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Technological Interventions for Impact Assessment on Backyard *Vanaraja* Poultry Farming in Two Districts of Arunachal Pradesh, India

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ABSTRACT

Optimum productive performance of *Vanaraja* poultry under improved technologies in backyard system of rearing was studied from August, 2022 to September, 2023. For this study, a total of 120 farmers with minimum two years of experience for rearing poultry were selected at random from 12 villages in the West Siang and Leparada districts of Arunachal Pradesh, India. The strength, weakness, opportunity and threats (SWOT) analysis revealed backyard poultry farming can always be a source for livelihood improvement for the rural farmers. After technologies demonstrated through FLD, 96.67% farmers adopted scientific housing with a gain of 3400±2.62g adult cock's body weight, whereas in TFP it was recorded as 2650±1.54g. The avg. age of laying first egg under FLD was found to be 24.40±0.32 weeks with a 140.04±1.25 numbers of egg production annually, whereas in case of TFP it was 25.44±0.54 weeks and 112.26±2.10 numbers. The overall mortality percentage of birds after 52 weeks of age was recorded as 6.18±0.14 in FLD whereas in TFP it was 19.47±0.25. The results showed that the former yielded much higher profits than the latter due to enhanced rearing practices.

Key Words: Demonstration, Food Security, Livelihood Improvement, Poultry

INTRODUCTION

Arunachal Pradesh, a state of NE India at Latitude 28°01′31.08″ North and Longitude 94°28′44.04″ East mostly covered by the Himalayan Mountains and has an area of 83,743 km^2. Among the 26 districts of Arunachal Pradesh, the study area comprised West Siang district located between 27°29′N and 29°23′N latitude and 94°02′ E and 95°15′ E longitude and Leparada district located between 27.8865°N and 94.7692°E. For the villagers of these areas, agriculture is the main occupation, but livestock and poultry farming also goes concurrently to support their livelihood, as their daily diet and traditional rituals are not completed without a product from the livestock or poultry (Baruah *et al*, 2021). This custom plays an important role as almost 90% of rural household are engaged in poultry production through backyard farming mostly with the native chicken (Rath *et al*, 2015). But the productivity and their contribution to the total meat and egg output is very low and almost static for the last few decades due to their low production potential (Singh *et al*, 2018). Besides that, few farmers started rearing some improved birds but due to lack of scientific knowledge they are not getting the optimum production as expected. This low and diminishing trend of productivity is an alarming factor which needs an immediate scientific approach to boost the farmers' income and socio-economic status. Keeping the above point in view the Front Line Demonstration (FLD) was conducted on backyard poultry farming with the introduction of improved birds *i.e. Vanaraja* developed by ICAR-Directorate of Poultry Research, Hyderabad, Telangana, India which were suitable for backyard free range farming. Due to the similarity in phonotypical appearance with native birds as well as higher growth rate and egg production potential than that of indigenous chicken, it is well accepted by the tribal farmers of

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these two districts. Hence, the present study was conducted to compare the performance of technology demonstrated through FLD and Traditional Farmers Practice (TFP) on backyard *Vanaraja* poultry rearing. The status of management practices followed by the tribal farmers, impact of interventions made through FLD and the improvement of socio-economic status of the farmers was also evaluated during the study.

MATERIALS AND METHODS

This study was carried out in West Siang and Leparada districts of Arunachal Pradesh, NE India. The study region had 2467 mm of annual rainfall on average, with July receiving the most (469.7 mm) and December receiving the least (22.0 mm). The study area's average relative humidity varied from 70% in the morning to 61% in the evening, with temperatures ranging from 15.9 to 24.2°C. Ten randomly selected villages were picked from six blocks that were chosen from these districts.

From each village, 6 farm families totalling 60 were selected for FLD by snowball sampling techniques based on the criteria that the said families were involved in poultry farming for not less than 4 years. Another 60 farm families from the same localities having minimum of 20 *Vanaraja* poultry were also selected randomly that used to raise poultry under existing low input backyard system and termed as Traditional Farmers Practice (TFP). A strength, weakness, opportunity and threats (SWOT) analysis was conducted as per the technique described by Groenendijk (2002). All the selected farmers under FLD were given hands on training in different groups at ICAR- KVK, West Siang, Arunachal Pradesh, India covering the topics on techniques on scientific poultry farming including disease prevention, first aid treatment both for birds 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 to the farmers' field. The farmers were assisted technically for changing their attitudes towards construction of poultry shed from non-scientific housing to low-cost scientific housing with locally available materials. Farmers received 20 numbers of *Vanaraja* chicks of each sex from the hatchery facility of ICAR-KVK West Siang, ICAR Research Complex for NEH Region, Arunachal Pradesh Centre, Basar and from the Government Duck and Poultry farm, Joysagar, Sivasagar, Assam. Day old chicks were kept in brooder house up to 6 weeks of age and concurrently vaccinated with vaccines for *Ranikhet* and *Gumboro* disease following the recommended standard immunisation procedure. At the time of brooding period, chicks of Vanaraja were fed 'Broiler Chicken Starter'. After brooding, *i.e.* at 42 days of age, when the birds attained around 650 to 750 g weight they were ready to let loose at backyard environment in day time for foraging, while at night time shelter was provided to them. Source of clean drinking water should always be provided in such a place that birds can easily access to them. Veterinary care was also given to the birds as and when required or when the farmers were complaining for any disease occurrence. Data on performance of birds were gathered mostly from primary source using a series of well-structured questionnaire aided by an interview schedule to take care of the uneducated respondents. Additionally, information was gathered about the respondents' socioeconomic traits, managerial and cultural practices, expenses and profits, productivity, and the primary obstacles to productive and successful backyard chicken farming. Questionnaires were prepared in such a way that, besides generating the data on various aspects of poultry farming it also generate data on socio-economic profile of the farmers both under FLD and TFP. Data were collected bi-monthly after initial data collection on impact of training, breed introduction, shelter management, health care management including socio-physiological factor. The approximate expense of raising was calculated by adding the fixed costs (land, poultry shed, and equipment cost) and variable costs (cost of day-old chicks, feed, vaccination, medication, and labour). The revenue from selling eggs, cocks, and spent hens was added together to determine the return. The data were examined by using descriptive statistics like percentage, mean and standard deviation for evaluating the economic and social characteristics, managerial techniques and impediment to backyard poultry rearing in the

Table 1. Strength, Weakness, Opportunity and Threats (SWOT) analysis of backyard poultry farming.

Sr. No.	Particular	Findings
1.	Strength	Ability of the birds to survive and produce under adverse husbandry practices.
		Phonotypical similarity of improved birds like *Vanaraja* with native birds' particularly multi -coloured plumage is well adopted by the tribal farmers.
		Increasing demand for poultry meat and eggs.
		Commercialization of poultry rearing gives an egg and meat revolution and thereby provide employment to a large section of the rural youths.
2.	Weakness	Absence of sufficient numbers of breeder farmers nearby for continuous supply of quality chicks.
		Non availability of quality poultry feeds at an affordable price.
		Lack of adequate support from the development and financial bodies to establish poultry-based industries.
		Tendency of the poultry farmers to raise poultry on zero to negligible inputs.
3.	Opportunity	Self-employment particularly for t he rural youth as a poultry entrepreneur.
		Self Help Group (SHG) personnel to be engaged in production of quality poultry chicks by establishing small solar/battery based hatchery units.
4.	Threat	Shortages of affordable quality concentrate feed (> 70%) in the poultry industry.
		Increasing incidence of emerging and reemerging diseases in poultry sector leads to creation of negative views for the budding poultry entrepreneur.

study area and by using standard statistical analysis techniques as per the methodology followed by Snedecor and Cochran (1994) wherever required. For estimation of the cost and benefits from backyard poultry production Gross Margin analysis was used. Then the poultry owners' Net Farm Income (NFI) was calculated according to the procedure outlined by Oladunni and Fatuase (2014).

If Gross margin is > 0 then backyard poultry enterprise is considered as profitable. Lastly, the entire net return was divided by the net cost of production to determine the benefit cost ratio. The Perception Index (PI) of technological intervention on backyard poultry farming was determined by multiplying the frequency count of each cell of a degree of change with its corresponding weigh. The PI score and ranking were obtained concurrently by summing the values of each cell. The PI range is maintained at 0, with 0 denoting no improvement and 100 denoting the greatest improvement brought about by the technical intervention. Technological impact on backyard poultry farming over different factors was assessed using the nonparametric Wilcoxon Z Statistic.

Care for zoonotic diseases

Throughout the study general hygienic practices as per WHO standard were followed before and after handling the birds or their excrement. To minimize the exposure of zoonotic diseases to the owner or poultry handler consumption of food or drinking was avoided near the farm premises.

Ethical approval

The overall well-being of the birds was not harmed throughout the course of this investigation. Relevant authorities gave their approval.

RESULTS AND DISCUSSION

Results of strength, weakness, opportunity and threats (SWOT) of backyard poultry farming

Table 2. Socio-economic status of the poultry farmers (N=120).

Sr. No.	Socio-economic profile	Numbers	Percent
1.	Level of Education		
i.	Illiterate	7	5.83
ii.	Primary level (class I to IV)	51	42.50
iii.	Secondary level (class X)	40	33.33
iv.	Higher secondary level (class XI, XII) and above	22	18.33
2.	Family size		
i.	Small (4 members)	11	9.17
ii.	Medium (5 to 6 members)	60	50.00
iii.	Large (more than 6 members)	49	40.83
3.	Family type		
i.	Joint family	52	43.33
ii.	Nuclear family	68	56.67
4.	Cultivable land holding in Hectare		
i.	Up to 1	53	44.17
ii.	Between 1 to 2	65	54.17
iii.	More than 2	2	1.67
5.	Source of income		
i.	Agricultural crops + livestock	30	25.00
ii.	Agri. crops + livestock + off-farm activities	32	26.67
iii.	Agri. crops + livestock + non -farm activities	18	15.00
iv.	Agri. crops + livestock + off -farm + non -farm activities	40	33.33
6.	Annual Income in INR		
i.	Low (up to 50,000/ -)	22	18.33
ii.	Medium (50,000/ - to 1,00,000/ -)	79	65.83
iii.	High (above 1,00,000/ -)	19	15.83

by the farmers were presented in Table 1.

SWOT analysis showed that besides having many hindrances, backyard poultry farming can be a source for livelihood improvement particularly for the rural youths and school dropouts. It may also acts as a medium for establishing small scale poultry entrepreneur which ultimately helps in doubling farmers' income (Baruah *et al,* 2021).

Among the respondents 42.50% had primary level education whereas, 5.83 % were illiterate of which 50.00% of the families were of medium size, while 56.67 % had nuclear family. About 54.17 % families had land holding between 1 to 2 ha. and major source of income were crop, livestock, off farm and non-farm activities (33.33%) resulting the farmers were in medium income group (65.83%). In many South East Asian countries like India, similar types of low education level and socio-economic structures were also reported earlier (Nath *et al,* 2013) which may be one of the reason for practicing non-scientific farming with minimum or nil inputs (Riedel *et al*, 2012).

Due to technological intervention under FLD, a great impact had observed in the study area. Earlier only 8.33 % farmers had scientific housing, which increases 96.67 % after FLD where farmers were made the poultry shed either with bamboo and roof with corrugated galvanized iron sheet, or low cost locally available materials "*Toko* leaves" (*Livistona jenkinsiana Griff*). Before, majority of farmers (70.00%) had poor surrounding condition where the poultry were

Table 3. Impact of scientific management.

Sr. No.	Measurable indicator	Criteria	TFP (n=60)		FLD (n=60)	
			Number	% over the total	Number	% over the total
1.	Housing	Scientific housing	5	8.33	58	96.67
2.	Reason of rearing	i. Commercial purpose	5	8.33	15	25.00
		ii. Household consumption	55	91.67	45	75.00
3.	Periodical deworming, vaccination, Seeking veterinary aid	i. Deworming	11	18.33	60	100.00
		ii. Vaccination	11	18.33	60	100.00
		iii. Seeking veterinary aid	8	13.33	60	100.00
4.	Hygiene and sanitation maintenance in and around the poultry farm	i. Poor	42	70.00	2	3.33
		ii. Good	15	25.00	37	61.67
		iii. Very good	3	5.00	21	35.00

Figure in parenthesis indicate number of birds

housed but after the FLD, the majority of the farmers (61.67%) maintained good hygiene and sanitation. Similar impact due to technological intervention was also reported by Patel *et al.,* (2014) and Awasthi *et al* (2015).

The average mean age at sexual maturity (23.21±0.69 weeks), age at marketing (13.00±2.2 weeks), age at first egg production (24.40±0.32 weeks) were found to be significantly ($p<0.05$) lower in technologies demonstrated under FLD than that of TFP (24.97±0.59 weeks, 14.00±3.2 weeks and 25.44±0.54 weeks respectively), while body weight at first egg production (1799.42±120 g) under FLD was found to be significantly ($p<0.05$) greater than that of TFP (1616±128). This might be due to the fact that in FLD farmers are adopting better managemental practices including hygiene, sanitation and health care measurements (Patra *et al,* 2018). A variation in the management method, feed supplement, and other environmental conditions might possibly be the cause of the disparity in the results (Patel *et al*, 2018). Vanaraja poultry birds' first egg weights at TFP and FLD were 44.17±0.38 and 45.58±0.43 respectively with no significant difference between the groups. Ghosh *et al* (2005); Niranjan *et al* (2008) were also reported first egg weight of *Vanaraja* birds was 44.86 g. A significantly ($p<0.05$) higher numbers of avg. monthly egg production (11.67±0.13) and annual egg production (140.04±1.25) were recorded in the FLD than that of TFP (9.41±0.32and 112.26±2.10) which might be due to the difference in feed, better farm and rearing condition (Patel *et al,* 2018). A significantly ($p<0.05$) higher mortality rate under TFP at 0 to 8 weeks of age (14.93±0.19) than that of FLD (6.02±0.25) was recorded in the present study which was also reflected in overall mortality pattern in TFP (19.47±0.25) and FLD (6.18±0.14). The higher mortality pattern in TFP and lower in FLD might be due to maintaining proper health care like periodical deworming, vaccination, hygiene and sanitation under FLD (Islam *et al*, 2015). Kumaresan *et al* (2008) also reported that

Table 4. Productive and reproductive results of *Vanaraja* under TFP and FLD

Sr. No.	Parameter	TFP (n=60)	FLD (n=60)
1.	Age at sexual matu rity (Weeks)	24.97 ±0.59 [a]	23.21 ±0.69 [b]
2.	Age at marketing (Weeks)	14.00 ±3.2 [a]	13.00 ±2.2 [b]
3.	Adult cock weight (g)	2650 ±1.54 [a]	3400 ±2.62 [b]
4.	Age at first egg production (Weeks)	25.44 ±0.54 [a]	24.40 ±0.32 [b]
5.	Body weight at first egg production (g)	1616 ±128 [a]	1799.42 ±120 [b]
6.	Average first egg weight (g)	44.17 ±0.38	45.58 ±0.43
7.	Average monthly egg production (no.)/bird	9.41 ±0.32 [a]	11.67 ±0.13 [b]
8.	Annual egg production (no.)/bird	112.26 ±2.10 [a]	140.04 ±1.25 [b]
9.	Mortality (%)		
a.	0 to 8 weeks	14.93 ±0.19 [a]	6.02 ±0.25 [b]
b.	9 to 24 weeks	4.20 ±0.55	0.03 ±0.02
c.	25 to 52 weeks	0.34 ±0.13	0.13 ±0.12
d.	Overall	19.47 ±0.25 [a]	6.18 ±0.14 [b]
10.	Egg colour	Tinted	Tinted

Figure in parenthesis indicate number of birds
Mean under the same superscript in a row didn't differ significantly (P<0.05)

good brooding, vaccination and balance feed practices reduces the mortality rate of *Vanaraja* poultry.

The expenses of raising 20 *Vanaraja* chickens under FLD and TFP for the age of 18 months were displayed in Table 5.

In current study the total production cost of *Vanaraja* chickens under FLD was found to be greater (Rs. 9371/-) than that of the TFP (Rs. 7141/-) this might result from the higher percentage of feed cost (10.24%) and poultry shed construction cost (21.34%) in FLD. Similar type of cost involvement in backyard poultry rearing also reported by Uddin *et al* (2013). Current finding is in contrast with the finding of Nath *et al* (2013), where he has stated that feed cost alone constituted the majority of expenditure for *Vanaraja* under backyard farming condition.

The study revealed that maximum amount of net return in case of FLD was achieved through the sale of eggs (67.61%), followed by sale of cocks (22.73%) and spent hens (9.66%). In the case of TFP, the same return trend was noted, with the biggest income coming from the sale of eggs (62.33%), followed by the sale of cock (26.54%) and the sale of spent hens (11.13%).

The total gross income and net income in FLD was recorded as Rs. 26,920 and Rs. 17,549, respectively, which was 66.75% and 61.70% higher than that of gross income (Rs. 17,970) and net income (Rs. 10,828) of TFP. The Gross Margin (Rs.) and the Net Farm Income under FLD and TFP were recorded as Rs.11,177, Rs.8178.00, Rs.5186 and Rs.3686 respectively, which indicate that scientific interventions under FLD give much more profit than that of TFP. Under FLD and TFP, the anticipated benefit cost (B: C) ratio was 2.87 and 2.52, respectively. Higher B: C ratio in case of FLD than that of TFP might be due to better management of chickens under FLD which leads to increased egg production and achievement of better body weight within the allotted time (Uddin *et al*, 2013).

Perception of farmers towards the technologies demonstrated

The factors *viz.* knowledge improvement, spreading of knowledge, livelihood improvement, social and financial security, confidence of scientific poultry farming, risk taking ability for new venture, participation in group activities, information utilization abilities and overall satisfaction were achieved a highly significant

Table 5. Estimated rearing cost of 20 *Vanaraja* under TFP and FLD ,

Sr. No.	Particular	Rearing Cost (Rs.)	
		TFP	FLD
1	Variable Cost		
A	Cost of a day old chicks @Rs. 40/ - for Vanaraja	800.00 (11.20)	800.00 (8.54)
B	Cost of feed up to the age of 42 days		
i	1.2 kg of broiler starter/ bird i.e. 24 kg @ Rs. 40/ - per kg	-	960.00 (10.24)
ii	10 kg of broken rice @ Rs. 25/ - per kg	250.00 (3.50)	-
C	Cost of vaccine @ Rs. 1.60/ chick	32.00 (0.45)	32.00 (0.34)
D	For Vanaraja chick, cost of medicine and feed supplement @ Rs. 4.00/chick	-	80.00 (0.85)
E	For Local chicken, cost of medicine and feed supplement @ Rs. 3.00/chick	60.00 (0.84)	-
F	For both the flock (FLD & TFP) cost of labour @ 10 hrs. / month = 1.25 Man -days × 18 months = 22.50 man -days × Rs. 200/ - per Man -day	4500.00 (63.01)	4500.00 (48.02)
Total Variable cost (A)		5642.00	6372.00
2	Fixed cost		
A	Land	Available with the farmers	Available with the farmers
B	Low cost poultry shed constructed from locally availabl e material (L/S)	1000.00 (14.00)	2000.00 (21.34)
C	Depreciation cost on poultry shed @ 33.33 % per year	499.95 (7.00)	999.99 (10.67)
D	Drinker/ Feeder	Locally made	Locally made
Total fixed cost (B)		1499.95	2999.00
3	Total cost of production (D = A+B)	7141.95	9371.00
4	Cost of production per bird (D/20)	357.10	468.55

data (as œ =0.000<0.05) which indicates FLD had a greater influence on *Vanaraja* poultry farming in the study area.

CONCLUSION

Ensuring the adoption of efficient scientific production technologies such as low-cost scientific housing, feeding and health care techniques in backyard *Vanaraja* poultry farming has huge potential for the resource poor tribal farmers than that of traditional rearing techniques.

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Table 6. Estimated return from *Vanaraja* chickens under TFP and FLD.

Sr. No.	Particular	TFP (n=20)	Amount (Rs.)	FLD (n=20)	Amount (Rs.)
1	Income from sale of eggs (10 female under FP and 13 Females under FLD)	Avg. annual egg production 112 eggs/ hen *i.e.* 1120 nos. of eggs @ Rs. 10/- per egg	11,200 (62.33)	Avg. annual egg productio n 140 eggs/ hen *i.e.* 1820 nos. of eggs @ Rs. 10/- per egg	18,200 (67.61)
2	Sale of cocks (6 nos. both in FLD and FP)	Avg. body weight = 2.65 Kg. Total weight = 15.90 Kg @ Rs. 300/- per Kg	4,770 (26.54)	Avg. body weight = 3.40 Kg. Total weight = 20.40 Kg @ Rs. 300/- per Kg	6,120 (22.73)
3	Sale of spent hens (13 nos. under FLD and 10 nos. under FP)	Rs. 200/ hen	2000 (11.13)	Rs. 200/ hen	2,600 (9.66)
4	Total gross income	-	17,970	-	26,920
5	Net income	-	10,828	-	17,549
6	Net income / bird	-	541.40	-	877.45
7	Gross margin (Net income – Total variable cost)	-	5186	-	11,177
8	Net Farm Income (GM-Total fixed cost)	-	3686	-	8178
9	Benefit-Cost-Ratio (BCR)	-	2.52	-	2.87

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

Sr. No.	Particular	Perception Index (PI)	Rank	Wilcoxo n Z Statistic	Significance at P=0.05
1.	Knowledge improvement	100.00	I	-8.000	0.000
2.	Spreading of knowledge among the farmers	86.50	II	-8.300	0.000
3.	Livelihood improvement	84.00	III	-7.240	0.000
4.	Social and financial security	62.00	IV	-7.280	0.000
5.	Confidence of scientific poultry farming	56.50	V	-6.250	0.000
6.	Risk taking ability for new venture	45.20	VI	-6.055	0.000
7.	Participation in group activities	42.50	VII	-6.840	0.000
8.	Information utilization ability	41.50	VIII	-6.820	0.000
9.	Overall satisfaction	40.00	IX	-7.135	0.000

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