Original Research

Effect of Season on Performance of Broiler Chicken under Deep Litter System of Management in Assam

M. Sarma[1], M. K. Borah, K. P. Kalita[2], J. D. Mahanta[2], N. Kalita[2], J. K. Talukdar[2], P. Deka[2], T. K. Amonge[2] and R. Islam[3]*

[1]Poultry Science, Livestock Research Station, AAU, Mandira, Assam, INDIA
[2]College of Veterinary Science, AAU, Khanapara, Guwahati-781022, Assam, INDIA
[3]SMS (Animal Science), KVK, Dhubri, AAU, Bilasipara, Assam, INDIA

***Corresponding author:** dr.rafiqulvets@gmail.com

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Abstract

A total of 30 broiler farms (6 farms in each of 5 selected agro-climatic zones) were selected randomly to study the effect of season on the performance of broiler chicken in Assam. For this purpose, 400 Cobb commercial broiler chicks were utilized and were fed with ad-libitum commercial broiler feed under standard managemental conditions. The final body weight was highest during winter season (2719.95±5.92g) followed by pre-monsoon and post-monsoon season and was significantly low in monsoon season. Best FCR was found during post-monsoon (1.61) followed by pre-monsoon (1.63) as compared to winter (1.74) and monsoon season (1.76). The feed consumption and live body weight were also higher in winter season. Livability percentage varied with age and season. The BCR was recorded highest during winter season (1.20). Therefore, the best season for the small-scale broiler farmers to earn profitability in all the selected agro climatic zones was winter though they need to take extra care during chick period.

Key words: Season, Broiler, Performance, Profitability

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Introduction

The Indian poultry sector is one of the most vibrant, fastest growing, agro-based, techno-commercial industry (Bhadauria *et al.*, 2014). There are several constraints affecting growth of the poultry industry, among which temperature-associated environmental challenges, especially adverse environmental condition (hot and cold climate) imposes severe stress on birds and leads to reduced performance. Thermal discomfort may result in improper expression of genetic potential in birds (Kataria *et al.*, 2008) and production performances of broiler chicken are greatly affected due to adverse ambient temperatures

(Zahraa *et al.*, 2008). At present, climatic variation is a key threat for poultry industry, especially for marginal poultry farmers in open-house systems (Osti *et al.*, 2017).

Assam is situated within the longitude 90° E to 96° E longitude and 24° N to 28° N latitude and lies in the regime of monsoon climate of the sub-tropical belt. The climate of the state is characterized by hot-humid summer and dry and cool winter. Due to poor economic condition of the majority of the farmer, the broiler shed are kuccha, made up with locally available materials without any sophistication in open house system of management thereby highly vulnerable to a wide range of seasonal variations prevailing in Assam which greatly influences the productivity of broilers and is a key threat for broiler farmers of Assam. Hence, to provide valuable guideline to the broiler farmers, the present study was designed to determine the seasonal effect on production performances and economy of broiler production in five agro-climatic zones of Assam.

Materials and Methods

The present study was conducted in north bank plain, upper Brahmaputra valley, central Brahmaputra valley, lower Brahmaputra valley and hill plateau of Assam between the March 2017 and February 2018 in four different seasons prevalent in Assam *viz.* pre-monsoon (March to May), monsoon (June to September), post-monsoon (October to November) and winter (December to February). A total of 30 broiler farms (6 farms in each of 5 selected agro-climatic zones) were selected randomly. Data on outside (macro climate) temperature and relative humidity in all the selected zones were collected from Meteorological Report of Regional Research Stations, Assam Agricultural University and data on in-house (micro climate) temperature and relative humidity were recorded in the center of the broiler shed thrice daily at 7 am, 2 pm and 8pm during the experimental period. Parameters like body weight, feed consumption, FCR, livability and economy were studied.

For the present study, Cobb 400 broilers sourced to same hatchery were used. All the birds were fed *ad-libitum* with a commercial feed with same formulation and ingredients, sourced to the same manufacturer. Broiler pre-starter crumbs diet (23.10% CP) was given from 1st to 14th day, broiler starter diet (22.10%) was fed between the 15th and 28th day and broiler finisher diet (20.21% CP) was fed from the 29th to 42nd days. Same open-sided poultry houses were used under the same management, except for the different climates of all the four seasons under study. The broilers were reared under deep litter systems with rice husks as litter material throughout the experimental period following standard and uniform managemental procedures in all the farms. Except for standard spot-heating by hover brooder during the brooding period (0 to 14th day of age), ambient temperature in the broiler house was determined by the outside climate. Birds were vaccinated against Ranikhet disease with LaSota strain (5th day) and infectious Bursal disease with 'MB' or intermediate plus strain (14th day). Body weight, feed consumption, FCR and livability percent at day old, 14th day, 28th day and 42nd day of age were recorded in all selected farms in all the four

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seasons. Twenty percent of broilers in each farm were randomly selected and weighed in the early morning before offering any feed and water with the help of standard weighing balance. From these records, average body weight at 14th day, 28th day and 42nd day under different treatment groups were calculated. The average feed intake of farms under study were calculated on bi-weekly basis (14th day, 28th day and 42nd day) from difference of quantity of feed offered and residual feed. The average bi-weekly and total feed conversion ratio (FCR) and livability percentage of birds under different treatment groups were also calculated. The average cost of production and gross profit per kg live broiler and BCR in various seasons was calculated by adopting the formulae described by Narahari and Kumararaj (2008).

Results and Discussion

The data on average body weight, feed consumption, FCR and livability are presented in Table 1. The average body weights of broiler chicken during pre-monsoon, monsoon, post-monsoon and winter seasons were 463.91±1.80, 428.29±1.93, 450.65±1.89, 533.65±1.75 g at 14th day of age, 1341.74±2.86, 1197.36±2.98, 1322.96±2.61 and 1539.88±2.10 g at 28th day of age and 2607.07±4.26, 2127.88±4.24, 2548.34±4.70 and 2719.95±5.92 g at 42nd day of age day of age, respectively. The broilers achieved significantly (P≤0.05) higher body weight during winter followed by pre-monsoon, post-monsoon and monsoon seasons in all the age groups. Rajini *et al.* (2009) and Ali *et al.* (2015) also recorded lower body weight for broilers reared during summer as compared to those reared during winter.

Table 1: Effect of seasons on production performances of broiler

Parameters	Day	Seasons			
		Pre-monsoon	Monsoon	Post-monsoon	Winter
Mean body weight (g)	14	463.91^{a}±1.80	428.29^{b} ±1.93	450.65^{c} ±1.89	533.65^{d} ±1.75
	28	1341.74^{a} ±2.86	1197.36^{b}±2.98	1322.96^{c}±2.61	1539.88^{d}±2.10
	42	2607.07^{a} ±4.26	2127.88^{b}±4.24	2548.34^{c}±4.70	2719.95^{d}±5.92
Mean feed consumption (g)	0 - 14	443.32^{a} ±8.99	406.15^{b} ±6.29	431.18^{a} ± 6.06	539.72^{c} ± 6.08
	0 - 28	1747.36^{a} ±13.38	1660.3^{b}±14.80	1729.23^{a}±13.19	2177.33^{d}±16.90
	0 - 42	4246.68^{a} ±20.12	3756.45^{b}±22.17	4095.20^{c}±23.43	4739.02^{d}±23.89
FCR	0 - 14	0.96	0.95	0.95	1.01
	0 - 28	1.3	1.39	1.31	1.41
	0 - 42	1.63	1.76	1.61	1.74
Livability (%)	0 - 14	99.30^{a} ±0.12	99.40^{a} ±0.19	99.33^{a} ±0.13	97.23^{b} ±0.13
	15 - 28	99.23^{a} ±0.18	99.40^{a} ±0.15	99.23^{a} ±0.17	98.50^{a} ±0.15
	29 - 42	99.10^{a} ±0.12	97.24^{b} ±0.13	99.40^{a} ±0.13	99.47^{a} ±0.11
	0 - 42	97.83^{a} ±0.14	96.04^{b} ±0.13	97.97^{a} ±0.13	95.20^{c} ±0.14

In a more recent study in open-house system in Nepal, Osti *et al.* (2017) recorded highest body weight in winter and lowest in the summer. Contrary to the present observation, Nembilwi (2002) and Thirumalesh *et al.* (2012) stated that season did not significantly influence (P>0.05) body weight of broilers. In the present investigation, the significantly (P≤0.05) lower body weight during monsoon season as compared to

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winter, pre-monsoon and post-monsoon season might be due the combined effect of high temperature and humidity that changes the favourable micro-climatic condition for optimum growth of broiler chicken (Imik *et al.*, 2012 and Bhadauria *et al.*, 2014). The optimal temperature range for efficient production for broiler chickens over 4 weeks of age was 18 - 21˚C (Aengwanich and Simaraks, 2004). During this season the highest temperature and humidity inside the broiler shed (*i.e.* micro-climate) was recorded as 36.39ºC and 85.37 per cent respectively and the highest outside (macro-climate) temperature recorded was 40.7ºC. Further, at high temperature birds tend to consume less feed (Abu-Dieyeh, 2006; Akyuz 2009 and Ali *et al.*, 2015) affecting the body weight gain.

Moreover, during monsoon due to heat stress the serum cortisol level increases. Cortisol, involves in production of additional glucose from non-carbohydrate sources of the body, particularly through catabolism of muscle proteins i.e. gluconeogenesis. The wasting of muscle protein was another reason for lower body weight of broiler chicken during monsoon (Anonymous). The significantly (P≤0.05) higher body weight during winter as compared to other seasons might be due to in-house comfortable condition resulting favourable microclimatic condition for broiler chicken and higher feed intake. More feed consumption resulted in higher body weight gain (Al-Fataftah and Abu-Dieyeh, 2007 and Ali *et al.*, 2015). Broiler chickens adapted more easily to lower temperature than to higher temperature (Manning and Wyatt, 1990). The optimal temperature range for efficient production for broiler chickens over 4 weeks of age is 18 – 21ºC (Aengwanich and Simaraks, 2004) and the thermo-neutral zone of poultry is 12.77 – 23.89ºC. El Boushy and Van Marle (1978), further defined the comfort zone of broilers with temperature between 15 to 25°C and 60-65% humidity, where the birds are able to regulate their heat balance relatively well and do not spend much energy on activity (Syafwan *et al.*, 2011). During winter season the temperature and humidity inside the broiler shed (*i.e.* micro-climate) was recorded as 25.10- 19.95^{0}C and 57.82–72.71 per-cent, respectively, which falls almost within the thermo-neutral *i.e.* comfort zone. At thermo-neutral zone the birds exhibit its maximum genetic potential in obtaining body weight and growth (Anonymous).

The mean feed consumption of broiler chicken among different seasons differed significantly (P≤0.05), wherein the broilers consumed significantly (P≤0.05) higher feed in winter followed by pre-monsoon, post-monsoon and monsoon seasons. Mahanta *et al.* (2008), Haque (2011), Al-Rahman (2011) and Ali *et al.* (2015) also observed significantly increased feed consumption during winter than in the summer season. Contrary to the present findings, in a recent study Osti *et al.* (2017) detected no significant differences in feed intake among broilers reared in winter and summer seasons in Nepal. In the present finding, significantly (P≤0.05) lower feed consumption during monsoon season might be due to high temperature and humidity. During monsoon season, when the environmental temperature was high, the bird had to maintain the balance between heat production and heat loss. In order to maintain this balance, they consumed less feed to reduced metabolic heat production (Anonymous). On the other hand, significantly

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(P≤0.05) higher feed consumption during winter as compared to pre-monsoon, monsoon and post monsoon season in the present study might be due to lower ambient temperature. At low ambient temperature with artificial heat management in the shed to its optimum requirement birds remain comfortable and their normal physiological activity gets maintained. Under such situation the birds consumed feed up to its highest possible level which resulted in maximum feed consumption.

At 42nd days of age, the overall FCR of broiler chicken during pre-monsoon, monsoon, post-monsoon and winter seasons was 1.63, 1.76, 1.61 and 1.74 respectively. Numerically higher FCR was observed during Monsoon and winter season while better FCR was observed during pre-monsoon and post-monsoon seasons. Mahanta *et al.* (2008) also observed significantly ($P \leq 0.05$) better FCR in post-monsoon and poorest in winter season. Interestingly, Doley *et al.* (2015) also recorded better feed conversion ratio of chicks in pre-monsoon than those in monsoon season. However, Imaeda (2000) indicated that feed conversion efficiency was nearly constant during summer and winter which contradicted the present findings. Koknaroglu and Atilgan (2007) also recorded no significant difference in FCR in winter, spring, summer and fall. The higher FCR in the present study during winter as compared to pre-monsoon and post-monsoon season might be due to lower ambient temperature where part of energy is diverted to maintain the balance between body temperature and environmental temperature (Tabler *et al.*, 2013 and Osti *et al.*, 2017). The poor FCR during monsoon season might be the result of high environmental temperature during monsoon that brings about a reduction in feed consumption and efficiency in the utilization of feed energy for production purposes (Howlider and Rose, 1989). The mean livability percentage of broiler chicken up to 42 days of age, during pre-monsoon, monsoon, post-monsoon and winter seasons was 97.83±0.14, 96.04±0.13, 97.97±0.13 and 95.20±0.14 respectively which was within normal range, however significantly (P≤0.05) lower livability percentage was recorded during winter season followed by monsoon season. The significantly (P≤0.05) higher livability percentage in the present study during pre-monsoon and post-monsoon season might be due to comfortable house temperature for broiler chicken. The significantly lower livability (P≤0.05) of adult broiler chicken (29-42 days of age) during monsoon season might be due to higher environmental temperature which increased the incidence of heat stroke (Anonymous). On the other hand significantly (P≤0.05) lower livability of broiler chick (0 - 14 days of age) during winter season was due to low temperature which was sometimes worsened by power cut particularly in night time resulting in sudden huddling and consequent death of the chicks. However, the overall livability was found to be above 95% that is considered normal for broiler enterprises.

The season wise cost of production per kg live broiler was found to be (Rs.) 91.19, 96.89, 90.78 and 95.63 for pre-monsoon, monsoon, post-monsoon and winter seasons respectively (Table 2). The cost of production per kg live broiler was found to be highest in monsoon season followed by winter, pre-monsoon and post-monsoon season.

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Table 2: Effect of seasons on cost of production and profitability of broiler

Parameters	Seasons			
	Pre-monsoon	Monsoon	Post-monsoon	Winter
Cost of day-old chick (Rs.)	47.7	46.9	54.27	53.87
Cost of broiler pre-starter feed (Rs.)	38.96	36.76	37.64	38.48
Cost of broiler starter and finisher feed (Rs.)	36.64	34.36	34.92	35.44
Sale price of per Kg live broiler (Rs.)	105.33	101.27	107.3	115.23
Production cost per kg live broiler (Rs.)	91.19	96.89	90.78	95.63
Gross profit per kg live broiler (Rs.)	14.14	4.34	16.52	19.6
BCR	1.15	1.04	1.18	1.2

Gross profit per kg live broiler was found to be (Rs.) 14.14, 4.34, 16.52 and 19.60 for pre-monsoon, monsoon, post-monsoon and winter seasons respectively (Table 2). Hence, gross profit per kg live broiler was highest in winter season and lowest in monsoon season. The higher cost of production during monsoon and winter was mainly due to higher FCR in the concerned seasons. Despite higher cost of production, the gross profit was found to be highest in winter season due to higher market price of ready birds as market price of live broiler was the major contributing factor affected gross return in different seasons (Ali *et al.*, 2015). However, during summer the cost of production was higher as against the lower sale price realization that resulted in lowest profit. These findings were in agreement with the reports of few earlier workers (Rahman *et al.*, 2003 and Ali *et al.*, 2015) who also found higher profit in winter than in summer season. Ramdur *et al.* (2010) and Ali *et al.* (2015) also registered less sale value per bird in summer, rainy and winter season respectively.

The season wise overall mean BCR during pre-monsoon, monsoon, post-monsoon and winter seasons were 1.15, 1.04, 1.18 and 1.20 respectively (Table 2). Numerically best BCR was found in winter season followed by post monsoon and pre-monsoon season. However, lowest BCR was recorded during monsoon season. Ali *et al.* (2015) also recorded significantly ($P \leq 0.05$) better BCR in winter than that of summer season. However, Haque (2011) described highest BCR in rainy season followed by winter and summer ($P \leq 0.05$) in Bangladesh. The highest BCR during winter season was due to the higher body weight, better FCR as compared to monsoon season and high market price of live broiler in winter season. During pre-monsoon and post-monsoon the BCR was better than the summer. It might be due to better FCR and better price realization during those seasons as compared to monsoon season.

Conclusion

The final body weight was highest during winter season followed by pre-monsoon and post-monsoon season and was significantly low in monsoon season. Best FCR was found during post-monsoon season followed by pre-monsoon season as compared to winter and monsoon season. However, the feed consumption and live body weight was higher in winter season. Livability percentage varied with age and

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season. Significantly lower livability percent was recorded in young chicks in winter. However, livability in adult birds was lowest in monsoon. From profitability point of view, the winter season was the best followed by pre-monsoon and post-monsoon season, however negligible gross profit was recorded in monsoon season. The best season for the small scale broiler farmers to earn profitability in all the selected agro climatic zones was winter though they need to take extra care during chick period. The farmers may try to manipulate the environmental factors in order to obtain better livability, FCR and body weight in monsoon season.

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