IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 13, Issue 3 Ser. I (March 2020), PP 36-43
www.iosrjournals.org

Productive and Reproductive Performance of BAU-Bro Parents

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Abstract: *A study was designed to evaluate the performance of BAU-Bro parental lines and parents after five generations of selection. The experiment was set up with 1744 one-day-old male and female line and parental line chicks. The male lines were synthetic male line white (MLW), male line white$_2$ (MLW$_2$) and male line color (MLC) whereas the female lines were female line white (FLW), female line color (FLC), female line color-brown (FLC-br) and the two way parental lines, female line white$_2$ (MLW x FLW), female line color$_2$ [FLC-Br x MLC] and female line color$_3$ [MLC x FLC-Br]. The chicks were brooded up to 5 weeks of age and reared up to 18 weeks of age on litter floor and then transferred to individual laying cages in an open house. Adlibitum feeding was practiced for first 3 weeks in male lines and 5 weeks in the female lines. Restricted feeding was practiced thereafter till the end of the experiment. The plumage color was white in all white lines while the color lines were variable in plumage color. The white lines,male line white$_2$ attained 1021.80±14.72g at 5 weeks of age, while male line white, female line white and female line white$_2$ attained 962.11±10.75, 333.40±6.45 and 551.59±7.39g.The color lines,female line color$_3$ attained the highest weight, 617.90±11.48g at 5 weeks of age followed by female line color$_2$, female line color-brown, male line color and female line color.Dressing percentage of male lines varied from 70-72%, while in female lines 67-71%.The body weight at sexual maturity was highest in male line white$_2$, 3980±8.14g and male line white, 3797±62.75g and was lowest in female line white, 1641±22.18g and female line color, 1643±30.36g while other lines were intermediate in size. All genotypes came to sexual maturity in between 168-175 days except male line white, 198 days and male line white$_2$ 220 days. Egg weight at sexual maturity was highest in male line white, 50.18±1.05g and numerically lowest in female line color$_3$, 41.38±0.97g.While at 32 weeks the highest egg weight was in female line white$_2$, 55.58±0.44g and lowest in female line color, 47.04±0.41g. Egg production up to 35 weeks of age was highest in female line white$_2$, 72.31±1.89 eggs and lowest in male line white$_2$, 18±12.16 eggs and male line white, 37.18±3.66 eggs. Fertility percentage of eggs was satisfactory but the hatchability of the genotypes was poor due to electricity and mechanical problem in the hatcher. The livability at different stages of production was above 91%.*

Keywords: *Broiler parents, growth, egg production, fertility, hatchability, livability*

Date of Submission: 12-03-2020 Date of Acceptance: 27-03-2020

I. Introduction

Poultry farming is an important tool for poverty alleviation, creation of new jobs and improves the nutritional security. Commercial poultry production has started during the last quarter of 20th century in Bangladesh,and now it has become a leading sector of the country. Especially, broiler chicken is playing a major role in providing cheap animal protein to human diet. However, most of the inputs for broiler farming are import oriented. Bangladesh imported2.41 million broiler grandparents and 1.12million broiler parents during 2016 at a cost of US$ 13.57 million(DLS 2017). With the present production, the availability of animal protein is only 12g/person/day. But we need 50-60g animal protein/person/day (Ali *et al*., 2017). When the required level of production is targeted, then we have to spend about US$ 55-68 million per year to import parents/grandparents. In addition, the imported stocks may act as a carrier of some known and unknown diseases and are not well adjusted to our prevailing hot and humid environment(Beato and Capua 2011).In the peak summer, imported stocks often suffer from decreased feed consumption, impaired feed efficiency and low egg production.

Many people of Bangladesh prefer color chicken with comparatively tough meat and pay more prices than fast growing white feathered broiler. With a view to reduce the dependencies on imported stocks, some countries have developed their own parents. Adebambo *et al*., (2011) mentioned that the genetic progress can be attained either by selection or cross breeding. A selection study was initiated to develop broiler sire and dam lines from the locally available genetic resources in Bangladesh.The present study was undertaken to evaluate the performance of BAU-Bro parents after five generations of selection.

II. Materials And Methods

The experiment was carried out at Bangladesh Agricultural University (BAU) Poultry Farm, Mymensingh, Bangladesh with day-old pedigreed chicks of three male lines, MLW, MLW_2, MLC, and six female lines, FLW, FLW_2, FLC, FLC-Br, FLC_2 and FLC_3. A total of 1744 day old chicks (DOC) from the aforementioned sire, dam and parental lines were hatched. All DOCs of all lines were individually identified by wing band at hatch. The experimental chickens werebrooded with electric brooder up to 5 weeks of age depending on weather condition and season.They were reared up to 18 weeks of age in a semi-monitored building with concrete floor. They were then transferred to individual laying cages in open sided house with concrete floor and were reared up to 35 weeks of age to collect phenotypic data on individual chickens. Moderate restricted feeding was practiced and clean water was supplied *ad-libitum*. Debeaking, de-warming, vaccination and lighting program were maintained.

The photoperiod was maintained 24 hours during 1^{st} two days and then gradually reduced to natural light of 12 hours at 4 weeks of age and similar lighting hours was maintained up to 19 weeks of age. The light hour was increased to 16 hours from 20 weeks of age using artificial light and continued to the end of the experiment.

The experimental chicken were fed four type of diets; starter (0-5 week), grower (6-17 week), pre-breeder (18-22 week) and breeder (23-35 week) diets during brooding, growing, pre-breeding and breeding period, respectively. The ingredients and nutrients composition of the experimental diets is shown in Table no 1. Fresh, cool and clean drinking water was supplied *ad-libitum* during the experimental period.

Table no 1: Nutrient composition of the experimental diets*

Ingredient composition	Starter 0-5 wk	Grower 6-17 wk	Pre-Breeder 18-22 wk	Breeder 23-35 wk
Maize	63.20	61.85	66.76	63.45
Rice polish	-	13	-	-
Soybean meal	28.00	19.0	23.00	23.5
Protein concentrate	6.00	3.00	5.00	3.0
Limestone	1.4	1.0	2.5	7.0
Di-calcium phosphate	0.35	1.2	1.5	2.0
Common salt	0.5	0.5	0.5	0.5
Premix*	0.2	0.3	0.3	0.3
Lysine	0.10	-	0.09	-
DL-Methionine	0.2	0.10	0.3	0.2
Toxin binder	0.05	0.05	0.05	0.05
Nutrient composition				
Metabolizable energy (kcal/kg)	2920	2875	2911	2749
Crude protein (%)	21.31	16.0	18.05	16.71
Calcium (%)	1.13	1.16	1.94	3.79
Av. phosphorus (%)	0.37	0.46	0.54	0.56
Lysine (%)	1.17	0.90	1.06	0.92
DL-Methionine (%)	0.40	0.43	0.65	0.51

*Supplied per kg of diet: Vit.A, 12000 IU; Vit.D3, 2200 IU; Vit.E, 10 mg; Vit. K3, 2 mg; Vit.B1, 1 mg; Vit,B2, 5 mg; Vit,B6, 1.50 mg; Vit B12, 0.01 mg; Nicotinic acid, 30 mg; Folic acid, 1 mg; Pantothenic acid, 10 mg, Biotin, 0.05 mg, Choline chloride, 500 mg; Copper, 10 mg; Iron, 30 mg; Manganese, 60 mg; Zinc, 50 mg; Iodine, 1 mg; Selenium, 1 mg, Cobalt,0.10 mg.

Theexperimental chickens were vaccinated against Newcastle Disease, Infectious Bursal Disease, Fowl Pox, Salmonella and Fowl Cholera as a routine vaccination program as shown in Table no 2.

Table no 2: Vaccination program

Age (day)	Name of disease	Name of vaccine	Route	Manufacturer
5	Newcastle Disease	BCRDV	Eye drop	Livestock Research Institute (LRI), Mohakhali, Dhaka
10	Infectious Bursal Disease	D-78	Eye drop	Intervet International B. V. Boxmer, Holland
20	Newcastle Disease	BCRDV	Eye drop	LRI, Mohakhali, Dhaka
21	Fowl Pox	FPV	Wing web	LRI, Mohakhali, Dhaka
24	Infectious Bursal Disease	E-228	Eye drop	Intervet International B. V. Boxmer, Holland
56	Fowl Cholera	FCV	SC	BAU, Mymensingh

63	Salmonella	SV	SC	BAU, Mymensingh
69	Newcastle Disease	RDV	IM	LRI, Mohakhali, Dhaka
86	Fowl Cholera	FCV	SC	BAU, Mymensingh
92	Salmonella	SV	SC	BAU, Mymensingh
135	Newcastle Disease	RDV	IM	LRI, Mohakhali, Dhaka

BCRDV: Baby chick Ranikhet disease vaccine, RDV: Ranikhat disease vaccine, FPV: Fowl pox vaccine, FCV: Fowl cholera vaccine, SC: Subcutanuous, IM: Inter muscular.

Parameters recorded

Body weight and body weight gain,shank color, plumage color, comb type,dressing meat yield, feed consumption,age at sexual maturity, body weight at sexual maturity, egg weight, egg production, fertility, hatchabilityand livability were recorded.

Data analysis

Collected and calculated data were analyzed with a linear mixed model that included the effects of genotype, sex and hatch. The covariates and their interactions that had significant effects at the nominal 5% level were included in the final model for comparisons of phenotypic data among genotypes. Genotype differences were determined using Tukey's HSD post-hoc test. Statistical Discovery Software JMP® 5.01 (SAS Institute Inc., Cary, North Carolina, USA) and/or R (R Core Team, 2015) were used to analyze the data.

III. Results And Discussion

Shank color, feather color and comb type

The qualitative characteristics such as shank color, feather color and comb type of MLW, MLW_2, MLC, FLW, FLC, FLC-Br, FLW_2, FLC_2, FLC_3 is shown in Table no 3. Most white lines have white shank, while the colored lines have yellowish, blackish and white shank. The shank colors of white lines do not match with the observation of Ali *et al.,* (2013);Prodhan *et al.,* (2013) and Ahmed *et al.,* (2007). Ali *et al.,* (2013) found 31.85% and 100% yellowish shank color in MLW and FLW. Ahmed *et al*., (2007) found 100% yellowish shank in synthetic broiler.

It is evident that all white genotypes have 100 percent white feather, while colored strains have variable per cent brown/brown barred and black/black barred feather which is comparable with the earlier observations of Ali *et al.,* (2013) and Prodhan *et al.,* (2013). All the genotypes have 100% single comb.

Table no 3: Qualitative characteristics of shank color, feather color and comb type of meat type chicken genotypes and their frequencies

Lines/ genotypes	No.of birds	Shank color	Freq. (%)	Feather color	Freq. (%)	Comb types	Frequencies (%)
MLW	134	Whitish	100	White	100	Single	100
MLW_2	65	Whitish	100	White	100	Single	100
MLC	148	Yellowish Whitish Blackish	72.29 3.37 24.32	Black/ black barred	50.59	Single	100
				Red/brown/ brown barred	49.41		
FLW	349	Whitish	100	White	100	Single	100
FLC	172	Yellowish Whitish Blackish	45.85 38.21 15.92	Dark red/ Black	27.70	Single	100
				Red/brown/ brown barred	72.30		
FLC-Br	395	Yellowish Whitish Blackish	61.53 31.06 7.39	Black/ black barred	1.76	Single	100
				Brown/ brown barred	98.24		
FLW_2	313	Whitish	100	White	100	Single	100
FLC_2	51	Yellowish Whitish Blackish	69.84 6.34 23.80	Black/ black barred	38.76	Single	100
				Brown/ brown barred	61.24		
FLC_3	97	Yellowish Whitish	45.65 23.91	Black/ black barred	51.08	Single	100

		Blackish	30.43	Brown/ brown barred	48.92		

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

Body growth

The Least sq. means of body weight in male and female line parents (mixed sex) at DOC, 1, 3, and 5 weeks of age are shown in Table no 4. It is evident that the highest ($P\leq0.05$) body weight was attained in male line white$_2$ (MLW_2) followed by male line white (MLW) during all ages The present findings are lower than the observation of Hascik *et al.,* (2010). They found higher body weight at similar ages in synthetic broiler breeder. Female line color-brown(FLC-Br) attained higher live weight ($P\leq0.05$) than female line color (FLC) in most ages. The body weight of male and female breeder found in this study is lower than the findings of Gogoi and Mishra (2013).

The male lines, MLW_2 and MLW gained 27.86g and 26.05g per day through individual selection at five weeks of agewhich is lower than the observation of Hascik *et al.*, (2010). The female lines, FLW and FLC gained 8.42g and 8.35g per day up to 5 weeks of age. FLC-Br at 5 weeks gained 14.69g per day. The result is partially comparable with the observation of Siegel (1978) who found 20g gain per generation for high weight female line.

The body weight gain during 0-5 weeks was 975 and 911g in MLW_2 and MLW which is lower than the observation of Hascik *et al.,* (2010).

Similar trend of growth was observed during growing and breeding period (6-35weeks) of male genotypes (Table no 5) and female genotypes (Table no 6).

Table no 4: Least sq. means of body weight, weight gain & dressing per cent of genotypes (straight run) during early growing periods (0-5 weeks)

Lines/ genotypes	DOC (Mean ±SE) g	1st week (Mean ±SE)g	3rd week (Mean ±SE)g	5thweek (Mean± SE)g	Weight gain 0-5 wks	Weight gain(g/day)	Dressing (%)
MLW	50.22± 0.33^{a}	118.62± 1.35^{a}	426.63±5.14^{b}	962.11± 10.75^{b}	911.89	26.05	72.25
MLW_2	46.46± 0.47^{b}	120.94± 1.86^{a}	463.30± 7.24^{a}	1021.80± 14.72^{a}	975.34	27.86	72.30
MLC	38.88± 0.28^{d}	78.20± 1.14^{de}	264.12± 4.36^{e}	552.17± 9.05^{d}	513.29	14.66	70.16
FLW	38.67± 0.20^{d}	58.12± 0.81^{f}	160.79± 3.12^{f}	333.40± 6.45^{f}	294.73	8.42	67.00
FLC	34.26± 0.27^{e}	54.78± 1.11^{f}	158.81± 4.24^{f}	326.67± 8.79^{f}	292.41	8.35	71.30
FLC-Br	42.37± 0.18^{c}	83.72± 0.75^{c}	284.56± 2.88^{d}	556.69± 6.00^{d}	514.32	14.69	70.75
FLW_2	38.66± 0.23^{d}	77.89± 0.93^{e}	275.17±3.61^{de}	551.59± 7.39^{d}	512.93	14.654	-
FLC_2	39.18± 0.50^{d}	85.12± 1.98^{cd}	298.53± 7.74^{d}	565.89± 15.74^{cd}	526.71	15.04	-
FLC_3	41.68± 0.36^{c}	94.17± 1.45^{b}	331.39± 5.58^{c}	617.90± 11.48^{c}	576.22	16.46	-

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

Dressing percent

The dressing meat yield of male lines genotypes at comparable body weight (1000-1200g) were almost similar i.e. 70-72 per cent (Table no 4) which match well with the observations of Ali *et al*., (2013). While the female lines were 67-71 per cent which is slightly lower than the findings of Ali *et al*., (2013). Kosarachukwu *et al.*,(2010) reported 69.75, 67.40 and 66.63 per cent dressing meat yield in Ross, ArborAcres and Anak broiler strain.

Table no 5: Least sq means of body weight of male genotypes during 6 to 35 weeksof age

Genotypes	BW^{6}(Mean± SE) g	BW^{7}(Mean± SE) g	BW^{8}(Mean± SE) g	BW^{12}(Mean ±SE) g	BW^{16}(Mean ±SE) g	BW^{20}(Mean ± SE) g	BW^{24}(Mean ± SE) g	BW^{28}(Mean ±SE) g	BW^{32}(Mean ±SE) g	BW^{35}(Mean ±SE) g
MLW	964 ± 42.58^{a}	1082 ± 61.95^{a}	1296 ± 78.00^{a}	2571 ± 148.66^{a}	2931 ± 151.58^{a}	3130± 155.03^{a}	3615± 170.85^{a}	3499.0± 261.40^{a}	3616.50± 296.16^{a}	4160.75± 288.04^{a}
MLW_2	1136 ±56.33^{a}	1207± 81.95^{a}	1296± 103.19^{ab}	2256 ± 196.66^{ab}	3059 ± 200.52^{a}	2948 ± 205.09^{ab}	3363± 226.02^{ab}	3542.0± 522.80^{a}	3260.0± 592.32^{a}	4390.0± 576.08^{ab}
MLC	673± 33.97^{b}	792± 49.42^{ab}	991± 62.22^{ab}	1692± 118.59^{b}	2049± 120.92^{b}	2120± 123.67^{c}	2555± 136.29^{bc}	2802.80± 165.32^{a}	2862.70± 187.31^{a}	3109.0± 182.17^{ab}
FLW	390± 22.09^{c}	462± 32.14^{c}	568± 40.47^{c}	987 ± 77.13^{c}	1188 ± 78.65^{d}	1382 ± 80.44^{d}	1725± 88.65^{e}	1922.36± 104.56^{b}	1912.80± 118.46^{b}	1906.92± 115.21^{c}
FLC	421± 25.19^{c}	494± 36.65^{c}	610± 46.14^{c}	1075 ± 87.94^{c}	1365 ± 89.67^{cd}	1554 ± 91.72^{d}	1895± 101.08^{de}	1958.57± 139.72^{b}	1900.21± 158.30^{b}	2022.14± 153.96^{c}
FLC-Br	672± 24.02^{b}	837± 34.94^{b}	1010± 44.00^{b}	1824 ± 83.85^{b}	1988 ± 85.50^{b}	2105 ± 87.45^{c}	2483± 96.37^{c}	2700.55± 123.22^{a}	2800.0± 139.61^{a}	2941.33± 135.78^{b}
FLC_2	926± 37.55^{a}	1089± 54.63^{a}	1262± 68.79^{ab}	1595 ± 131.10^{b}	1782 ± 133.68^{bc}	2418 ± 136.73^{bc}	2660± 150.68^{bc}	3147.33± 213.43^{a}	3326.33± 241.81^{a}	3548.16± 235.18^{ab}
FLC_3	919± 65.05^{a}	1035± 94.63^{ab}	1181± 119.15^{ab}	1718 ± 227.08^{abc}	2119 ± 231.54^{abc}	2387 ± 236.82^{abc}	2643± 260.98^{abcd}	3227.0± 261.40^{a}	3515.0± 296.16^{a}	3753.0± 288.04^{ab}

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

Table no 6: Least sq mean of body weight of female genotypes during 6 to 35 weeksof age

Genotypes	BW^{6}(Mean± SE) g	BW^{7}(Mean±SE) g	BW^{8}(Mean±SE) g	BW^{12}(Mean±SE) g	BW^{16}(Mean±SE) g	BW^{20}(Mean± SE) g	BW^{24}(Mean± SE) g	BW^{28}(Mean±SE) g	BW^{32}(Mean±SE) g	BW^{35}(Mean±SE) g
MLW	1048± 29.32^{a}	1112± 36.96^{d}	1229± 45.70^{ab}	2387± 68.33^{a}	2790± 73.50^{a}	2904± 72.47^{a}	3325± 73.39^{a}	3742.81± 85.95^{a}	3802.82±113.44^{a}	4126.63±119.49^{a}
MLW_2	1048± 30.28^{a}	1170± 38.18^{d}	1409± 47.20^{a}	2364± 70.57^{a}	2993± 75.92^{a}	2968± 74.84^{a}	3304± 75.80^{a}	3605.50±100.78^{a}	3906.12±133.02^{a}	4228.50±140.11^{a}
MLC	557± 25.59^{c}	678± 32.26^{c}	818± 39.89^{bc}	1416± 59.64^{cd}	1534± 64.16^{bc}	1705± 63.25^{c}	2158± 64.06^{bc}	2173.09± 60.77^{b}	2260.59± 80.21^{c}	2343.22± 84.49^{c}
FLW	362± 12.43^{d}	403± 15.67^{d}	486± 19.38^{e}	854± 28.97^{e}	1030± 31.16^{e}	1209± 30.72^{e}	1578± 31.11^{d}	1631.35± 30.56^{c}	1548.79± 40.33^{d}	1614.58± 42.48^{d}
FLC	354± 17.48^{d}	413± 22.04^{d}	516± 27.25^{e}	952± 40.74^{e}	1180± 43.83^{de}	1456± 43.21^{d}	1649± 43.76^{d}	1686.06± 42.97^{c}	1618.06± 56.72^{d}	1768.88± 59.74^{d}
FLC-Br	607± 13.11^{c}	749± 16.53^{c}	891± 20.44^{d}	1519± 30.55^{cd}	1554± 32.87^{bc}	1772± 32.41^{c}	2092± 32.82^{bc}	2300.88± 21.29^{b}	2491.88±41.30^{bc}	2577.39±43.50^{bc}
FLW_2	730± 16.58^{b}	900± 20.91^{b}	1092± 25.85^{bc}	1709± 38.65^{b}	1668± 41.58^{b}	2112± 40.99^{b}	2226± 41.51^{b}	2308.66± 40.31^{b}	2566.26± 53.21^{b}	2772.46± 56.04^{b}
FLC_2	675± 33.86^{bc}	800± 42.68^{bc}	942± 52.78^{cd}	1262± 78.90^{d}	1401± 84.88^{bcd}	1768± 83.68^{c}	2035± 84.75^{bc}	2167.93± 76.18^{b}	2337.4 ±100.56^{bc}	2604.6 ±105.92^{bc}
FLC_3	788± 24.45^{b}	913± 30.83^{b}	1085± 38.12^{bc}	1413± 56.99^{cd}	1406± 61.31^{cd}	1769± 60.44^{c}	1969± 61.21^{c}	2316.63± 60.77^{b}	2598.63±80.21^{bc}	2746.95± 84.49^{b}

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

The characteristics body weight of genotypes at 20 week

It is evident that (Table no6) the 20 week body weight is significantly heavier in MLW_2, MLW followed by FLW_2, FLC-Br, FLC_3, FLC_2 and MLC and the lowest body weight was in female lines, FLW and FLC. The results are comparable with Ali *et al.,* (2015).Theyfound higher 20 week body weight in BAU-Bro white parents than BAU-Bro color parents.The male lines were significantly heavier than female lines which are comparable with the observation of Ali *et al.,* (2013).The crossed, $FLW_2$was intermediate in size. The results partially agree with the observation of Kumar *et al.,* (2003). They found that synthetic dam lines pullets ranges from 2052.75± 12.11 to 2584.79±27.44g at 20 weeks of age.

Table no 7: Reproductive performance of female genotypes (24 to 35thweek)

Lines/ Genotypes	BWSM (Mean±SE)g	ASM (Mean±SE)days	EW^1 (Mean±SE)g	EW^{32} (Mean±SE)g	EN^{35} (Mean±SE)
MLW	3797± 62.75^a	197.72± 4.22^a	50.18± 1.05^a	51.90± 0.84^{bcd}	37.18± 3.66^d
MLW_2	3980± 08.14^a	220.00± 14.00^{ab}	45.00± 3.51^{abc}	45.00± 2.81^{cde}	18.00± 12.16^d
MLC	2286± 45.42^{bc}	180.61± 3.05^{bc}	43.61± 0.76^b	49.42± 0.61^d	54.66± 2.65^{bc}
FLW	1641± 22.18^d	174.23± 1.49^{cd}	46.98± 0.37^{ac}	52.50± 0.30^{bc}	54.23± 1.29^b
FLC	1643± 30.36^d	168.80± 2.04^d	44.08± 0.51^b	47.04± 0.41^e	58.65± 1.77^b
FLC-Br	2181± 25.62^c	185.10± 1.72^{ab}	43.75± 0.43^b	50.54± 0.34^d	45.62± 1.49^{cd}
FLW_2	2421± 32.50^b	171.90± 2.18^{cd}	42.04± 0.54^b	55.58± 0.44^a	72.31± 1.89^a
FLC_2	1778± 78.67^d	179.42± 5.29^{abcd}	41.71± 1.32^b	51.57± 1.06^{bcd}	57.71± 4.59^{bc}
FLC_3	2240± 57.72^{bc}	178.46± 3.88^{bcd}	41.38± 0.97^b	50.69± 0.78^{cd}	58.38± 3.37^b

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

Reproductive Performance

Body weight at sexual maturity

The body weight at sexual maturity was significantly heavier in MLW_2, MLW followed by FLW_2, MLC, FLC-Br and the lowest was in FLW and FLC, while the crossbred, FLC_2 and FLC_3 was intermediate weight. The results agree with the observations of Ali *et al*., (2013) and but not with the observation of Ali *et al.,* (2015) who found BAU-Bro color parents wereheavier than BAU-Bro white parents at sexual maturity. The mature body weight of FLW was 1641±22.18g which agree with the observation of Tongsiri *et al*., (2014).

Age at sexual maturity

The reproductive performance of the genotypes is shown in Table 7. It is evident that female lines came to sexual maturity significantly earlier i.e. 168-185 days (24-26 weeks). The result agrees with the earlier observations of Ali *et al*., (2013).The male lines delayed sexual maturity i.e. 180-220 days (26-31 weeks) which is comparable with the findings of Islam *et al*., (2009).The crossbred had early sexual maturity i.e. 172-179 days (25-26 weeks). The most of the commercial hybrid come to sexual maturity at 168-175 days (24-25 weeks) of age (Cobb Breeder Management Manual, 2013)but Kumar *et al*., (2003) found that synthetic broiler pullet came to sexual maturity at 160.77±0.77 to 177.23±0.23 days (23-26 weeks). The sexual maturity is affected by a number of factors such as genotypes, nutrient density of diet, level of feeding, age at light stimulation, seasons of hatching etc.

Egg Size

The egg size at sexual maturity was significantly larger in MLW, FLW and MLW_2,while the genotypes i.e. MLC, FLC, FLC-Br, $FLW_{2,}$ FLC_2, FLC_3had almost similar egg size at sexual maturity. The results agree with the observation of Ali *et al*., (2013). The egg weight at 32 weeks (EW_{32}) increasedin all the genotypes and significantly larger was in FLW_2followed by FLW, MLW, FLC_2, FLC_3, FLC-Br MLC (BI), FLC and the lowest was in MLW_2. The egg size at 32 weeks of age is partially comparable with the observation of Kumar *et al*., (2003).

Egg Production

It is evident that egg production up to 35 weeks of age was significantly higher in FLW_2 followed by FLC, $FLC_{3,}$ $FLC_{2,}$ MLC, FLW and the lowest was in FLC-Br, MLW and MLW_2. Azam (2017) found 53.91 eggs in FLW up to 35 weeks of age which is similar to the present findings.But in FLC he found 65.68 eggs which is slightly higher than the present findings. Hudson *et al*., (2001) found 46.80-52.00 eggs in broiler breeder hen up to 35 weeks of age. When expressed in per cent, egg production was 93.90, 76.16, 83.25, 82.44, 78.08, 70.42, 72.41, 75.87 and 64.28, per cent respectively. Most of the lines have good egg production except MLW_2.

Fertility and hatchability

Most of the genotypes showed satisfactory fertility i.e. above 80% except FLW_2 (69.72%) and FLC_2 (66.67%), while most of the genotypes showedmoderate hatchability i.e. above 70% except FLC_2(49.03%),

FLC_3 (55.42%) and MLC 69.37%. Probably this might be due to problem in the hatcher. Ali *et al*., (2015) found 96.77% and 90.24% hatchability in BAU-Bro white and BAU-Bro color parents.

Table no 8: Fertility and hatchability of the genotypes

Lines/ genotypes	Eggs set (No.)	Weak chicks	Healthy chicks (No.)	Total chicks (No.)	Fertility (%)	Hatchability (%)
MLW	224	9	134	143	87.94	72.58
MLW_2	105	6	65	71	80.95	83.52
MLC	320	12	176	188	84.68	69.37
FLW	517	33	343	376	87.81	82.81
FLC	260	9	169	178	84.61	80.9
FLC-Br	530	18	392	410	90.18	85.77
FLW_2	713	0	313	313	69.64	70.71
FLC_2	156	0	51	51	66.67	49.03
FLC_3	217	0	97	97	80.64	55.42
Total	3042	87	1740	1827	81.46	72.23

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

Livability

The livability of male and female lines and parents during different stages of growth and production is shown in Table no 8. It is evident that the livability was almost similar in male, female lines and parents during brooding period (0-5weeks), growing (6 - 23 weeks) and laying period (24-35 weeks). The livability during brooding period was 91 to 100%, while during growing period was 94 to 99% and laying period was 91 to 100% in different genotypes. The results are similar to the findings of Ali *et al*., (2013). They found 95-99%, 91-99% and 94-98% livability during brooding, growing and laying period in BAU-Bro parents. Ali *et al*., (2015) found 85% livability in BAU-Bro white parents and 84% livability in BAU-Bro color parents up to 55 weeks of age. The experimental birds were reared in open houses. While the breeders generally reared the breeding birds in controlled houses where a mortality of 5% during brooding period, 5-10% during growing period and 8% during laying period may occur (Cobb Breeder Management Manual, 2013).

Table no 9: Livability (%) of genotypes of chicken during different stages of growth & production periods

Lines/ genotypes	0 - 5 weeks	6 - 23 weeks	24 - 35 weeks
MLW	91.05	95.74	96.66
MLW_2	96.93	96.08	91.43
MLC	92.62	95.31	94.12
FLW	98.55	98.80	93.19
FLC	98.26	99.18	97.22
FLC-Br	96.71	95.72	95.90
FLW_2	97.43	93.87	95.11
FLC_2	100	98.95	100
FLC_3	97.94	97.80	97.10

FLW_2= (MLW x FLW), FLC_2= [FLC-Br x MLC], FLC_3= [MLC x FLC-Br]

IV. Conclusion

The selection for five generations of sire and dam lines to produce day old broiler chicks from parents reveals promising performance in body weight, age at sexual maturity, egg weight, egg number, fertility, hatchability and livability. However, selection should be continued for few more generations to fix up the genes in the parental lines of white and color strains for the production of day old broiler chicks.

Acknowledgement

The authors are grateful to KGF for providing financial support for the study and Department of Poultry Science for providing basic facilities for the study.

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M. Sharifuzzaman. "Productive and Reproductive Performance of Bau-Bro Parents." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 13(3), 2020, pp. 36-43.