PERFORMANCE OF MEAT PURPOSE HYBRID CHICKEN UNDER INTENSIVE SYSTEM

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ABSTRACT

A study was carried out at Livestock farm, IAAS, Chitwan, Nepal in 2011 to identify the best compatible genotypes of hybrid male parents with available breeds of female chicken for the meat production. The measureable traits were egg weight, day old chick weight, feed consumption, body weight gain, infertility, hatchability, feed conversion ratio and meat quality. Research results revealed that the Black Australorp were the best performer with respect to egg size (57.50±0.95 g.) compared with other breeds such as Sakini, New Hampshire and Lohmann Brown. The highest body weight of chicks at eight weeks age was observed in the case of F_1 progenies of LIR crossed with New Hampshire (1388.33±44.57 g.). On female lines, Sakini (1211.50±48.82 g.) and Black Australorp (1404.50±48.82 g.) were found the best compatible with Cobb 500. On other hand, New Hampshire (1388.33±44.57 g.) and Lohmann Brown (1334.54±46.55 g.) were observed the best compatible with LIR while considering body weight until 8th week of age observed. The Black Australorp hen compared fairly well with comparison to other female lines in terms of growth up to eight weeks of age. Although, the F_1 progenies of LIR and Cobb 500 grew faster, on the basis of FCR, the progenies of Giriraja crossed with Black Australorp (2.63) was observed good performer, which indicated that if the feed consumption could be increased, progenies of Giriraja crossed with Black Australorp will be the best compatible breeds for meat production.

Key words: Chicken, body weight, feed conversion ratio, compatible genotype etc.

INTRODUCTION

Poultry are important birds raised in commercial scale in Nepal. Commercial poultry farming has been spread all over the country. In Nepal, it is growing at a rate of 15% per annum involving over 30,000 farm families directly or indirectly in this sector. About 2.5 to 2.7 million layers and about 16 Million broilers are produced annually. The total investment in this sector amounts to about Rs. 10 billion (Nakarmi, 2001).

Total meat production in Nepal during 1999/00, 2004/05, 2007/08 and 2008/09 was 189160, 1214817, 233900 and 241690 metric ton, respectively. Out of that poultry alone contributed 12659, 15461, 16712, and 16662 m. ton respectively (CBS, 2009). The highest annual growth rate of poultry meat (5.2%) compared to other during 1998/ 99 also indicates that poultry meat production is increasing every year over other meat. But per capita meat consumption in Nepal was quite low (456 g. in comparisons to that of world *i.e.* 6.849g.) (FAO, 1999).The knowledge gained from this study would facilitate in devising the economically efficient breeding management and appropriate breeding strategies to be followed in future. Hence, this study aims to identify the best compatible parents for the meat production under intensive system and their economic analysis of F_1 hybrid progenies.

MATERIALS AND METHODS

The experiment was conducted from third week of January to last week of September, 2011 at IAAS Livestock farm, Rampur, Chitwan, Nepal. Twenty female chicken from each breed of Sakini, New Hampshire, Black Australorp and Lohmann Brown Classic and four male chicken form each breed belonging to meat type broilers Cobb 500, LIR and Giriraja were selected as experimental birds. The mating design has been presented in table 1.

Table 1. Mating design of male and female chickens for experimental purpose.

♂ (Male) / ♀ (Female)	Giriraja (GR)	Cobb 500 (C500)	LIR (LIR)
New Hampshire (NH)	NH×GR (T1)	NH×C500 (T5)	NH×LIR (T9)
Black Australorp (BA)	BA× GR (T2)	BA×C500 (T6)	BA×LIR (T10)
Lohmann Brown (LB)	LB× GR (T3)	LB×C500 (T7)	LB×LIR (T11)
Sakini (SK)	SK×GR (T4)	SK×C500 (T8)	SK×LIR (T12)

The breeding combinations were made by separating each female line into three groups (see table 1). The conception of the male to the female for the production of fertile eggs to make hatch for day old chicks, was made by the artificial insemination. The parent birds were fed the layers pellet feed containing 2800 Kcal/kg energy and 17.6% CP. The male and female parents were fed 160 and 120 g feed per day. The F_1 progenies were fed diets with the broiler B_0, B_1, B_2 and B_3 ration containing 23%, 21%, 20% protein and 2900 Kcal, 3000 Kcal, 3150 Kcal and 3200 Kcal energy respectively. Measurements were realized for effect of genetic groups on egg weight and weight of day old chicks, feed consumption and body weight gain, fertility and hatchability, meat quality and economics of growing different groups of hybrid progenies.

The records of F_1 progenies of different breed interaction were statistically and economically analyzed by using Harvey Statistical Software (1990) further, the pair wise comparison on the mean for significant differences was made using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Average egg weight of different female parents crossed with hybrid males

The overall mean of egg weight of different female parents considered for this study was observed 54.97±0.25 g. The results of this study revealed that the egg weight was significantly affected ($p<0.005$) by genetic groups. Accordingly, highest egg weight (57.50±0.95 g) was observed in Black Australorp among the different genetic lines. In addition, there was significant difference in the egg weight of Black Australorp mated with LIR hybrid broiler breed. And this resembled the highest weight as compared to the egg weight of other genetic combinations. Wyatt *et al*. (1985) reported that egg weight is a dominant factor in determining chick hatch weight, which was also observed in this study.

Average weight traits of F_1 crossbred progenies

Research results also showed that the overall mean of day old chick weight was observed 37.34±0.21 g. It was also revealed that the weight of day old chicks was significantly affected ($p<0.01$) by genetic groups. Accordingly, highest weight (38.81±0.65 g) of day old chicks was observed in the case of F_1 progenies of Lohmann Brown×Cobb 500 among the different genetic lines. Besides, female line of Sakini was best compatible with Cobb 500 and that of Black Australorp, New Hampshire,

and Lohmann Brown were best compatible with LIR, Giriraja, and Cobb 500 respectively while considering the weight of day old chicks.. Sklan *et al.* (2003) reported that additional phenotypic effects affecting broiler growth were relationships between egg size and early muscle development and Entiting *et al.* (2007) reported that growth were relationships between albumen proportion and embryonic growth.

Thus, Giriraja, LIR and Cobb 500 maleswere best compatible to New Hampshire, Black Australorp and Lohmann Brown respectively than other females.

The results of this study revealed that the weight of chicks in every week was significantly affected ($p<0.05-<0.001$) by genetic groups.The overall mean of weekly body weight of chicks from one week to eight week was observed 74.30±0.85 g, 157.83±2.25 g, 271.73±3.19 g, 414.05±5.25 g, 576.15±7.01 g, 760.65±8.26 g, 661.59±11.91 g, and 1198.59±13.10 g respectively. Accordingly, highest weight of eight week chicks (1404.50±48.82 g) was observed in the case of F_1 progenies of Black Australorp × Cobb 500 among the different genetic lines. Besides, female line of Sakini and Black Australorp was best compatible with Cobb 500 than that of New Hampshire and Lohmann Brown were best compatible with LIR while considering the weight of eight week old chicks.

Table 2. Effect of genetic group on body weight of eight week chicks of different breed interaction raised under intensive system at IAAS Livestock Farm

Breed interaction	No. of observations	Least square mean (g)
Overall	144	1198.51±13.10
Sakini x Giriraja	11	$957.72±46.55^{ef}$
Sakini x LIR	10	$925.50±48.82^{f}$
Sakini x Cobb 500	10	$1211.50±48.82^{bcd}$
Black Australorp x Giriraja	19	$1217.89±35.42^{bcd}$
Black Australorp x LIR	11	$1305.45±46.55^{ab}$
Black Australorp x Cobb 500	10	$1404.50±48.82^{a}$
New Hampshire x Giriraja	14	$1146.07±41.26^{de}$
New Hampshire x LIR	12	$1388.33±44.57^{a}$
New Hampshire x Cobb 500	10	$1274.50±48.82^{bcd}$
Lohmann Brown x Giriraja	15	$958.00±39.86^{ef}$
Lohmann Brown x LIR	11	$1334.54±46.55^{ab}$
Lohmann Brown x Cobb 500	11	$1258.18±46.55^{bcd}$
Level of Significance		***($p<0.001$)

There was significant difference in weight of seven week old progenies of New Hampshire x LIR as compared with other genetic lines of same age chicken and this resembles the highest weight as compared to the progenies of other genetic combinations. According to Sharma (2008) the body weight of the pure breed of hybrid broiler Cobb-100, pure breed New Hampshire and indigenous breed sakini at 8th week were 1889.0 g, 463.6 g and 520.0 g respectively under intensive management system, which was again found in this study. Khanal (2002) also reported the body weight of 280 days of chicken had reached as much as up to 1300 g. Similarly, Bhurtel (1993) reported that the average weights of local male and female chicken under scavenging system were found 1.67 kg and

1.42 kg respectively. Shah (2000) also reported the growth performance of local chicken at eight week of age, was found 390.1 g and 350.1 g in male and female chicken respectively. Aganga *et al.* (2000) reported that the growth performance of mature village chicken were 2.2 kg for male, and 2.0 kg for female.

Thus, Giriraja and Cobb500 males were best compatible to Black Australorp females, whilst LIR male was best compatible with New Hampshire than other females.

Feed consumption behavior

The progenies of Black Australorp crossed with different hybrid broiler males, the lowest average feed consumption (76.28 g) was observed in the progenies crossed with Giriraja. Among all the crossed progenies,the progenies of male Cobb 500 corssed with female chicken of Sakini and Black Australorp were found higher feed (146.0 g and 146.07 g respectively) consuming behavior within the eighth week of age.

Within the progenies of Sakini crossed with different hybrid broiler males, the lowest average feed consumption (132.6 g) was observed in the hybrid progenies crossed with Giriraja. Khanal (2002) indicated that the 8th week body weight of sakini was 400-600 g with average feed consumption of 3.2 kg for 1 kg body weight.

Evaluation of feed conversion ratio (FCR) of F_1 cross bred progenies

Within the comparison on a single breed, Sakini, crossed with three male lines; LIR, Cobb 500 and Giriraja, the best compatible progeny was found to be the progenies of Sakini × Cobb 500 x on the basis of average feed conversion ratio (3.46). Timothy *et al.* (2003) also found that the growth efficiency for local chicken was higher in early ages while the reverse was observed after 15 week of age. There were several reports that reported live weights of indigenous chickens under intensive systems of management (Yeong , 1992;Jalaludin *et al.*,1985). Those weighed 380 g at 8 weeks and 1170 g at 15 weeks in the present study could be due to attributed to the level of protein in the diet. Khanal (2002) reported that the 8th week body weight of locally raised chicken could be 400-600 g in Nepal with average feed consumption of 3.2 kg for one kg body weight, which however was a bit higher for the hybrid progenies in the present study. Among the hybrid progenies, the progenies of Black Australorp crossed with Giriraja was observed the best compatible one on the basis of feed conversion ratio (2.63) which was followed by New Hampshire x LIR(2.95) at the end of 8th week of age.

Fertility and hatchability

The infertile percentage was observed highest in Giriraja × Sakini, i.e. 8.33%, where as chicks dead shell was observed highest (22.22%) in Cobb 500 x Black Australorp (Table 3). It might be the reason due to higher egg weight and porosity in the improved breeds than the locally adapted Sakini or Giriraja chicken. Ricklefs and Starck (1998) also reported that egg weight and the length of the incubation period have the greatest impact on hatch weight.

Table 3. Genetic effect on fertility and hatchability of different breed interaction raised under intensive system at IAAS Livestock Farm

Breed	Infertile %	DIS %	Hatching %
SK x GR	8.33	8.33	83.33
SK LIR	4.55	13.64	81.82
SK x C500	0.00	5.88	94.12
BA x GR	0.00	4.55	95.45
BA x LIR	0.00	10.00	90.00
BA x C500	0.00	22.22	77.78
NH x GR	7.41	3.70	88.89
NH x LIR	3.45	13.79	82.76
NH x C500	0.00	3.57	96.43
LB x GR	6.45	16.13	77.42
LB x LIR	3.57	7.14	89.29
LB x C500	0.00	10.00	90.00

The hatchability percent was observed high in the breed of Cobb 500 × New Hampshire and Giriraja x Black Australorp, i.e. 96.43% and 95.45% respectively. The hatchability percentage was observed lowest in Cobb 500 x Black Australorp and Giriraja x Lohmann Brown, i.e. 77.78% and 77.42% respectively. Sah *et al.* (2000) reported that poultry raisers now-a-days adopted the New Hampshire with high popularity for backyard farming due to good fertility (96.7±0.28%) with higher percentage of Hatchability (83.26±0.93%) in addition to their resistant qualities to adverse climatic condition, which however was not found much relevance to the findings of the present study.

Meat quality test

The lower score of organoleptic evaluation means better quality in terms of taste (juiciness, tenderness and greasy). The lower score of organoleptic evaluation of meat belongs to offspring of Black Australorp x Giriraja received score 2.73, while the other genetic group belongs higher score than the progenies of Black Australorp x Giriraja. Jammarkattel (2004) reported that the meat quality of broiler raised under scavenging system was superior (tasty) compared to the broiler raised under intensive system. The difference in taste might have been associated to the type of feed protein source (Smith, 1990), housing system(Sharma, 2008; Marle and Webb, 2008) and so on. Table 4 represents the meat quality of birds kept under internsive management system.

Table 4. Evaluation of meat taste of superior cross bred progenies raised under intensive system at IAAS Livestock Farm

Progenies	Juiciness	Tenderness	Greasiness	Overall Mean	Rank
BA × C 500	3.0	3.2	3.0	3.06	III
LB × LIR	2.8	3.2	3.3	3.10	II
BA × GR	2.3	3.1	2.8	2.73	V
SK × C 500	3.5	2.9	2.1	2.83	IV
NH × LIR	3.1	3.0	3.6	3.23	I

Mortality and survivability

Mortality was observed significantly higher (31.58%) in the chicks obtained from crossing Lohmann Brown with Giriraja while 100% survivability was observed in other crossbred chicks of Black Australorp. It implies that Black Australorp was the best compatible with all of the male lines used in the present research work, but Lohmann Brown and New Hampshire were observed best compatible only with Cobb 500 and Giriraja respectively. Most of the chicks mortality was observed during the third and fourth weeks of age. However, Shah *et a*l 2000 reported the adoption of New Hampshire in backyard poultry with a good livability (87.90%).

Economic analysis of F_1 hybrid progenies

In the present research for the best compatible breed for crossing to each other, most of the chicks were observed male dominant in feather colour. Economically the best compatible breed were observed the hybrid progenies of LIR crossed with New Hampshire because the higher net income (Rs. 338.96) was observed compared with other group of hybrid progenies. On the basis of feed consumption and body gained within eight week of age, both Giriraja and Cobb 500 broiler males were found best compatible with Black Australorp. Along the findings, the indigenous breed Sakini and the hybrid Lohmann Brown were observed the best compatible with Cobb 500 and LIR, respectively.

CONCLUSIONS

Although, the compatible progenies in diffrent aspects varies with their own characters of mortality, feed consumption, body weight gain, feed conversion ratio, hatchability and fertility; The target should be upgrading the level of income of chicken raising farmers. On the basis of all the aspects of their genetic performance, the maximum price fetching progenies crossed in between New Hampshire and LIR was found the best compatible progeny for meat production. However, A long term and multi seasonal research is expected to verify further the research results.

In general, the Black Australorp (57.50 g) appeared the best performer with respect to average egg weight compared with other breeds. The highest body weight of chicks at eight weeks age (1388.33±44.57 g) was observed in the case of F_1 progenies of BA crossed with Cobb 500. On female lines, Sakini (1211.50±48.82 g) and Black Australorp (1404.50±48.82 g) were found the best compatible with Cobb 500 and on other hand, New Hampshire (1388.33±44.57 g) and Lohmann Brown (1334.54±46.55 g) were observed the best compatible with LIR. The Black Australorp hen compared fairly well with comparison to other female lines in terms of egg weight. Although, the F_1 progenies of LIR and Cobb 500 grew faster, but on the basis of average FCR value, the progenies of BA xGiriraja crossed with Black Australorp (2.63) was observed best performer, but the feed consumption behavior was observed poor which indicated that if the feed consumption could be increased, there would be no doubt to say that the hybrid progenies of Giriraja crossed with Black Australorp will be the best compatible breeds for meat production

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REFRENCES CITED

Aganga, A. A., U. J. Omphile, P. Malope, C. H. Chabanga, G. M. Motsamai, and L. G. Motsumi. 2000. Traditional poultry production and commercial broiler alternatives for small-holder farmers in Botswana. Livestock Research for Rural Development 12 (4): 1-9.

Bhurtel, R. 1993. A comparative study on the status of indigenous chicken in the farming system of midhillls and plain land of Nepal. Unpublished Ph. D. thesis, University of the Philippines Los Banos, the Philippines.

CBS. 2009. Statistical Pocket Book Nepal. Central Bureau of Statistics, Ramshah Path, Kathmandu, Nepal.

FAO. 1999. Poultry international production, processing and marketing, worldwide. Watt poultry world book international edition.

Harvey W.R. 1990. Least square analysis of data with unequal subclass numbers. United States Department of Agriculture, Agricultural Research Service, ARS, USA.

Jalaludin, S. and Sivarajasingan, 1985. Some breed characteristics of thekampung chicken. *In:* Proceedings of the Regional Seminar on Future Developments on Poultry Industr, Kuala Lumpa (Eds. Aini, I. Ramla, H). pp. 43-45.

Khanal, D. 2002. Problems and prospects on conservation of indigenous breeds of livestock species in Nepal. M. Sc. Thesis, Pokhara University.

Marle, K. E., and E. C. Webb. 2000. Carcass characteristics of South African native chicken lines. South African Journal of Animal Science 30 (1): 53-56.

Nakarmi, S. B. 2001. Status of poultry farmers in Nepal. *In:* Proceedings of 4th National Animal Science convention, NARC, Khumaltar, Kathmandu, Nepal.

Ricklefs, R. E. and M. J. Starck. 1998. Embryonic growth and development. Pages 31–58 in Avian Growth and Development. Oxford Univ. Press, New York, NY.

Sah, R. B., P. Mandal and R. S. Mandal. 2000. Information on the Native chicken raised in the eastern Terai region of Nepal. Annual Report. ARS. Tarahara.

Shah, R. B. 2000, A Comparative study of 50% Black Australorp and local chicken in Banigama, Morang and Dhangadhi, Siraha. Annual Report, RARS, Parawanipur. 68p.

Sharma, M. P. 2008. Species, breed and their interaction with poultry (Chicken and Duck) management systems. Ph. D. Thesis, IAAS, Rampur, Chitwan

Sklan, D., S. Heifetz, and O. Halevy. 2003. Heavier chicks at hatch improves marketing body weight by enhancing skeletal muscle growth. Poult. Sci. 82:1778–1786.

Smith, A. J. 1990. The integration of rural production in to the family food supply system CTA proceeding of Smallholder Rural Production. Thessaloniki, Greece, pp 115-128.

Timothy, N., P. Gondwe and B. A. Wollny. 2003. Comparative Productivity of Black Australorp and Indigenous Chickens under Free ranging Village Conditions in Malawi. DeutscherTropentage Conference on International Agriculture Research for Development. Gotting, Oct 8-10, 2003.

Wyatt, C. L., W. D. Weaver and W. L. Beane. 1985. Influence of egg size, eggshell quality and post hatch holding time on broiler performance. Poult. Sci. 64: 2049–2055.

Yeong, S.W. 1992. Effect of dietary protein level on growth performance of village chicken. *In:* Proceedings of the National IRPA. Seminar Agriculture Sector (Eds. Ho, Y. W. Vidyadaran, M.K. Abduila, Janudin, M.R. and Bahaman, A.R.) Vol. 2: 519-520.