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Production Performance of Improved Poultry under Backyard Farming System in Hill Agro-Climatic Condition in West Bengal

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ABSTRACT

Backyard poultry is primarily kept for egg and meat production on a subsistence basis in rural areas of India. Farmers usually rear desi/native type chicken having low egg and meat production potential. Krishi Vigyan Kendra (KVK), Kalimpong; the farm science centre of Uttar Banga Krishi Viswavidyalaya, demonstrated improved breeds of backyard poultry in selected farmers' field to scale up the practice in the locality by proving their potential over the local strains at micro farming situation. The present study has been conducted on two improved purebred poultry with primary objective to study the laying performance, egg production, morbidity and mortality rate and preference of farmers towards the improved poultry breed in hill agro-climatic condition. A total of 1442 Vanaraja birds, 1576 RIR birds and 986 desi birds were considered under study from 180 farmers selected for data collection. Preferences for improved poultry breeds among farmers were assessed in Garrett Ranking Method. The result shows that Vanaraja male and female attained an average weight of 0.67kg & 0.53kg, 1.54kg & 1.09kg, 2.76kg & 2.14 kg, 4.09kg & 3.48kg and 5.15kg & 4.42kg at the age of 4weeks, 10weeks, 20weeks 40weeks and 72weeks respectively. RIR male and female attained an average weight of 0.61kg & 0.52kg, 1.41kg & 1.04kg, 2.55kg & 2.11 kg, 3.04kg & 2.42kg and 3.72kg & 3.19kg at the age of 4weeks, 10weeks, 20 weeks 40weeks and 72weeks respectively. Desi male and female attained an average weight of 0.32kg & 0.29kg, 0.96kg & 0.85kg, 1.57kg & 1.48 kg, 2.54kg & 1.88kg and 2.92kg & 2.76kg at the age of 4weeks, 10weeks, 20 weeks 40weeks and 72weeks respectively. Vanaraja shows significantly higher growth rate than RIR and Desi in hill agro-climatic condition. RIR shows early sexual maturity, higher weekly egg lay, higher laying period, higher total egg production and higher eight egg weight than Vanaraja and Desi. The study also shows significant difference in sexual maturity and weekly hen lay between two improved breed in hill agro-climatic condition. The study further shows that the overall mortality and morbidity of Desi was lower than Vanaraja and RIR. The seasonal effect on mortality shows that all the varieties of poultry birds have high mortality rate during rainy season followed by winter months. The study also shows that high return on investment was the major reason for adopting improved poultry breed followed by low investment and high growth rate.

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1. Introduction

Village chicken production under the free range and semi-intensive system is one of the viable alternative systems for improving the livelihood of rural households which provide additional income and supplement protein intake in rural and tribal folks. Pathak and Nath (2013) opine that livestock and poultry rearing is an imperative factor for improving the nutritional security of rural poor in India. In the backyard farming system farmers usually rear desi/native type chicken having low egg and meat production potential. Most of these indigenous strains exhibit poor production performances. The contribution of native birds in the total poultry population has dropped from 50% about 30 years ago to about 10% now (Rangnekar and Rangnekar, 1999). Backyard poultry is primarily kept for egg and meat production on a subsistence basis in rural areas of India. Indian poultry industry has made a tremendous growth during the last four decades. Globally, India ranked third in egg production (66.45 billions) and fifth in chicken production (3.6 MT) in the year 2011-12. This increase in poultry production has enhanced the per capita availability to 55 eggs and 2.4 kg poultry meat per annum (GOI 2013). The knowledge of performance of economic traits in chicken is important for the formulation of breeding plans for further improvement in production traits. Growth and production traits of a bird indicate its genetic constitution and adaptation with respect to the specific environment (Ahmed and Singh, 2007). Loss in output might be due to genotype, ambient factors, management and climate (Cahaner and Leenstra, 1992). Similarly, earlier studies have shown that different agro-climatic zones in West Bengal have an effect on productive performance of RIR birds (Das *et al.*, 2014). It is therefore very essential to recognize potential poultry suitable for backyard farming in hill region of West Bengal which are easily adaptable to high rainfall, cold environment and high altitude. With these views, the present study has been conducted on two improved purebred poultry birds with primary objective to study the laying performance of improved purebreds, egg production, morbidity rate, mortality rate in hill agro-climatic condition and farmers' perception towards these improved poultry breeds.

2. Material and Methods

2.1 Study location

The study was carried out in backyard poultry farming system located within the Gorkhaland Territorial Administration (GTA) area. GTA is a semi-autonomous administrative body for the Darjeeling hills in West Bengal

India. GTA presently has three hill sub-divisions Darjeeling, Kalimpong, Kurseong and some areas of Siliguri Sub-division under its authority. It has an area of 3,149 square kilometers. Annual mean maximum and minimum temperature at administrative headquarter of GTA (*i.e.* Darjeeling town) is 14.9°C and 8.9°C respectively. Average rainfall is 2831.9 millimeter and average numbers of rainy days are 106 days (Anonymous, 2012). The altitude of Darjeeling town is 2134 meters above sea level.

2.2 Study design

The present investigation is about the On Farm Trial and Front Line Demonstrations conducted at farmers' field on backyard poultry by Krishi Vigyan Kendra (KVK), the farm science centre of Uttar Banga Krishi Viswavidyalaya, for Darjeeling district of West Bengal state, India. The KVK demonstrated the improved breeds of backyard poultry in selected farmers' field to scale up the practice in the locality by proving their potential over the local poultry birds at micro farming situation. Over the years improved breeds of Rhode Island Red (RIR) and Vanaraja at 4 weeks old chicks were distributed for demonstration in different blocks of the district benefitting a large numbers of farmers. The day old chicks of Rhode Island Red and Vanaraja were procured from reliable sources and kept in our institute poultry unit for 4 weeks before distributing to the farmers. During these days, the day old chicks were brooded for 20 days and also vaccinated against Marek disease, New Castle disease (Ranikhet disease) and Infectious Bursal diseases (Gumboro disease). Farmers were provided vaccines also encouraged to vaccinate Desi birds with these vaccines to prevent important poultry diseases. A total of 2000 each of Vanaraja and RIR were procured by the Kendra but 1800 each of these birds were distributed under On Farm Trail and Frontline distribution in the district. Among these 1442 Vanaraja birds, 1576 RIR birds and 986 Desi birds were considered under the study from 180 farmers (60 farmers per subdivisions) selected for data collection. Among Vanaraja birds (cock: 514, hen: 928), RIR birds (cock: 492, hen: 1084) and Desi birds (cock: 418, hen: 568)

2.3 Data analysis

Simple statistical techniques like frequency, mean and standard deviation were applied for interpretation of data using SPSS 20. Garrett's Ranking Technique (Garrett, 1981) has been used to analyze the factors influencing the preference for adopting the improved poultry breed by the respondents. The respondents were asked to rank the factors given. The order of merit, assigned by the respondents was converted into ranks by using the following formula,

Percent position of each rank = $100 (R_{ij}-0.05)/N_j$,
 Where R_{ij} = Rank given for the i^{th} factors for the j^{th} respondent.

N_j = Number of factors ranked by the j^{th} respondent

The percentage position of each rank obtained is converted into scores by referring to the table given by Henry Garrett. Then for each factors the scores of individual respondents were added together and divided by the total number of the respondents for whom the score were added. These mean scores (MS) for all the factors were arranged in order of merit and inference drawn.

The percentage position and their corresponding Garrett's table values are shown in Table 1.

Table 1. Percentage position and their corresponding Garrett Value

Rank	Percentage Position		Garrett's Table Value
1	$100(1-0.5)/8$	= 6.25	79
2	$100(2-0.5)/8$	= 18.75	67
3	$100(3-0.5)/8$	= 31.25	59
4	$100(4-0.5)/8$	= 43.75	53
5	$100(5-0.5)/8$	= 56.25	46
6	$100(6-0.5)/8$	= 68.75	40
7	$100(7-0.5)/8$	= 81.25	32
8	$100(8-0.5)/8$	= 93.75	20

3. Results and Discussion

The study shows that the average weight gain of Vanaraja birds were higher than RIR and Desi. Vanaraja male attained an average weight of 0.67kg, 1.54kg, 2.76kg, 4.09kg and 5.15kg at the age of 4weeks, 10weeks, 20weeks 40weeks and 72weeks respectively whereas Vanaraja female attained an average weight of 0.53kg, 1.09kg,

2.14kg, 3.48kg and 4.42kg at the age of 4weeks, 10weeks, 20weeks, 40weeks and 72weeks respectively. RIR male attained an average weight of 0.61kg, 1.41kg, 2.55kg, 3.04kg and 3.72kg at the age of 4 weeks, 10 weeks, 20 weeks 40 weeks and 72 weeks respectively whereas RIR female attained an average weight of 0.52kg, 1.04kg, 2.11kg, 2.42kg and 3.19kg at the age of 4weeks, 10 weeks, 20 weeks 40 weeks and 72 weeks respectively. Desi male attained an average weight of 0.32kg, 1.09kg, 1.57kg, 2.54kg and 2.92kg at the age of 4 weeks, 10 weeks, 20 weeks 40 weeks and 72 weeks respectively whereas Desi female attained an average weight of 0.29kg, 0.96kg, 1.48kg, 1.88kg and 2.76kg at the age of 4weeks, 10weeks, 20weeks 40weeks and 72weeks respectively (Table 2). The study was supported by the earlier study by Zuyie *et al.* (2009), Deka *et al.* (2014) Das *et al.* (2014) and Karunasree *et al.* (2017). Table 2 further shows that Vanaraja shows significantly ($p<0.01$) higher body weight gain than RIR at different time interval.

Table 3 shows that egg production performance of RIR is better than Vanaraja and Desi. RIR shows sexual maturity (168.34days), weekly egg lay (3.78eggs), laying period (48.58weeks), total produce (159.74eggs) and egg weight (58.42gm) in hill agro-climatic condition whereas Vanaraja shows sexual maturity (176.09days), weekly egg lay (3.38eggs), laying period (46.69weeks), total produce (148.92eggs) and egg weight (52.11 gm). Desi poultry shows sexual maturity (187.34days), weekly egg laid (2.17eggs), laying period (48.42weeks), total produce (76.59eggs) and egg weight (38.74gm.) in hill agro-climatic condition. Earlier studies by Das *et al.* (2014) in RIR under different agro-climatic region of West Bengal and in Vanaraja by Bhattacharya *et al.* (2005); Niranjana *et al.* (2008); Bharambe and Garud (2012); Islam *et al.* (2015); Sahu *et al.* (2016) are close to the present findings.

Table 2. Body weight of improved poultry breed under backyard farming system

Sl. No	Breeds	Body Wt. @4wks (kg.)		Body Wt. @10wks (kg.)		Body Wt. @20wks (kg.)		Body Wt. @40wks (kg.)		Body Wt. @72wks (kg.)	
		M	F	M	F	M	F	M	F	M	F
1.	Vanaraja (Mean±SD)	0.67±0.03 ^a	0.53±0.09 ^a	1.54±0.12 ^a	1.09±0.19 ^a	2.76±0.16 ^a	2.14±0.42 ^a	4.09±0.07 ^a	3.48±0.45 ^a	5.15±0.23 ^a	4.42±0.17 ^a
2.	RIR (Mean±SD)	0.61±0.09 ^b	0.52±0.08 ^b	1.41±0.25 ^b	1.04±0.17 ^b	2.55±0.37 ^b	2.11±0.36 ^b	3.04±0.15 ^b	2.42±0.38 ^b	3.72±0.52 ^b	3.19±0.16 ^b
3.	Desi (Mean±SD)	0.32±0.12 ^c	0.29±0.13 ^c	0.96±0.43 ^c	0.85±0.31 ^c	1.57±0.56 ^c	1.48±0.36 ^b	2.54±0.65 ^c	1.88±0.74 ^c	2.92±0.62 ^c	2.76±0.36 ^b

Note: Wt. = Weight; wks= weeks; M= male; F= female; Means bearing different superscripts in a row differ significantly ($P<0.01$).

Table 3. Laying performance of improved poultry breed under backyard farming system

Sl. No.	Breeds	Sexual maturity (days)	Weekly hen lay	Laying period (wks.)	Total produce (no./bird)	Egg weight (gm.)
1.	Vanaraja	176.09±12.17 ^a	3.38±0.57 ^a	46.69±9.12 ^a	148.92±22.48 ^a	52.11±2.36 ^a
2.	RIR	168.34±11.06 ^b	3.78±0.82 ^b	48.58±3.73 ^a	159.74±36.02 ^a	58.42±4.21 ^a
3.	Desi	187.34±21.27 ^c	2.17±0.43 ^c	34.42±3.73 ^b	76.59±27.80 ^b	38.74±9.42 ^b

Means bearing different superscripts in a row differ significantly ($P < 0.01$).

The study shows that both morbidity and mortality of Desi was found lower in hill agro-climatic condition in West Bengal. The overall mortality of Desi was 8.62 percent followed by Vanaraja (11.78%) and RIR (13.39%) and whereas morbidity was 9.60 percent in Desi followed by Vanaraja (12.44%) and RIR (14.67%). Kumaresan *et al.* (2008) also reported that mortality of the adult Vanaraja birds was 12%. The study further shows that age wise mortality rate of the two improved varieties of poultry where it was found that mortality was higher in Vanaraja birds within 4 and 10 weeks of age but RIR had higher mortality rate at 20, 40 and 72 weeks of age. The seasonal effect on mortality shows that all types of poultry birds have high mortality rate during rainy season followed by winter and summer months (Table 4). Banja *et al.* (2017) had also reported higher mortality due to cold weather but this study contradicts earlier studies by Abalaka *et al.* (2013) and Shittu *et al.* (2014) who had reported that mortality was higher in summer and rainy season. This may be due to the reason that the temperature in summer is not so high in hill as that of the plains.

Similarly, the temperature in hills is very low in hills than that of the plains, so higher mortality in cold weather. Due to lack of scientific management of the chicks during the initial 4 to 5 weeks in the village conditions is the major hurdle for success of the backyard farming. The birds need to be protected against Ranikhet disease (Kumar *et al.*, 2014). Keeping this in mind, the day old chicks were kept in the institute poultry unit for 4 weeks where they were brooded for 20 days and vaccination against Marek, New Castle Disease (Ranikhet disease) and Infectious Bursal Diseases (Gumboro disease) were given. This may also be the reason for comparatively less morbidity and mortality rate due to different diseases.

The Garrett ranking of farmers' preferences of improved poultry breed for rearing under backyard system shows that high return on investment (MS=62.66) was the major reason for adopting improved poultry breed followed by low investment (MS=52.71) and high growth rate (MS=49.61). Others reasons like early sexual maturity and higher egg weight were not the major criterion for preferring improved poultry breeds (Table 5).

Table 4. Morbidity and mortality at different age and season in improved poultry breed under backyard farming system

Sl. No.	Breeds	Morb. (%)	Mort. (%)	Age (%)					Season (%)		
				4wks	10wks	20wks	40wks	72wks	Summer	Rainy	Winter
1.	Vanaraja	12.44	11.78	30.19	16.04	18.87	15.09	19.81	16.50	50.94	32.55
2.	RIR	14.67	13.39	19.50	13.28	21.16	20.33	25.73	18.67	45.23	36.09
3.	Desi	9.60	8.62	34.29	10.00	12.86	15.71	27.14	15.71	58.57	25.71

Note: *Morb.* = Morbidity; *Mort.* = Mortality

Table 5. Preferences of improved poultry breed among farmers for rearing under backyard system (N=180)

Sl. No.	Reason for Preferences	Total Score	Mean Score	Ranking
1.	High return on investment	11279	62.66	I
2.	Low investment	9488	52.71	II
3.	Higher growth rate	8930	49.61	III
4.	Higher egg laying capacity	8450	46.94	VI
5.	Early sexual maturity	8618	47.88	VII
6.	Higher egg weight	7251	40.28	VIII
7.	Morbidity and mortality is less	8691	48.28	IV
8.	Marketing of birds is easy	8573	47.63	V

Conclusion

The study shows that the performance of Vanaraja was comparatively better than RIR in hill agro-climatic region in West Bengal in term of body weight gain and reduced mortality rate. But the performance of RIR was better than Vanaraja in term of egg production performance in the hill agro-climatic zones and both these improved poultry birds was better in productive performance than the desi birds. Therefore, it can be concluded that those farmers preferring backyards poultry only for egg purpose should adopt RIR birds where farmers preferring both meat and egg purpose should go with Vanaraja poultry birds in the hill agro-climatic situation.

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