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Backyard poultry farming empowering women for doubling farmers' income

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Abstract
Small scale backyard poultry farming in resource-poor areas is a tool for nutritional security, subsidiary income and women empowerment contributing for doubling the farmers' income. Raising indigenous poultry in backyard is an age old practice with several constraints like lack of improved varieties, high mortalities and traditional management practices. Demonstrations on semi-intensive rearing of Kamrupa chicken, developed by Assam Agricultural University and local chicken birds (each of 20 numbers) are conducted in farmers' backyard. Limited concentrate feeding was done in 1st 2 weeks. Thereafter, let them scavenge, provided with agri and kitchen wastes and sometimes supplemented with available food grains at daytime as in semi intensive system. Comparative economic calculations were done along with traditional rearing stock. Trainings were provided to the women farmers on scientific management practices and hygiene and healthcare management. Hands-on method demonstrations were done on prophylactic vaccinations of poultry. Records were taken on economic parameters viz., body weight gain for meat purpose, egg production, disease incidences, mortality rates and total cost up to either marketing or egg production for 1.5 years. The B:C ration for Kamrupa chicken, local chicken raised in semi intensive system and traditional rearing stock were 4.2, 3.1 and 1.6 respectively. However, the B:C ratios are subject to alter and go up and down based on market demand, consumer preference and social and festive seasons. Raising improved and indigenous poultry birds adopting scientific practices bear the potential to bring revolutionary change in rural economy, empower women economically ultimately contributing to doubling farmers income.

Keywords: Backyard poultry farming, empowering women, doubling farmers' income

Introduction
Backyard poultry farming is practised since ages by rural people, mostly women of North-Eastern Region of India including Assam. It is a potent and impactful tool for women's economic empowerment and livelihood promotion of the rural masses of Assam. Backyard poultry farming by and large was a low input or no input venture [21, 25]. Backyard poultry farming is mostly popular in rural and resource-poor areas of India and provides rural families with income, nutritionally rich food sources (meat and eggs), boosts up women and unemployed youths, and reduces the gap between demand and supply of poultry eggs and meat. There is hardly any requirement of infrastructure setup for backyard poultry farming and it can be easily handled by women, aged family members and children [8]. Commercial layer farming is practically non-existent in Assam [23]. In spite of low productivity, the contribution of backyard poultry towards Indian egg production is about 30 to 40 per cent [15]. Kamrupa chicken, a dual type multicolored new variety of chicken was developed by crossing Indigenous birds of Asom with a broiler parent PB-2, and a layer parent Dahlem Red, procured from Directorate of Poultry Research, Hyderabad [6]. Hence, the present comparative study was conducted to understand the performance and potential of Kamrupa with that of indigenous chicken in semi intensive backyard system of rearing compared to traditional open range local poultry raising in Nalbari district of Assam.

Materials and Methods
One hundred and fifty rural women farmers of Nalbari district were selected through Participatory Rural appraisal technique under different programmes of Krishi Vigyan Kendra, Nalbari for rearing of poultry in backyard system. One hundred participants were provided with 20 numbers of Kamrupa chicks and 50 participants were provided with 20 numbers of

indigenous or local chicks. Parellely, another 50 farmers rearing local chicken in traditional open range with too little or no care were also included for comparative studies in same economic parameters. Training for motivation and capacity building towards rearing improved poultry with scientific essence were conducted for imparting scientific skills on management, brooding, feeding, and health care. Day old chicks of Kamrupa and indigenous chicken were reared under intensive system with simplified brooding up to 2 weeks. After second week, birds were let loose for scavenging during the day time and offered limited amount of feed per bird as mixture of grains, crushed maize, boiled and broken rice and kitchen waste. The birds had access to insects, worms, seeds of grasses, tender leaves of grasses etc. on scavenging. Mineral mixtures were supplemented with feed. The chicks were vaccinated against Ranikhet and infectious bursal disease. Regular deworming was carried out with anthelmintics. Body weights at day old, 4, 8, 12, 16, 20 and 22 weeks of age, Age at first lay (AFL), Disease incidences and mortality rates were recorded.

Results and Discussion

The average body weight gain of Kamrupa and indigenous chicken in semi intensive and local chickens reared in traditional scavenging or open range system at different ages is depicted in Table 1.

Table 1: Average body weight gain of Kamrupa and indigenous chicken at different ages in semi intensive and open range system

Age	Kamrupa (av. B. wt. in g)		Indigenous (av. B. wt. in g)		Indigenous in traditional open range system (av. B. wt. in g)	
	Male	Female	Male	Female	Male	Female
Day old	38	38	29	29	29	29
4 weeks	380	320	200	170	120	80
8 weeks	740	530	380	310	190	140
12 weeks	1260	1050	530	390	260	190
16 weeks	1900	1320	650	510	390	260
20 weeks		1420		660		380
22 weeks		1400		720		485
26 weeks		1520		850		520
Shank length	75 mm		51 mm		47 mm	
Keel length	159 mm		134 mm		122	
Breast angle	85^0		54^0		47^0	

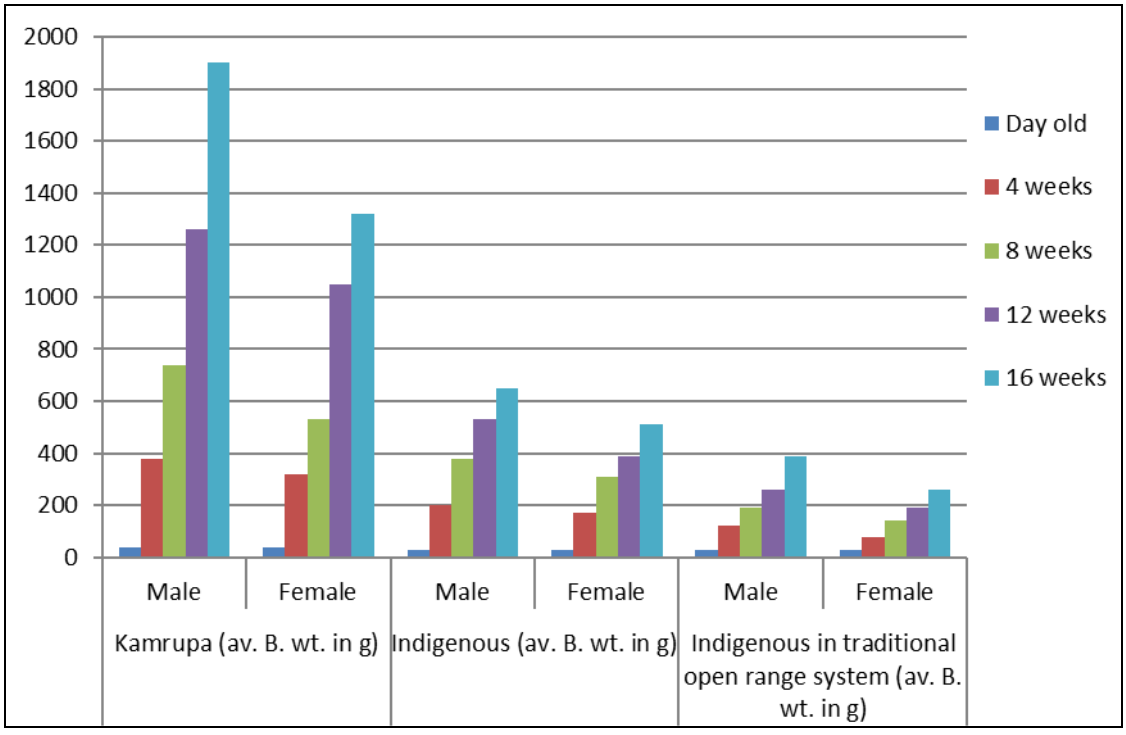

Fig 1: Week wise comparative body weight gain by 3 groups of chickens Kamrupa and Indigenous chicken reared in semi intensive system and indigenous chicken raised in traditional scavenging system.

The day old chicks of Kamrupa and indigenous chicken were 38 and 29 g respectively. There was no separation of male and female chicks up to 16 weeks when cocks and few females were sold for meat purpose on attainment of marketable body weight from both the group with a feed conversion ratio (FCR) of 2.1 and 3.4 respectively. The FCR of Giriraja, an improved poultry for backyard farming and native fowl were mentioned to be 3.1 and 4.2 respectively (ALPCO, Nakkazi *et al.* (2015) reported that the FCR of the chickens under intensive system ranged between 2.9-5.7 with a mean of 3.8, 3.6 and 4.0 feeding different dietary level of CP and KcalME/kg respectively. Feed conversion ratio (FCR) is a measure of how efficient the birds on a particular feed utilize it to gain weight. It also varies with diet, environmental conditions genotype among others. Kuietche *et al.* (2014) reported that the feed conversion ratio of local barred chickens in Cameroon increased with increase in dietary energy of the feeds while Hosseini *et al.* (2010) also reported

a similar trend on broiler chicks. However this was only observed in the fifth week when birds on the commercial diet (D18) had a higher FCR compared to the other diets. This could be as a result of inconsistence caused by feed wastage at farm level since wasted feed can be assumed to have been consumed. The body weight of day old chicks of Kamrupa birds were 37-40 g Kalita *et al.,* (2017). Deka *et al.,* (2014) reported that the day-old male chicks of Vanaraja and indigenous were 34.36 ± 0.82 and 27.85 ± 1.009 g respectively.

The average body weight gain of Kamrupa and indigenous chicken at different ages in Table 1 revealed that at 16 weeks of age Kamrupa male and female attained an average body weight of 1900 g and 1320 g respectively, whereas the corresponding weight of indigenous male and female reared in same condition were 650 g and 510 g respectively. In traditional practice the weight of local chicken at 16 weeks were only 390 and 260 g for male and female respectively. Kalita *et al.* (2016) found during their study that the body weights of the Kamrupa birds at all stages of growth reared under intensive rearing system were significantly higher than the free range system. Kalita *et al.* (2017) recorded body weight of Kamrupa birds at 8 and 20 weeks of age was 700-800 g and 1700-1800 g reared under semi intensive where as under backyard system it was 500-65- g and 1300-1500 g respectively. Deka *et al.,* (2014) reported from his survey study that the Mean (± SE) body weight gain at 24 weeks of age, Vanaraja male and female attained an average body weight of 1991.96 ± 70.70 and 1489.57 ± 65.17 g respectively, whereas the corresponding weight of indigenous male and female were 908.48 ± 17.80 and 848.70 ± 29.47 g respectively. Ramana *et al.,* (2010) reported comparatively lower body weight of Vanaraja and indigenous, which might be due to difference in managerial practices. The study of Deka *et al.,* (2014) revealed that 80% of the respondents said that their chickens did not receive enough feed, indicating that nutrition is a major constraint in family poultry production. The labour cost was considered in the study as the operation did not require any full time involvement of any person of the family and practised a semi-intensive rearing system. The performance characters viz., the shank length, keel length and breast angle of Kamrupa and indigenous birds in semi intensive system and local birds in free range scavenging were recorded to be 75 mm, 51 mm and 47 mm; 159 mm, 134 mm 122mm; 85^0, 54^0 and 47^0 respectively. Kalita *et al.* (2016) recorded the shank length, keel length and breast angle were recorded as 3.98±0.64 cm, 3.21±0.25 cm and 63.75±2.23 degree in intensive system and 4.31±0.98 cm, 3.88±0.76 cm and 62.35±2.54 degree in free range system, respectively. This Kamrupa variety has coloured plumage, mediocre body weight and longer shanks with optimum egg production. The shank length may be used as` indication of skeletal size and consequently body weight and related parameters [4]. The shank length of Gages breed at 8 weeks of age was 69.01±0.25mm. The Shank length of male and female of Ghagus birds at 16 and 24 weeks of age was 112.6±0.50, 127.9±0.55 and 98.9±0.31, 101.7±0.36mm, respectively [5]. Nordskog (1976) mentioned that length of shank is a better measure for the genetics of size than body weight. Some researchers have asserted that there were relationships between shank length and live body weight [10, 2, 15]. Tzudzuk *et al*. (2007) and Ramadan *et al*. (2014) concluded that there were significant relationships between shank and keel lengths with carcass characters. Debes *et al*. (2015) studied for possible correlation of shank length on body weight, egg production, blood parameters (plasma calcium concentration, and carcass characters of Matrouh chicken strain. There is a strong linear relationship between body weight, neck length, shank length, thigh length, keel length, breast width and back length for both Hubbard and Arboracre strains [27]. The body size component, best predicted by trunk length, is highly correlated with body weight; the compactness component is best predicted by breast angle and either breast depth or shank thickness. The combination of live weight, shank length and either breast angle or keel length of the broiler in multiple regression models is as predictive of weights of carcass fat, protein, and moisture as is the combination of carcass components, weight, specific gravity and percentage carcass weight from either the back or breast Reid *et al.* (1984).

Table 2: Performance and economic traits of Kamrupa and indigenous chicken

Trait	Semi intensive		Traditional Open range practice
	Kamrupa	Indigenous	Local
Mortality	3%	10%	60%
Healthcare	Vaccination, deworming, Mineral mixture, Antibiotic on need basis.		Nil
Age at first lay (in days)	168 days	192 days	236
Egg Production/Year/Hen	154	54	40
Egg weight			
40 weeks	49 g	40 g	36 g
72 weeks	58 g	50 g	47 g
Shell colour	Brown	Brown	Brown
Yolk colour	Yellow	Yellow	Yellow
Yolk weight	18.2 g	16.0 g	15.7 g

Kamrupa chicks were found to be sturdy and less prone to environmental stress resulting in negligible chick mortality. Majority of the mortality cases were found to be negligence of farmer and accidental. The mortality rate was found to be 3%, 10% and 60% for and local chicken raised in farmer's practice respectively. Kalita *et al*. (2017) recorded the survivability rate of Kamrupa chicken as 98% and 96% under semi intensive and backyard system respectively. The survivability rate of Kamrupa chicken was reported to be around 96% (ALPCO). Deka *et al*. (2014) found Vanaraja less prone to environmental stress and mortality of Vanaraja and indigenous birds were 4.55 ± 0.38 and 4.85 ± 0.51 per cent respectively. Kamrupa and indigenous chicken raised in semi intensive system were vaccinated against Ranikhet, Infectious bursal disease and Fowl pox disease. However, traditionally raised local stock was reared without any prophylaxis. Commercial mineral mixture, calcium supplementation and deworming were carried out particularly to the pullets and layer birds in semi intensive system. Antibiotic treatment was practised seldom to the affected birds only as and when

needed. Deka *et al*. (2014) stated that the health management of the birds was mainly through ethno veterinary medicine as only 12% of the respondents used conventional drugs. They also stated that Ranikhet disease, which was believed to be the main constraint affecting scavenging chickens in India, was not the major cause of mortality in the vaccinated scavenging chicken and the main cause of death was predator. The entire poultry keepers were not aware about vaccination against Newcastle and Infectious bursal diseases. They accounted 70% of mortality followed by predators (15%), theft (11%) and other cause including unfavourable weather condition and accident (4%). Chickens were kept mainly as a subsidiary source of income, meat and egg.

Kamrupa and indigenous chickens raised in semi intensive and traditional system laid first egg at the age 168, 192 and 236 days respectively (Table 2). Kalita *et al*. (2016) found that the Kamrupa pullets matured by 20.83 days earlier and laid 20.40 more eggs annually in intensive system compared to that of free range system. Kalita *et al*. (2017) recorded age of first lay of Kamrupa chickens as 150-170 days and 180-200 days raised under semi intensive and backyard system respectively. Deka *et al*. (2014) reported that Vanaraja and indigenous chicken attained sexual maturity at an average age of 178.13± 0.79 and 191.25 ± 1.46 days respectively. The findings of Kamrupa corroborated the results of Niranjan *et al.,* (2008a) who reported the age at sexual maturity of Vanaraja to be 164.79 days. The annual egg production of Kamrupa and indigenous chickens raised in semi intensive and traditional system was recorded to be 154, 54 and 40 respectively (Table 2). Kalita *et al*. (2016) found that the Kamrupa laid 20.40 more eggs annually in intensive system compared to that of free range system. Kalita *et al*. (2017) recorded annual egg production of Kamrupa to be 140-150 and 118-130 numbers under semi intensive and backyard system. Deka *et al*. (2014) reported that there was significant difference in annual egg production of Vanaraja (145.75 ± 1.44) and indigenous chicken (54.62 ± 1.13). Niranjan *et al.* (2008b) also reported almost similar egg production of 149.47± 4.46 numbers for Vanaraja up to 72 weeks of age. Broodiness character was shown by 10% of Kamrupa compared to 95% of indigenous or local chickens. Broodiness was not observed in Vanaraja chicken Niranjan *et al.* (2008b).

The eggs of weight laid by Kamrupa and indigenous chickens in semi intensive and traditional system at 40 and 72 weeks was recorded to be 49 and 58 g; 40 and 50 g and 36 and 47 g respectively. As per the report of Kalita *et al.,* (2016) the egg weight of Kamrupa at 32 weeks and 40 weeks were higher by 1.70 g and 2.66 g in intensive system than that of free range system. The egg quality traits, viz. shape index, albumin index, yolk index, Haugh unit, shell thickness and fertility and hatchability were better in free range system than that of intensive system. Kalita *et al.,* (2017) the egg weight of Kamrupa at 40 weeks was 55 g and 52 g in semi intensive and backyard system respectively. The egg weight of Vanaraja was recorded as 51.08 ± 0.36 and 59.06 ± 0.42 g at 40 and 72 weeks of age respectively and it was 36.12 ± 0.62 and 41.07 ± 0.48 g in indigenous chicken [5]. Numerically higher egg weight at 40th week (57.06 g) and 72nd week (62.35 g) was recorded by Niranjan *et al*. (2008b) in Vanaraja chicken. Since, egg weight is highly heritable trait, the difference among the groups might be due to utilization of exotic germplasm for the development of Vanaraja bird [25] which is also applicable to Kamrupa chicken. Egg weight variation in different genetic groups was reported by many authors [3, 12, 17]. The shell colour of both Kamrupa and local chicken eggs raised in both semi intensive and open range system was brown. The major pigment in eggshells of brown-egg laying hens is protoporphyrin IX, but traces of biliverdin and its zinc chelates are also present. The pigment appears to be synthesized in the shell gland. Recently, the genes that are involved in pigment synthesis have been identified, but the genetic control of synthesis and deposition of brown pigment in the commercial laying hen is not fully understood. The brown coloration of the shell is an important shell quality parameter and has a positive influence on consumer preference. The extent of pigment deposition is influenced by the housing system, hen age, hen strain, diet, stressors, and certain diseases such as infectious bronchitis [23]. Kalita *et al.,* (2017) reported about the colour of eggshell of Kamrupa as brown in both semi intensive and backyard. The shell colour of both types of Vanaraja and indigenous chicken egg was brown [5].

The yolk colour of both Kamrupa and indigenous chicken egg was yellow. The colour of the yolk is due to substances called carotenoids. The nutritional value of the egg is not affected by the yolk colour. The most important sources of carotenoids in poultry feed are maize (corn), maize gluten, alfalfa (lucerne) and grass meals; these sources contain the pigmenting carotenoids lutein and zeaxanthin, which, together with other oxygen-containing carotenoids, are known by the collective name of xanthophylls. The yolk Vanaraja was larger in size with dark yellow colour than indigenous chicken [5].

The average weight of egg yolk of Vanaraja and indigenous was found to be 18.70 ± 0.56 and 15.8 ± 0.68 g respectively. The weight of egg yolk of Kamrupa and local chicken eggs raised in both semi intensive and open range system was 18.2 g, 16.0 g and 15.7 g respectively. The egg yolk of Kamrupa bird was larger. Similar report was made by Deka *et al*., (2014) as the average weight of egg yolk of Vanaraja and indigenous was found to be 18.70 ± 0.56 and 15.8 ± 0.68 g respectively. The differences in yolk weight among the groups might be attributed to the differences in genotype, managemental and feeding programmes adopted [18].

The average price of eggs from all categories chickens Kamrupa and local irrespective of rearing system could fetch Rs. 6.00 per egg in all seasons. However, there was a price difference in live as well as dressed weight of meat of Kamrupa and local chickens as Rs. 200 and Rs. 240 per kg live weight respectively. There was no difference of price of local chicken based on the rearing system. Deka *et al*., 2014 reported that there was record of selling @ Rs.5 to 6/-per egg and Rs.120 to 150/- per Kg live weight of Vanaraja bird by the farmer locally with equal market demand and good realization. However, consumers acknowledged that the aroma and taste of eggs and meat from Kamrupa and Vanaraja chickens were similar to that of indigenous birds.

The benefit cost ratio of Kamrupa and indigenous chicken were found to be 4.2 and 3.1 respectively raised in semi intensive system and 1.6 for local scavenging group. Deka *et al.* (2014) recorded the benefit cost ratio of Vanaraja (3.47) to be significantly higher in comparison to indigenous chicken (2.42). Better ratio was might be due to better productive and reproductive performance of the dual purpose Kamrupa as compared to the indigenous chicken.

Conclusion

There is ample scope with immense potential of Kamrupa as well as indigenous local chicken for undertaking them as

component of backyard poultry farming by rural women for subsidiary income. The flock of these multi-coloured birds of 20 to 30 numbers per household would provide a handsome return with little extra care and comfortable shed for night shelter. The Kamrupa variety has the potential to perform better under semi intensive system of rearing with scientific management. Provision of scavenging in natural vegetation would provide excellent source of food supplemented with agri and kitchen wastes would render low or no expenditure on their maintenance. Finally, the venture of backyard poultry farming with improved poultry varieties for egg and meat production under agro-climatic condition of Assam by rural women, youths or SHGs will make them economically independent and socially empowered.

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