher side in FP (7.82±17 months) than in the FLD (6.93±89 months). A significantly (P<0.05) higher value of litter size at birth and litter size at weaning was recorded in pigs under FLD (9.85±0.14 and 8.06±0.42) over FP (6.24±0.23 and 9.85±0.14) which is in agreement with the findings of (Kumar *et al*., 1990 and Kadirvel *et al*., 2013). This might be due to the influence of breed and uterine environment (El-Saied *et al*., 2006 and Sellie, 1976). Higher body weight at different ages in pigs under FLD were also recorded over the FP (Table 6), which might be due to the advantage of heterosis along with the adoption of scientific feeding schedule. The higher pre weaning mortality rate in the pigs under FP (2.12±0.12%) over FLD (1.79±0.17%) recorded in the present study might be due to non-adoption of hygiene and sanitation in and around the pig farmand proper disease preventive measures. The increased level of awareness after the technological interventions on socio-physiological factors of the pig farmers under FLD were also recorded and given rank accordingly (Table 7).

Table 7: Perception of technological intervention on socio-physiological factors of the pig farmers under FLD.

S. No.	Particulars	Perception Index (PI)	Rank	Wilcoxon Z Statistic	Significance at P=0.05
1	Knowledge improvement	100	I	-8	0
2	Spreading of knowledge among the farmers	85.5	II	-8.2	0
3	Livelihood improvement	82	III	-7.25	0
4	Social and financial security	65.5	IV	-7.18	0
5	Confidence of scientific pig farming	58.4	V	-6.42	0
6	Risk taking ability for new venture	48.2	VI	-6.095	0
7	Participation in group activities	42.5	VII	-6.85	0
8	Information utilization ability	41	VIII	-6.84	0
9	Overall satisfaction	40	IX	-7.035	0

From the study it was found that all the nine factors namely knowledge improvement, spreading of knowledge among the farmers, livelihood improvement, social and financial security, confidence of scientific pig farming, risk taking ability for new venture, participation in group activities, information utilization ability and overall satisfaction were highly significant (as œ =0.000<0.05) which indicates that the interventions under FLD had a great impact on backyard pig farming under tribal situation.

Table 8: Impact of interventions on economic benefit and food security of pig farmers (Mean±SE)

S. No.	Particulars	Farmers' Practice	FLD
1	Gross cost (Rs.) of rearing 3 pigs for one year (GC)	25200.00±270.50^{p}	28500.00±825.70^{q}
2	Gross Return in Rs. (GR)	38820.00±120.50^{p}	68280.00±860.00^{q}
3	Net income in Rs. (NR)	13620.00±123.70^{p}	39780.00±910.00^{q}
4	Benefit Cost Ratio (BCR)	1.54:1^{p}	2.39:1^{q}
5	Daily food cost for a 4 to 5 members family	265.55±1.25^{p}	278.40±1.80^{q}
6	Food security for a 4 to 5 members family	51.29±0.84^{p}	142.89±7.68^{q}

Means of different groups with different superscripts within a row differ significantly ($p< 0.0001$)

The data (Table 8) on impact of interventions on economic benefit and food security of pig farmers under FP and FLD shows that there is a significant ($p< 0.0001$) high value of Benefit Cost Ratio (BCR) in FLD (2.39:1) than in FP (1.54:1). After adoption of technologies the farmers under FLD could get 142.89±7.68day's food security whereas, it is 51.29±0.8 days for the farmers who are practicing pig farming under traditional systems (FP). Improvement of food security by the farmers after adopting the small scientific intervention was also reported by Halder *et al*., 2005.

Conclusion

The present study was attempted to find out the impact of interventions through FLD on backyard pig farming and farmers' adoption level of technology demonstrated in three districts, namely West Siang, Leparada and Lower Siang of Arunachal Pradesh, India. It may be concluded that backyard pig farming with simple scientific interventions has huge potential for the resource poor tribal farmers of this region provided they will follow the simple techniques of rearing improved breeds with adoption of low-cost scientific housing, feeding and simple health care techniques.

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Conflict of Interests

There is no conflict of interest.

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