

# Comparative Performance of Different Varieties of Chicken in Eastern Hill and Plateau Region of India

Bal Krishna Jha\*, Asit Chakrabarti, Virendra Kumar Yadav and Pradip Kumar Sarkar

ICAR Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region, Ranchi, Plandu-834010, Jharkhand, INDIA

\*Corresponding Author: [bkjhaicar@gmail.com](mailto:bkjhaicar@gmail.com)

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## Abstract

*A comparative performance of different varieties of chicken namely Divyan Red, Vanaraja, Kaveri and Kadaknath was conducted during 2018-19 to find out an economical variety for rearing of poultry in Eastern Hill and Plateau Region of India. Chickens were randomly distributed into 4 groups of 100 each. The birds were reared under uniform and standard managerial practices. The study was conducted for 16 months (480 days) till the egg laying was ceased by the chickens. Various parameters were recorded at timed interval. The external and internal egg quality traits of different varieties were also determined. Significantly ( $P < 0.05$ ) higher egg weight ( $60.56 \pm 0.83$ g), shape index ( $77.16 \pm 0.56$ ), egg shell weight ( $5.96 \pm 0.07$ g), shell % ( $12.57 \pm 0.51$ ), albumen index ( $9.12 \pm 0.32$  %), and yolk index ( $51.41 \pm 0.43$  %) was found in Divyan Red followed by Vanaraja, Kaveri and Kadaknath respectively. The highest number of egg production was recorded in Vanaraja ( $168.66 \pm 14.01$ ) followed by Kaveri ( $159.77 \pm 13.88$ ), Divyan Red ( $157.47 \pm 13.55$ ) and least in Kadaknath ( $105.45 \pm 11.52$ ) respectively. The body weight was found to be significantly ( $P < 0.05$ ) higher in Divyan Red ( $2194.21 \pm 21$ g) followed by Vanaraja ( $2168.56 \pm 53.16$ g), Kaveri ( $1936.29 \pm 50.12$ g) and Kadaknath ( $1605.24 \pm 49.21$ g). Total weight gains (g) were significantly ( $P < 0.05$ ) higher in Divyan Red ( $1926.64 \pm 53.73$ ) and least in Kadaknath ( $1424.34 \pm 47.21$ ). Similarly, significantly ( $P < 0.05$ ) higher average daily weight gain (g/bird) was also recorded in Divyan Red ( $8.03 \pm 0.17$ ) and least in Kadaknath ( $5.94 \pm 0.10$ ). The total feed intake (kg/bird) was significantly ( $P < 0.05$ ) higher in Divyan Red and Vanaraja as compared to other two varieties of chicken. However, the FCR values were significantly ( $P < 0.05$ ) better in Divyan Red and Vanaraja than the Kaveri and Kadaknath. It was concluded that the chicken varieties Vanaraja, Divyan Red and Kaveri were equally better in respect of egg production and age at first egg in Eastern Hill and Plateau Region of India.*

**Keywords:** Different Chicken Varieties, Eastern Hill and Plateau Region, India, Performance

## Introduction

Jharkhand is mostly populated by tribal population and egg and poultry meat are the major protein sources in this area. Poultry have a major role in the supply of animal protein to humans in the form of egg and meat. More than 80% of the world poultry population is in village production systems, contributing up to 90% of poultry products in some developing countries (Guèye, 1998). Village poultry makes a substantial contribution to household food security throughout the developing world. It diversifies income, provides high-quality food and fertilizer, and acts as form of household savings and insurance. Indigenous and local breeds still contribute meaningfully to poultry meat and egg production and consumption in developing countries, where they make up to 90% of the total poultry population (Besbes, 2009). Keeping scavenging poultry is an activity that is generally carried out by women; it also contributes to women's empowerment. A study in the Niger Delta (Alabi *et al.*, 2006) showed that family poultry husbandry contributed 35% of the income of household women, and it was estimated at about 25% and 50% of Nigerian minimum wage and per capita income, respectively (Alabi *et al.*, 2006). Furthermore, experiences in Bangladesh and other countries have shown that village chicken can be used as a tool for poverty alleviation (Jensen and Dolberg, 2002). The indigenous chicken varieties are well adapted and they produce eggs and meat that is being exploited by the stakeholders for better livelihood. In Jharkhand, several different varieties of chicken like Divyan Red, Vanaraja, Kaveri and Kadaknath are being reared by the rural people for meat and egg production. The comparative performance of these varieties of chicken in terms of growth rate, egg production and egg qualities has not been evaluated so far in the place under study. Therefore, a study was conducted to evaluate the performance of four different varieties of chicken in Eastern Hill and Plateau Region of India.

## Materials and Methods

The study was carried out at the ICAR Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region, Ranchi, Poultry Research Farm under Livestock Production Unit during 2018-19.

### Management and Evaluation Trial

The average initial body weight of four different varieties of chicken namely Divyan Red, Vanaraja, Kaveri, and Kadaknath (4 weeks old;  $267.57 \pm 3.12$ ,  $263.42 \pm 2.15$ ,  $222.83 \pm 5.82$  and  $180.56 \pm 4.88$  g, respectively) were randomly distributed into 4 groups as T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> of 100 each. The birds were reared in poultry shed of deep litter system having feeders and waterers under uniform managemental condition up to 16 months of age. The body weight (g) was recorded at monthly intervals and feed consumption (g/day) was recorded daily for each group of chicken.

### Performance and Egg Quality Evaluation Trial

The trial was conducted using male: female sex ratio of 1: 5 after doing the segregation at sex differentiation of different varieties of chicken. The bird from each group was randomly selected to determine the body weight at monthly intervals. The feed actually consumed was measured on weekly basis. Feed was offered twice daily at 10.00 am and 3.00 pm and actual feed intake was determined. During the egg collection period, eggs from each chicken variety were collected before offering the daily meal. The external and internal qualities of 10 numbers of eggs from each variety of chicken were determined as per standard methods and the following formula described by Singh (1985).

### Experimental Groups and Treatments

The experimental birds were divided into 4 groups viz., T<sub>1</sub> (Divyan Red), T<sub>2</sub> (Vanaraja), T<sub>3</sub> (Kaveri) and T<sub>4</sub> (Kadaknath). All birds were fed concentrate mixture uniformly on dry matter basis. The feed formula is presented in Table 1. The feed was given to growers (9-20 weeks) and Layers (20 weeks and above) in the morning and evening as per standard schedule. The leftover feed was recorded next day before offering the fresh feed.

**Table 1:** Feed formula of grower and layer mash

S. No.	Ingredients (Kg)	Grower mash (9-20 weeks)	Layer mash (20 weeks & above)
1	Yellow maize	44	44
2	Rice polish	15	14
3	Wheat bran	15	10
4	Ground nut cake	16	20
5	Fish meal	6	8
6	Mineral mixture	2	2
7	Bone meal	1.5	1.5
8	Salt	0.5	0.5
9	Vitablend A, B <sub>2</sub> & D <sub>3</sub>	20 g	20 g
10	CP (%)	21.67	20.14
11	ME (Cal/Kg)	2700	2600

### Statistical Analysis

The data were analyzed using two ways ANOVA (Snedecor and Cochran 1989). The results were expressed as mean and pooled standard error of mean.

### Results and Discussion

The body weight of different varieties of chicken was recorded at fortnightly intervals up to 240 days of age (Table 2). It was observed from 30 days onwards that T<sub>1</sub> attained significantly ( $P < 0.05$ ) higher final body weight (267.57 g) than T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, respectively. The final body weight was found to be significantly ( $P < 0.05$ ) higher in Divyan Red (2194.21 ± 21g) followed by Vanaraja (2168.56 ± 53.16g), Kaveri (1936.29 ± 50.12g) and Kadaknath (1605.24 ± 49.21g). The higher final body weight in Divyan Red in comparison to other varieties might be due to better feed utilization. Jha and Chakrabarti (2017) found that the meat- feed ratio was 2.89 in Divyan Red bird, which indicates that meat production was economically remunerative.

**Table 2:** Fortnightly and monthly changes of body weight (g) of different varieties of chicken

Age in days	Divyan Red (T <sub>1</sub> )	Vanaraja (T <sub>2</sub> )	Kaveri (T <sub>3</sub> )	Kadaknath (T <sub>4</sub> )
30 days	267.57±3.12 <sup>a</sup>	263.42±2.15 <sup>b</sup>	222.83±5.82 <sup>c</sup>	180.56±4.88 <sup>d</sup>
45 days	316.14±4.10 <sup>a</sup>	300.25±3.45 <sup>b</sup>	299.17±3.11 <sup>b</sup>	235.23±4.12 <sup>c</sup>
60 days	425.22±5.56 <sup>a</sup>	410.11±6.78 <sup>b</sup>	390.12±6.32 <sup>c</sup>	304.79±5.35 <sup>d</sup>
75 days	677.32±9.15 <sup>a</sup>	649.33±8.54 <sup>b</sup>	611.32±9.35 <sup>c</sup>	409.56±7.14 <sup>d</sup>
90 days	980.44±15.55 <sup>a</sup>	962.37±27.49 <sup>a</sup>	940.47±21.54 <sup>b</sup>	622.21±16.14 <sup>c</sup>
120 days	1149.56±26.59 <sup>a</sup>	1175.17±37.49 <sup>a</sup>	1084.64±34.25 <sup>b</sup>	815.55±30.25 <sup>c</sup>
150 days	1498.27±38.25 <sup>a</sup>	1474.35±43.14 <sup>a</sup>	1285.12±47.35 <sup>b</sup>	1021.48±41.23 <sup>c</sup>
180 days	1688.52±41.22 <sup>a</sup>	1656.39 ± 43.21 <sup>a</sup>	1456.37±39.56 <sup>b</sup>	1233.12±40.12 <sup>c</sup>
210 days	1897.33±48.25 <sup>a</sup>	1865.45±47.46 <sup>a</sup>	1691.45±41.23 <sup>b</sup>	1398.23±42.26 <sup>c</sup>
240 days	2194.21±57.11 <sup>a</sup>	2168.56±53.16 <sup>a</sup>	1936.29±50.12 <sup>b</sup>	1605.24±49.21 <sup>c</sup>

*a, b, c & d with different superscripts in a row are significantly different at  $P < 0.05$*

The external and internal egg quality traits of different varieties of chicken are depicted in Table 3. The egg weight (60.56±0.83g), shape index (77.16±0.56), egg shell weight (5.96 ± 0.07g), shell % (12.57±0.51), albumen index (9.12±0.32 %) and yolk index (51.41±0.43 %) were found to be significantly ( $P < 0.05$ ) higher in Divyan Red as compared to other varieties. Sakunthaladevi and Reddy (2004) reported a shape index value of 72.52 in White

Leghorn layers, which is similar with the value of Kaveri variety of chicken. Sinha *et al.* (2018) reported the average shell weight and shell thickness which ranged from 4.14 to 5.62 g, and 0.36 to 0.39 mm respectively in Vanaraja and Gramapriya chicken. The Kadaknath chicken showed significantly ( $P<0.05$ ) lower egg weight ( $47.13\pm 0.63$ g), shape index ( $68.71\pm 0.21$ ), egg shell weight ( $5.71\pm 0.04$ g), and yolk index ( $42.56\pm 0.14$  %) as compared to other varieties. The Kaveri showed significantly ( $P<0.05$ ) lower albumen index ( $7.66\pm 0.42$  %) amongst the all varieties. Padhi *et al.* (1998) reported lower shell thickness (0.31) in Nicobari indigenous fowl against the present value of 0.43 mm in all the four varieties. Subramanian *et al.* (2001) reported lower albumin index (7.3%) in free ranging peahen. Singh *et al.* (2000) studied various reproduction and production performance traits of Aseel chicken under field condition and they reported an average egg weight of 47g, which is similar to the Kadaknath birds. The findings of Gupta *et al.* (2007) in respect of egg quality traits of different varieties of backyard chicken differed significantly except shape index.

**Table 3:** External and internal egg quality traits of different varieties of chicken

Parameters	Divyan Red (T <sub>1</sub> )	Vanaraja (T <sub>2</sub> )	Kaveri (T <sub>3</sub> )	Kadaknath (T <sub>4</sub> )
Weight of egg (g)	60.56±0.83 <sup>a</sup>	55.30±0.80 <sup>b</sup>	54.46±0.73 <sup>b</sup>	47.13±0.63 <sup>c</sup>
Shape index	77.16±0.56 <sup>a</sup>	74.82±0.46 <sup>b</sup>	72.46±0.42 <sup>b</sup>	68.71±0.21 <sup>c</sup>
Egg shell thickness (mm)	0.43±0.005	0.43±0.010	0.43±0.002	0.43±0.007
Egg shell weight (g)	5.96 ± 0.07	5.84 ± 0.05	5.89 ± 0.08	5.71 ± 0.04
Shell (%)	12.57 ± 0.51	12.43 ± 0.49	11.99 ± 0.50	12.41 ± 0.43
Albumen index (%)	9.12 ± 0.32 <sup>a</sup>	8.15 ± 0.33 <sup>b</sup>	7.66 ± 0.42 <sup>c</sup>	7.99 ± 0.31 <sup>c</sup>
Yolk index (%)	51.41 ± 0.43 <sup>a</sup>	47.68 ± 0.40 <sup>b</sup>	46.12 ± 0.39 <sup>b</sup>	42.56 ± 0.14 <sup>c</sup>

*a, b & c with different superscripts in a row are significantly different at  $P<0.05$*

The egg production performance of different varieties of chicken is depicted in Table 4. The age at first egg (AFE) of Divyan Red ( $170.29\pm 5.23$ ), Vanaraja ( $172.33\pm 4.48$ ) and Kaveri ( $169.54\pm 5.17$ ) chicken did not differ significantly and was in the range of 169.54 to 172.33 days. However, AFE value ( $180.23\pm 5.69$  days) of Kadaknath variety was significantly ( $P<0.05$ ) higher than the other varieties of chicken. Anonymous (2017) reported that age at first laying of Kadaknath variety was recorded higher (22 weeks) in comparison to improved varieties of Vanaraja (18 weeks) and Gramapriya (20 weeks). Significantly ( $P<0.05$ ) higher egg production was recorded for Vanaraja chicken at 480 days of age (68.57 weeks) followed by Kaveri, Divyan Red and Kadaknath. The present finding was in conformity with Deka *et al.* (2014) that Vanaraja was superior in terms of egg and meat production if managed effectively under agro climatic condition of Assam. Further, Niranjana *et al.* (2008) also reported that Vanaraja, a dual-purpose chicken has become popular among the rural people as one of the income generating activity especially for the rural women. In another study, Jha and Chakrabarti (2017) reported that Divyan Red variety was found to contribute significantly in improving the income of rural tribal people under backyard system of rearing.

**Table 4:** Egg production (numbers) performance of different varieties of chicken

Age in days	Divyan Red (T <sub>1</sub> )	Vanaraja (T <sub>2</sub> )	Kaveri (T <sub>3</sub> )	Kadaknath (T <sub>4</sub> )
180	11.11±1.12 <sup>a</sup>	9.13±1.59 <sup>a</sup>	7.16±2.11 <sup>a</sup>	2.16±1.99 <sup>b</sup>
210	21.12±2.22 <sup>a</sup>	15.45±3.01 <sup>b</sup>	11.21±2.89 <sup>b</sup>	5.23±2.56 <sup>c</sup>
240	33.56±4.56 <sup>a</sup>	30.56±7.02 <sup>a</sup>	23.19±6.56 <sup>b</sup>	14.59±6.12 <sup>c</sup>
270	48.23±5.55 <sup>a</sup>	52.42±6.17 <sup>a</sup>	36.46±4.98 <sup>b</sup>	23.23±5.02 <sup>c</sup>
300	65.21±8.12 <sup>a</sup>	75.49±5.59 <sup>b</sup>	52.21±6.45 <sup>c</sup>	39.43±7.33 <sup>d</sup>
330	87.56±8.67 <sup>a</sup>	99.47±9.12 <sup>b</sup>	79.46±8.55 <sup>b</sup>	51.41±9.10 <sup>c</sup>
360	107.14±7.48 <sup>a</sup>	123.29±9.33 <sup>b</sup>	99.54±9.12 <sup>c</sup>	62.59±9.15 <sup>d</sup>
390	121.16±12.33 <sup>a</sup>	137.27±7.55 <sup>b</sup>	12.23±8.33 <sup>c</sup>	70.38±10.12 <sup>d</sup>
410	131.19±10.59 <sup>a</sup>	147.48±11.33 <sup>b</sup>	136.26±12.13 <sup>c</sup>	78.47±10.25 <sup>d</sup>
440	138.33±12.22 <sup>a</sup>	156.38±11.45 <sup>b</sup>	148.68±11.11 <sup>c</sup>	88.45±12.02 <sup>d</sup>
450	147.45±14.12 <sup>a</sup>	163.87±14.55 <sup>b</sup>	153.89±13.78 <sup>c</sup>	98.88±12.88 <sup>d</sup>
480	157.47±13.55 <sup>a</sup>	168.66±14.01 <sup>b</sup>	159.77±13.88 <sup>a</sup>	105.45±11.52 <sup>c</sup>

*a, b, c & d with different superscripts in a row are significantly different at  $P<0.05$*

The mean body weight, daily weight gain, total feed intake and feed conversion ratio (FCR) of different varieties of

chicken at 480 days of age are presented in Table 5. The mean body weight and average daily weight gain of Divyan Red and Vanaraja was significantly ( $P<0.05$ ) higher than Kaveri and Kadaknath chicken. Anonymous (2017) observed that the body weight of Vanaraja chicks at different ages was higher in both the sexes followed by Gramapriya and Kadaknath. Mathivanan and Selvaraj (2003) recorded higher body weight in White Leghorn breed as compared to Kadaknath chicken.

**Table 5:** Mean ( $\pm$ S.E.) body weight, daily weight gain, total feed intake and Feed Conversion Ratio (FCR) of different varieties of chicken at 480 days of age

Parameters	Divyan Red (T <sub>1</sub> )	Vanaraja (T <sub>2</sub> )	Kaveri (T <sub>3</sub> )	Kadaknath (T <sub>4</sub> )
Body weight (g)	1926.64 $\pm$ 53.73 <sup>a</sup>	1905.14 $\pm$ 48.68 <sup>a</sup>	1713.46 $\pm$ 51.63 <sup>b</sup>	1424.34 $\pm$ 47.21 <sup>c</sup>
Average daily weight gain (g/bird)	8.03 $\pm$ 0.17 <sup>a</sup>	7.94 $\pm$ 0.15 <sup>a</sup>	7.14 $\pm$ 0.12 <sup>b</sup>	5.94 $\pm$ 0.10 <sup>c</sup>
Total feed intake (kg/bird)	23.20 $\pm$ 40.31 <sup>a</sup>	22.96 $\pm$ 41.42 <sup>a</sup>	21.38 $\pm$ 39.22 <sup>b</sup>	20.56 $\pm$ 38.45 <sup>c</sup>
FCR	12.04 $\pm$ 0.52 <sup>a</sup>	12.05 $\pm$ 0.43 <sup>a</sup>	12.48 $\pm$ 0.39 <sup>b</sup>	14.43 $\pm$ 0.20 <sup>c</sup>

*a, b & c with different superscripts in a row are significantly different at  $P<0.05$*

The total feed intake (kg/bird) was significantly ( $P<0.05$ ) higher in Divyan Red and Vanaraja as compared to other two varieties of chicken. However, the FCR values were significantly ( $P<0.05$ ) better in Divyan Red and Vanaraja than the Kaveri and Kadaknath. It indicated that the Divyan Red and Vanaraja both were comparatively better in converting feed into egg and meat. Jha and Chakrabarti (2017) also reported that the Divyan Red provides a lot of meat due to their large sizes and also lays a bigger eggs compared to those of desi chickens.

## Conclusion

The evaluation of comparative performance of different varieties of chicken indicated that Vanaraja, Kaveri and Divyan Red proved to be superior in terms of egg production and AFE in Eastern Hill and Plateau Region of India. These improved chicken varieties could be introduced in rural areas under backyard poultry rearing system for enhancing income level and providing employment opportunities and livelihood security to the stakeholders.

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## Conflict of Interests

There is no conflict of interest.

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## References

1. Alabi, R.A., Esobhawan, A.O., & Aruna, M.B. (2006). Econometric determination of contribution of family poultry to women's income in Niger-delta, Nigeria. *Journal of Central European Agriculture*, 7, 753- 760.
2. Anonymous. (2017). Annual Report. ICAR Research Complex for Eastern Region, Patna, Bihar, pp.66-67.
3. Besbes, B. (2009). Genotype evaluation and breeding of poultry for performance under suboptimal village conditions. *World's Poultry Science Journal*, 65, 260-271.
4. Deka, P., Sarma, M., Parsha, J.N., Rupam, B., Jogadev, M. & Binapani, D. (2014). Production performance of Vanaraja bird under Traditional system of rearing in Assam. *International Journal of Livestock Research*, 4(2), 81-85.
5. Gueye, E.F. (1998). Village egg and fowl meat production in Africa. *World's Poultry Science Journal*, 54, 73-86.

6. Gupta, C. S., Kumar, A., Arya, R., Patel, M., Ghosh, A. K., & Palod, A. (2007). Evaluation of egg quality of crossbred chickens reared under backyard farming in tarai areas of Uttaranchal. *Indian Journal of Animal Research*, 41, 216 – 219.
7. Jensen, H.K., & Dolberg, F. (2002). The Bangladesh Model and other experiences in Family Poultry Development. A conceptual framework for using poultry as a tool in poverty alleviation. INFPD E Conferences. International Network for Family Poultry Development. ([http://www.fao.org/ag/AGInfo/subjects/en/infpd/econf\\_bang.html](http://www.fao.org/ag/AGInfo/subjects/en/infpd/econf_bang.html)).
8. Jha, B.K. & Chakrabarti, A. (2017). Backyard poultry farming as a source of livelihood in Tribal village- An Economic Appraisal. *International Journal of Agricultural Science and Research*, 7(1), 267-274.
9. Mathivanan, R. & Selvaraj, P. (2003). Influence of dietary chromium on egg production and quality parameters in layers. *Indian Journal of Poultry Science*, 38, 51-53.
10. Musharaf, M. (1990). Rural poultry production in Sudan. Proceedings of International workshop on Rural Poultry Development in Africa, Ife-Ife, 160 –165.
11. Niranjana, M., Sharma, R.P., RajKumar, U., Chatterjee, R.N., Reddy, B.L.& Bhattacharya, T.K. (2008). Egg quality traits in chicken varieties developed for back yard poultry farming in India. *Livestock Research for Rural Development*, 20 (12).
12. Padhi, M.K., Rai, R.B., Senani, S. & Saha, S.K. (1998). Assessment of egg quality in different breeds of chicken. *Indian Journal of Poultry Science*, 33, 113-115.
13. Sakunthaladevi, K. & Reddy, P.M. (2004). Effect of strain on physical egg quality characteristics in White Leghorn layers; *Indian Journal of Poultry Science*, 39, 190-192.
14. Singh, V., Gupta, R.K., Singh, M. & Gurung, B.S. (2000). Reproduction and production performance of Aseel an indigenous breed of chicken; *Indian Journal of Poultry Science*, 35, 200-204.
15. Singh, R.A. (1985). *Poultry Production*. 2<sup>nd</sup> edition. Kalyani Publishers, Daryaganj, New Delhi (India)-110002.
16. Sinha, B., Mandal, K. G., Kumari, R., Kumari, A. & Gonge, D. S. (2018). Genetic impact on external and internal egg quality traits of Vanaraja and Gramapriya birds and their crosses in Bihar. *Indian Journal of Animal Research*, 52, 953-958.
17. Snedecor, G.W. & Cochran, W.C. (1989). *Statistical methods*. 8<sup>th</sup> edition. Iowa state University Press, Ames, Iowa.
18. Subramanian, K.S., Rajavelu, D. & Narahari, D. (2001). Studies on the nesting behaviour and egg characteristics of free ranging peahen (*Pavo cristatus*). *Indian Journal of Poultry Science*, 43, 284-286.

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