



Evaluation of Comparative Performance of Native X PB2, Dahlem Red Chicken and Their Crosses under Intensive Management System in Chhattisgarh

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ABSTRACT

Background: Developing and propagating location-specific rural chicken varieties appropriate for the current circumstances in various regions of the nation is the goal of the AICRP on Poultry Breeding. In regards to this, the current study evaluated the production performance of Native × PB2 cross chicken, Dahlem Red and their crosses under an intensive management system in the Chhattisgarh region, with the goal of developing a new location-specific dual purpose breed.

Methods: At the Poultry Demonstration and Experimental Unit, College of Veterinary Science and Animal Husbandry, Anjora, DSVCKVV, Durg, 240 day-old chicks from each group were raised under intensive management system. They were assessed for body weight (g) at day old, 4, 8, 12 and 20 weeks of age; shank length and keel bone length at 20, 32 and 40 weeks of age; age at sexual maturity (ASM); hen housed egg production (HHEP), hen day egg production (HDEP) at 28, 32 and 40 weeks of age; and egg weight at 28, 32, 36 and 40 weeks of age.

Result: There were significant ($P \leq 0.05$) differences among all 3 genetic groups for body weights, shank and keel length, sexual maturity, egg production and egg weight. Body weights at different age differed significantly between three groups; irrespective of age Native X PB2 (1607.38 ± 9.24 g) crossbred recorded higher body weight compared to Dahlem Red (1185.17 ± 7.80 g) and Dahlem Red X (Native X PB2) (1480.35 ± 12.16 g) crosses at 20 weeks of age. The age at sexual maturity differed significantly and lowest age of sexual maturity was recorded for Native X PB2 (166.25 ± 1.49 days) crossbred. Egg weight at 40 weeks of age differed significantly and recorded higher for Dahlem Red (61.73 ± 0.85 g) followed by Dahlem Red X (Native X PB2) (52.36 ± 0.88 g) than Native X PB2 (50.57 ± 0.10 g) crossbred. The hen day egg production up to 40 weeks of age was higher for Dahlem Red (54.63 ± 0.66) followed by Dahlem Red X (Native X PB2) (50.11 ± 0.76) crosses than Native X PB2 (31.69 ± 0.90) cross. The study concluded that Native X PB2 crosses may be useful for coloured meat birds and Dahlem Red X (Native X PB2) may be useful for dual purpose bird and Dahlem Red may be useful for layer type bird under same management and rearing conditions.

Key words: Body weight, Crosses, Dahlem red, Performance traits, Shank length.

INTRODUCTION

Backyard poultry farming is popular among rural and tribal areas in many countries, where it is challenging to establish the necessary infrastructure for commercial poultry production and where it is seen as an additional source of income generation (Niranjan *et al.*, 2008). The study revealed that poultry farming has been rising 5 times more than that of the agriculture crop production, which in turn pushed India to attain a substantial position in the world market (Toor and Goel, 2024). In Chhattisgarh one third of the population belongs to tribal community, the backyard poultry farming is a traditional practice and part of tribal culture and social system.

In the state of Chhattisgarh, there are estimated 187.12 lakh poultry, out of which 85.6 lakh of them are backyard chickens and 101.52 lakh are commercial chickens indicating an increase of 36.18% backyard poultry production increased from the previous census, but commercial poultry output declined by 13 percent (Anonymous, 2019). The demand for local chicken and egg is very high both in organised and rural markets, the meat and eggs produced by these indigenous chickens are highly valued for their

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flavour and texture (Sapkota *et al.*, 2002). The price differential between indigenous birds and commercially produced birds, which ranges from 50% to 100%, is indicative of this (Conroy *et al.*, 2005).

Notwithstanding these benefits and opportunities, low egg output and slower growth rates are the main barriers

to the backyard poultry production of Indigenous and nondescript chicken. This may be due to the lack of proper breeding plans for improving Indigenous birds for better and efficient production and are limited to certain pockets only. Thus, in an effort to boost backyard poultry production output, improved breeds that resemble native chickens or are phenotypically identical to native fowl are currently being widely introduced in the area (Singh *et al.*, 2002). Different backyard poultry breed (Vanaraja, Gramapriya, Srinidhi, CARI-shyama, Krishibro *etc.*) have been created by several institutes but they are not location specific, which is a disadvantage even though they work well. It follows that it is possible to create a breed that is appropriate for the climate of a given area by combining native genetics with local breeds to promote growth and productivity. In order to create a location-specific dual-purpose rural poultry variety, the AICRP on Poultry Breeding was reoriented towards rural poultry during the 2014-15 year, a three-breed cross will be used, with 25% inheritance from local native germplasm, 25% inheritance from improved broiler germplasm and remaining 50% inheritance from RIR/ Dahlem Red followed by selection and inter se mating (Anonymous, 2019). In the context of this, PB-2 (Punjab broiler-2), a synthetic-colored broiler female line obtained from the Directorate of Poultry Research, Hyderabad, is being used and crossed with native male (N) chicken of Chhattisgarh to produce the F1 generation (Native X PB2).

The F1 generation is then crossed with an improved variety, Dahlem Red, a layer parent obtained from the Directorate of Poultry Research, Hyderabad. Dahlem Red is an egg-purpose breed of chickens, imported from Germany to India. It is a red-feathered breed laying brown tinted eggs with good egg weight and known for its high disease tolerance and immune competence (Kundu *et al.*, 1999). This breed is used to produce improved germplasm suitable for backyard rearing in India. Thus, the objective of this study is to compare and analyze the production of Dahlem Red, the Native X PB2 cross and their crosses that were raised in an intensive system.

MATERIALS AND METHODS

A total of 240, day-old F1 crossbred chicks T1 (Native X PB2) obtained from Poultry Demonstration and Experimental Unit, College of Veterinary Science and

Animal Husbandry, Anjora, Durg and 240-day-old Dahlem Red chicks (T2) procured from Directorate of Poultry Research, Hyderabad were randomly split into four replicates, each containing 60 chicks and were housed separately in intensive system of rearing at farm. Once they reached sexual maturity, the female of Dahlem Red and the male of F1 crossbred were retained in the ratio of 1:6 and crossed using a flock mating technique on the farm to create the F2 crossbred chicks (Dahlem Red X (Native X PB2)(T3). The 240 day old F2 crossbred chicks obtained were reared under deep litter system at farm.

All chicks were brooded up to six weeks of age and thereafter transferred in floor pens on deep litter system for a period of 40 weeks. The birds were provided starter feed up to 0 to 6 weeks, grower feed 7 to 18 weeks and layer feed 18 weeks onwards (NRC, 1994). All the chicks were immunized against Ranikhet disease by using F1 and Lasota strain on 7 and 30 days respectively. Gumboro (IBD) disease vaccine was administered on 14 and 26 days by using intermediate strain. Standard management and healthcare practices were followed throughout the experimental period and were kept constant for all 3 genetic groups.

Performance of 3 genetic groups was assessed by collecting data on body weights at 0 day, 4, 8, 12 and 20 weeks of age using an electronic balance. Keel and shank length of birds were measured using Vernier callipers at 20, 32 and 40 weeks of age. Age of sexual maturity; hen day egg production (HDEP), hen housed egg production (HHEP) and Egg weight were recorded at 28, 32, 36 and 40 week of age.

Means and standard errors of various productions were calculated using standard statistical procedures (Snedecor and Cochran, 1994). Analysis of Variance (one way) to test the significance and Duncan's multiple range tests was carried out to compare the means of various traits of 3 genetic groups by using SPSS 25 software.

RESULTS AND DISCUSSION

Body weight

Body weight of three genetic groups at 0, 4, 8, 12 and 20 weeks of age is tabulated in (Table 1). Body weight was recorded significantly ($P \leq 0.05$) higher for Native X PB2 cross than Dahlem Red and Dahlem Red X (Native X PB2) crosses except at day old age. Day old body weight was

Table 1: Growth performance of Native X PB2 cross, Dahlem Red and Dahlem Red X (Native X PB2) crosses at different period of age.

Traits	Native X PB2 cross (T1)	Dahlem red (T2)	Dahlem red X (Native X PB2) (T3)	P- value
Body weight (g)				
Day old	33.09 $\pm$ 0.187 ^b	34.012 $\pm$ 0.23 ^a	34.23 $\pm$ 0.20 ^a	0.000
4 weeks	215.00 $\pm$ 2.96 ^a	168.71 $\pm$ 1.91 ^c	188.61 $\pm$ 2.83 ^b	0.000
8 weeks	506.50 $\pm$ 3.88 ^a	370.36 $\pm$ 5.85 ^c	464.10 $\pm$ 3.52 ^b	0.000
12 weeks	851.07 $\pm$ 3.36 ^a	640.99 $\pm$ 9.39 ^c	811.43 $\pm$ 5.50 ^b	0.000
20 weeks	1607.38 $\pm$ 9.24 ^a	1185.17 $\pm$ 7.80 ^c	1480.35 $\pm$ 12.16 ^b	0.000

a,b,c Means with different super scripts differ significantly ($P \leq 0.05$) with in a row.

recorded significantly ($P \leq 0.05$) higher in Dahlem Red X (Native X PB2) crosses (34.23 ± 0.20 g) followed by Dahlem Red (34.012 ± 0.23 g) and lowest value recorded in Native X PB2 (33.09 ± 0.187 g) group. At 4 week of age body weight was recorded significantly ($P \leq 0.05$) higher in Native X PB2 (215.00 ± 2.96 g) group followed by Dahlem Red X (Native X PB2) (188.61 ± 2.83 g) and lowest value recorded in Dahlem Red (168.71 ± 1.91 g) group. There was significant variation at 8 week body weight of Native X PB2 (506.50 ± 3.88 g), Dahlem Red (370.36 ± 5.85 g) and Dahlem Red X (Native X PB2) (464.10 ± 3.52 g) group. Among all three genetic group body weight was recorded significantly ($P \leq 0.05$) higher in Native X PB2 (851.07 ± 3.36 g) followed by Dahlem Red X (Native X PB2) (811.43 ± 5.50 g) and lowest value recorded in Dahlem Red (640.99 ± 9.39 g) at 12 week of age. However, at 20 week of age body weight recorded significantly ($P \leq 0.05$) higher in Native X PB2 (1607.38 ± 9.24 g) group than Dahlem Red X (Native X PB2) (1480.35 ± 12.16 g) and Dahlem Red (1185.17 ± 7.80 g) group. In the present investigation the Native X PB2 crossbred chicks had weekly body weights that were significantly higher than those of the dahlem red and dahlem red X (Native X PB2) groups under an intensive farming method. It might be due to the superior performance of Native X PB2 crossings results from the paternal inheritance from the 50% broiler parent line (PB2) that was used to develop the crosses. Birds' production and reproduction traits are influenced by their body weight, which is a direct reflection of their growth (Niranjan *et al.*, 2008). Numerous researchers have revealed a considerable impact of genetic group on the body weight of chickens (Mohammed *et al.*, 2005, Chatterjee and Sharma, 2007). Similar body weight estimated in the present study was consistent with report of Shivaprasad *et al.* (2017) in Dahlem Red chicken. The present investigation reports that lower body weight was noted in Jharsim birds by Kumar *et al.* (2018), in Kamrupa chicken by Sharma *et al.* (2020) and Kalita and Talukdar, (2022a) under intensive system. However, the current study is in contrast to previous research that found increased body weight in the Dahlem Red bird (Jha *et al.*, 2013; Jha *et al.*, 2015), Kamrupa birds (Kalita *et al.*, 2016) Himsamridhi chicken (Sankhyan and Thakur, 2019) and Pratapdhan birds

(Bhati *et al.*, 2021) and PD-1 x PD-4 (two way cross improved Aseel) (Rajkumar *et al.*, 2021).

Confirmation traits

The shank and keel length for each of the three groups at 20, 32 and 40 weeks of age are presented in (Table 2). Significant differences ($P \leq 0.05$) between different genetic groups were observed for both shank and keel length irrespective the age of measurement. At 20 weeks of age shank length of Dahlem Red was highest followed by Native X PB2 and Dahlem Red X (Native X PB2). The diversity and utilization of parents influencing the crossbred's shank length at different weeks of age is indicated by significant shank length between different crosses. Shank length recorded at 32 weeks of age showed significant ($P \leq 0.05$) difference between different crosses. Highest shank length was obtained in Dahlem Red (64.27 ± 0.49 mm) followed by Native X PB2 (61.81 ± 1.10 mm) and Dahlem Red X (Native X PB2) (60.37 ± 0.62 mm) group. Shank length was significantly ($P \leq 0.05$) longer in the Dahlem Red group at 40 weeks of age than in the Dahlem Red X (Native X PB2) group. In accordance with Kundu *et al.* (2015), higher shank length was observed in F1 crosses; literature revealed substantial differences in shank length between genetic groups at different ages. Shank length increased considerably with age, in line with the findings of Chinni *et al.* (2018). In contrast to the current study, Kalita and Talukdar, (2022a) measured lower shank length in Kamrupa chicken and Kalita *et al.* (2012) in indigenous chicken. The various combinations and use of parents influencing the crossbred's shank length at different weeks of age, is indicated by significant differences in shank length between crosses. In the present study keel bone length was recorded significantly ($P \leq 0.05$) higher in Native X PB2 (110.67 ± 0.42 mm) followed by Dahlem Red X (Native X PB2) (97.20 ± 0.41 mm) and Dahlem Red (94.90 ± 0.62 mm) at 20 week of age. During 32 week of age keel bone length was recorded significantly ($P \leq 0.05$) higher in Native X PB2 (112.95 ± 0.49 mm) and lowest value in Dahlem Red X (Native X PB2) (104.30 ± 0.82 mm). At 40 week of age keel bone length was recorded as 114.00 ± 0.44 mm, 109.04 ± 0.77 mm and 107.51 ± 0.87 mm, respectively in Native X PB2, Dahlem Red and Dahlem Red X (Native X PB2). According to present

Table 2: Body confirmation traits of Native X PB2 cross, Dahlem Red and Dahlem Red X (Native X PB2 cross) crosses at different period of age.

Traits	Native X PB2 cross (T1)	Dahlem red (T2)	Dahlem red X (Native X PB2) (T3)	P-value
Shank length (mm)				
20 weeks	59.33 ± 0.25^a	59.55 ± 0.39^a	56.29 ± 0.42^b	0.000
32 weeks	61.81 ± 1.10^b	64.27 ± 0.49^a	60.37 ± 0.62^b	0.000
40 weeks	63.02 ± 1.31^a	64.09 ± 0.58^a	60.36 ± 0.62^b	0.000
Keel length (mm)				
20 weeks	110.67 ± 0.42^a	94.90 ± 0.62^c	97.20 ± 0.41^b	0.000
32 weeks	112.95 ± 0.49^a	109.50 ± 0.67^b	104.30 ± 0.82^c	0.000
40 weeks	114.00 ± 0.44^a	109.04 ± 0.77^b	107.51 ± 0.87^b	0.000

a,b,cMeans with different super scripts differ significantly ($P \leq 0.05$) with in a row.

research lower keel length was documented by Kalita *et al.* (2012) in indigenous chicken of Assam. Similar finding was reported by Thirunavukkarasu *et al.* (2024).

Production performance

The averages of different production performance are presented in (Table 3). The age of sexual maturity (ASM) was reported significantly ($P \leq 0.05$) delayed in Dahlem Red (180.75 ± 0.75 days) followed by Dahlem Red X (Native X PB2) (172.50 ± 3.42 days) and Native X PB2 (166.25 ± 1.49 days) group. In accordance to the present findings delayed age of sexual maturity was reported by Singh *et al.* (2000) in Aseel breed and by Shivaprasad *et al.* (2017) in Dahlem red bird (181.02 days), by Yadav *et al.* (2017) in Ankaleshwar breed of poultry and by Thakur *et al.* (2020) in Himsamridhi variety of chicken (184 ± 2.5 days) and by Sarma *et al.* (2018) in Vanaraja (187.45 ± 1.02 days) and Shrinidhi chicken (189.78 ± 2.07 days). Jha *et al.* (2013) reported that Dahlem Red matures at the age of 143.65 days, Desi bird at 212.43 days and their crosses at 171.38 days in contrast to present investigation. Significant ($P \leq 0.05$) difference between crosses for ASM is in agreement with the report of Niranjana *et al.* (2008) and Haunshi *et al.* (2009). The Egg production at 28, 32 and 40 weeks of age showed significant ($P \leq 0.05$) difference between crosses (Table 3.). Hen housed egg

production and hen day egg production at 40 week of age were significantly ($P \leq 0.05$) higher in Dahlem Red and Dahlem Red X (Native X PB2) crosses than Native X PB2 crosses. The egg weights differed significantly ($P \leq 0.05$) between different crosses at all the ages of measurements at 28, 32, 36 and 40 weeks of age. The egg weight of three groups was presented in (Table 4). At 40 weeks highest egg weight was found in Dahlem Red and Dahlem Red X (Native X PB2) than Native X PB2 crosses. The egg weight of Native X PB2, Dahlem Red and Dahlem Red X (Native X PB2) group at 28 weeks were 38.01 ± 0.70 g, 43.97 ± 1.20 g and 44.13 ± 1.05 g, egg weight at 40 weeks of age were 50.57 ± 0.10 g, 61.73 ± 0.85 g and 52.36 ± 0.88 g, respectively. Higher egg weight and egg production in Dahlem Red X (Native X PB2) crosses might be due to the paternal inheritance of Dahlem Red birds utilized in developing the crosses. As the age's increases the egg weight increases, this was in agreement with the reports of Padhi *et al.* (2013). In accordance with present investigation lower hen day egg production recorded by Haunshi *et al.* (2009) and by Kumar *et al.* (2018) in Jharsim chicken at 40 week of age. In comparison to present finding, Sankhyan and Thakur, (2019) in Himsamridhi chicken, Dinesh *et al.* (2021) observed higher hen day egg production and hen housed egg production in Dahlem Red, Dahlem Red X Native and

Table 3: Production traits of Native X PB2 cross, dahlem red and dahlem red X (Native X PB2 cross) crosses at different period of age.

Traits	Native X PB2 cross (T1)	Dahlem red (T2)	Dahlem red X (Native X PB2) (T3)	P- value
ASM (Days)	166.25 ± 1.49^b	180.75 ± 0.75^a	172.50 ± 3.42^b	0.004
Egg production 28 weeks				
HDEP	13.21 ± 0.65^a	9.58 ± 0.32^b	11.59 ± 0.47^a	0.000
HDEP	12.82 ± 0.63^a	9.58 ± 0.32^b	10.16 ± 0.34^b	0.000
Egg production 32 weeks				
HDEP	28.18 ± 1.11^a	22.26 ± 0.61^b	27.15 ± 0.68^a	0.000
HDEP	27.21 ± 1.07^a	21.10 ± 0.53^b	20.86 ± 0.57^b	0.000
Egg production 36 weeks				
HDEP	32.41 ± 0.96^b	41.97 ± 0.82^a	41.18 ± 0.64^a	0.000
HDEP	24.00 ± 0.78^c	33.54 ± 0.79^a	27.73 ± 0.41^b	0.000
Egg production 40 weeks				
HDEP	31.69 ± 0.90^c	54.63 ± 0.66^a	50.11 ± 0.76^b	0.000
HDEP	23.43 ± 0.73^c	42.94 ± 1.02^a	31.44 ± 0.58^b	0.000

a,b,c Means with different super scripts differ significantly ($P \leq 0.05$) with in a row.

Table 4: Egg weight of native X PB2 cross, dahlem red and dahlem red X (Native X PB2) crosses at different period of age.

Traits	Native X PB2 cross (T1)	Dahlem red (T2)	Dahlem red X (Native X PB2) (T3)	P- value
Egg weight (g)				
28 weeks	38.01 ± 0.70^b	43.97 ± 1.20^a	44.13 ± 1.05^a	0.000
32 weeks	49.05 ± 1.04	51.36 ± 1.94	49.24 ± 1.21	0.471
36 weeks	50.51 ± 1.63	54.16 ± 1.23	50.81 ± 0.92	0.112
40 weeks	50.57 ± 0.10^b	61.73 ± 0.85^a	52.36 ± 0.88^b	0.000

a,b,c Means with different super scripts differ significantly ($P \leq 0.05$) with in a row.

Dahlem Red X Native X Dahlem Red crosses and by Kumar *et al.* (2018) in Jharsim chicken. The egg weight reported by Sharma and Hazary, (2002) in Vanaraja birds ranged from 42 to 44 g, while Sheikh *et al.* (2018) found that crossbred birds had an egg weight of 44.6 g at 40 weeks of age, which was less than that was found in the current study. The egg weight estimated in this study was in line with Bharambe and Garud, (2012) who recorded that egg weight was higher in purebred (48.81 g) than crossbred (48.12 g). Kalita *et al.* (2012) recorded that the egg weight at 40 weeks of age were 35.42 ± 2.29 g in indigenous chicken of Assam and Iqbal *et al.* (2009) recorded 46.06 ± 0.48 g in indigenous chicken of Kashmir, which was lower than present finding. Kalita *et al.* (2017) recorded that egg weight at 40 weeks of age was 39.64 ± 2.53 g in PB-2 x Indigenous bird and 48.60 ± 3.55 g in Dahlem Red bird, respectively which was lower than the finding of present investigation.

CONCLUSION

In order to give farmers additional alternatives, more crosses are always needed for backyard poultry production. Crossbred birds showed better growth performance, body confirmation characteristics, reduced FCR and early age of sexual maturity, superior egg production and egg weight. In light of this, the current study examined the productivity of Dahlem Red, Native X PB2 crosses and their crosses. The majority of the attributes showed substantial differences between Native X PB2, Dahlem Red and Dahlem Red X (Native X PB2) performance during the starter, grower and laying periods. Native X PB2 cross will be a good color meat type birds due to faster growth rate than other group, Dahlem Red X (Native X PB2) may be an excellent option for backyard poultry production because of their better growth rate and increased egg output. Dahlem Red could be used as a layer birds. The overall performance of the crosses demonstrated that they could be more beneficial than raising native birds and could be used and propagated as low-input technology birds in a rural poultry farming system in Chhattisgarh based on a number of characteristics, including growth, confirmation, egg production and egg weight.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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