Evaluation of Generation-wise Performance of Hybrid Layers under Reciprocal Recurrent Selection

Ramesh Kumar[1], S. Kalra[2], S. Singh[3] and B.Parkash[4]

Krishi Vigyan Kendra, Jind-126102 Haryana

ABSTRACT

In the present study generation wise performance of hybrid layers has been evaluated under reciprocal recurrent selection with the aim to devise suitable breeding strategy. Performance data spread over 9 generations from 1994 to 2003 were utilized for the study. The average egg number upto 40 weeks of age ranged from 55.28±0.63 to 81.48±0.75 and 57.02±1.04 to 81.25±0.71 in purebreds and crossbreds, respectively. The egg production declined during fourth and sixth generation. The average egg weight ranged from 49.15±0.18 g to 53.70±0.18 g in purebreds and 48.06±0.32 g to 53.21±0.22 g in crossbreds over the generations. Heritability estimates for egg number and egg weight in purebred was 0.255±0.054 and 0.286±0.060 and 0.324±0.090 and 0.369±0.061, respectively in crossbreds. In general crossbreds were slightly superior to the purebreds for most of the performance traits.

Key words: reciprocal recurrent selection, breeding strategy, egg number, egg weight, heritability

[1]Krishi Vigyan Kendra, Jind (Haryana)-126102; [2]CCSHAU Hisar; [3]Krishi Vigyan Kendra, Rajasthan; [4]NBAGR, Karnal;
Corresponding author E-Mail–drrameshkvk @gmail.com

INTRODUCTION

In egg type chicken, egg number and mature egg size are the traits of immense economic significance. Application of quantitative genetics in poultry breeding has revolutionized the poultry development. As a result, the present commercial layer strains produce about 280-290 eggs per year, twice the number of eggs of acceptable size and quality per bird against the number of eggs produced by their counterparts in 1950's. Still concerted efforts are needed to improve further the production potential of chicken stock through proper application of breeding strategies. Therefore, it is essential to have adequate information of performance parameters of flocks for the formulation of appropriate breeding plans for its improvement. Hence, the present study was undertaken with the aim to evaluate the generation wise performance of hybrid layers under reciprocal recurrent selection.

MATERIALS AND METHODS

Data utilized in the present study were collected from records spreading over nine generations during 1994-95 to 2002-03 for the performance traits of both strains ('H' strain and 'C' strain) and their reciprocal crossbred through reciprocal recurrent selection. The chicks of all the four genetic groups (H×H, C×C, H×C and C×H) were brooded and reared hatch wise. The progenies were produced in different hatches at weekly intervals during the month of April and May each year. All the chicks were pedigreed, wing banded at the time of hatching and reared hatch wise using standard managemental practices. Cockerels were separated from the pullets at eight weeks of age. Trapnest records of each pullet were maintained to record the age at first egg and total egg production upto 40 weeks of age. During the 40th week, three eggs from each pullet were weighed and averages of these were considered as egg weight of the pullet. Generation wise, least square means and heritabilities of these traits of purebreds and crossbreds were estimated using Mixed Model Least Squares Maximum Likelihood Computer Programme of Harvey (1987).

RESULTS AND DISCUSSION

Generation wise least squares means along with their standard errors for egg number and egg weight of different genetic groups are presented in Tables 1 and 2, respectively.

Egg number upto 40 weeks of age: The average number of eggs produced upto 40 weeks of age ranged from 55.28±0.63 to 81.48±0.75 and 57.02±1.04 to 81.25±0.71 in purebreds and crossbreds, respectively (Table 1). The pullets of C×H and H×C crossbred group produced almost equal number of eggs in 9th generation (G9) but H×C crossbred group laid more eggs than H×C cross in G1, G2, G3, G5, though the differences were significant in 6th generation (G6) only. Difference in the performance of two reciprocal crosses suggests that a particular strain should be used as male line and the other as female line for producing a commercial hybrid layer. Gowe and Fairful (1985) also reported reciprocal effects for egg production in White Leghorn stocks of chickens.

Brah et al. (1995), Sheoran (1996) and Brah et al. (2002) reported higher egg number upto 40 weeks of age in purebreds than crossbreds, which is divergent to the present results. However, higher egg production than the present study were reported by Singh et al. (1981), Kumararaj et al. (1990), Reddy et al. (1990), Chaubal et al. (1994) and Chaudhary et al. (1997) for

Table 1. Generation wise least squares means for egg number of different genetic groups

Gen.	Genetic groups				Overall	
	H×H	H×C	C×C	C×H	Purebreds	Crossbreds
1.	76.48^{a} ±0.95 (241)	77.68^{a}±1.63 (178)	75.48^{a}±1.02 (237)	76.40^{a}±1.64 (150)	75.04^{a}±0.45 (478)	76.59^{a}±0.98 (328)
2.	83.12^{a}±1.02 (349)	79.47^{b}±0.86 (149)	83.93^{a}±1.09 (279)	78.05^{b}±1.06 (151)	81.48^{a}±0.75 (628)	78.76^{b}±0.68 (300)
3.	65.92^{b} ±1.13 (159)	75.06^{a}±2.97 (31)	65.34^{b}±0.98 (199)	70.08^{ab}±2.26 (37)	65.60^{b}±0.74 (358)	72.35^{a}±1.84 (68)
4.	61.17^{a} ±0.94 (166)	57.29^{bc}±1.08 (75)	46.07^{c}±0.85 (128)	59.59^{ab}±1.57 (61)	58.96^{a}±0.66 (294)	58.32^{a}±0.93 (136)
5.	82.05^{a} ±0.70 (221)	81.67^{a}±0.96 (136)	72.06^{b}±0.60 (251)	80.69^{a}±1.05 (104)	76.74^{b}±0.51 (472)	81.25^{a}±0.71 (240)
6.	57.50^{a} ±0.88 (156)	59.34^{a}±1.47 (50)	53.24^{b}±0.84 (129)	53.52^{b}±1.28 (33)	55.28^{a}±0.63 (285)	57.02^{a}±1.07 (83)
7.	65.60^{ab} ±0.76 (179)	62.66^{b}±1.32 (95)	65.76^{a}±0.78 (183)	63.08^{ab}±1.24 (79)	65.68^{a}±0.55 (362)	62.86^{b}±0.91 (174)
8.	59.96^{b} ±1.53 (57)	64.67^{a}±1.22 (81)	62.24^{ab}±1.45 (53)	65.04^{a}±1.37 (65)	61.06^{b}±1.06 (110)	64.84^{a}±0.90 (146)
9.	65.33^{b} ±1.25 (129)	72.38^{a}±1.34 (117)	67.25^{b}±1.23 (138)	72.62^{a}±1.28 (129)	66.33^{b}±0.88 (267)	72.51^{a}±0.92 (246)
Over -all	70.86^{a} ±0.46 (1657)	71.12^{a}±0.55 (912)	68.50^{b}±0.44 (1597)	70.94^{a}±0.57 (809)	72.03^{b}±0.30 (3254)	73.86^{a}±0.36 (1721)

Gen. = Generation; Figures in parentheses are the number of observations. Means bearing different superscripts (among genetic groups and crosses separately) differ significantly (P<0.05)

purebreds as well as crossbreds.

Egg production declined during fourth and sixth generations. The main reason of this decline may be the Gumboro outbreak in this population causing death of high producing birds. Another possible reason might be that while selecting the pullets, emphasis was given on egg weight in later generations thus causing decline in egg production because of negative genetic correlation between the two traits.

Table 2. Generation wise least squares means for egg weight of different genetic groups

Gen.	Genetic groups				overall	
	H×H	H×C	C×C	C×H	Purebreds	Crossbreds
1.	51.31^{b}±0.24 (241)	52.80^{a}±0.41 (178)	51.34^{a}±0.26 (237)	52.41^{ab}±0.41 (150)	51.32^{a}±0.12 (478)	52.68^{b}±0.14 (328)
2.	50.89^{b}±0.13 (349)	51.91^{a}±0.13 (149)	50.96^{b}±0.15 (279)	51.82^{a}±0.12 (151)	50.92^{b}±0.10 (628)	51.86^{a}±0.08 (300)
3.	50.40^{a}±0.26 (159)	47.48^{b}±0.52 (31)	50.43^{a}±0.23 (199)	48.54^{b}±0.38 (37)	50.42^{a}±0.17 (358)	48.06^{b}±0.32 (68)
4.	53.59^{a}±0.24 (166)	53.36^{a}±0.30 (75)	53.85^{a}±0.29 (128)	53.02^{a}±0.33 (61)	53.70^{a}±0.18 (294)	53.21^{a}±0.22 (136)
5.	51.09^{a}±0.22 (221)	50.10^{b}±0.30 (136)	50.59^{ab}±0.19 (251)	50.60^{ab}±0.30 (104)	50.83^{a}±0.14 (472)	50.32^{b}±0.21 (240)
6.	52.72^{a}±0.20 (156)	50.64^{b}±0.39 (50)	53.06^{a}±0.19 (129)	50.39^{b}±0.34 (33)	52.88^{a}±0.14 (285)	50.54^{b}±0.23 (83)

7.	$52.88^{a}\pm0.18$	$51.39^{b}\pm0.25$	$52.70^{a}\pm0.18$	$50.80^{b}\pm0.29$	$52.79^{a}\pm0.13$	$51.12^{b}\pm0.19$
	(179)	(95)	(183)	(79)	(362)	(174)
8.	$50.45^{ab}\pm0.44$	$50.54^{a}\pm0.36$	$50.92^{a}\pm0.39$	$49.35^{b}\pm0.39$	$50.68^{a}\pm0.30$	$50.01^{a}\pm0.27$
	(57)	(81)	(53)	(65)	(110)	(146)
9.	$49.22^{ab}\pm0.26$	$49.53^{a}\pm0.31$	$49.09^{ab}\pm0.26$	$48.67^{b}\pm0.25$	$49.15^{a}\pm0.18$	$49.07^{a}\pm0.20$
	(129)	(117)	(138)	(129)	(267)	(246)
Over	$51.47^{a}\pm0.08$	$50.85^{b}\pm0.12$	$51.33^{a}\pm0.08$	$50.50^{c}\pm0.11$	$51.43^{a}\pm0.06$	$51.00^{b}\pm0.08$
- all	(1657)	(912)	(1597)	(809)	(3254)	(1721)

Gen. = Generation; Figures in parentheses are the number of observations. Means bearing different superscripts (among genetic groups and crosses separately) differ significantly ($P<0.05$)

Egg weight: Average egg weights were significantly higher for the crossbreds than the purebreds in generations G1 and G2 only and significantly lower in G3, G6 and G7. In the remaining generations the egg weight of purebreds and crossbreds were almost similar. The averages for egg weight in purebreds ranged from 49.15±0.18 g to 53.70±0.18 g and 48.06±0.32 g to 53.21±0.22 g in crossbreds over the generations (Table 2) which is in close conformity with the findings of Reddy et al. (1980), Kumararaj et al. (1990), Reddy et al. (1990), Chaubal et al. (1994), Brah et al. (1995), Chaudhary et al. (1997) and Brah et al. (2002). No definite trend was discernible for the differences in egg weight of two reciprocal crosses in all the generations investigated. Chaubal et al. (1994) also reported superiority of crossbreds over purebreds in two generations of RRS.

Heritability estimated from sire component of variance pooled over generations for egg number and egg weight in purebreds were 0.255±0.054 and 0.286±0.060, and the corresponding values for crossbreds were 0.324±0.090 and 0.369±0.061, respectively. Heritability estimates were higher for the crosses than the purebreds for both the traits suggesting the buffering qualities of the heterozygous genotypes in relation to a changing environment. Also the additive genetic variation observed among crossbred progenies may contain the additive genetic variation found in the purebred lines plus the purebred's non-additive genetic variation which is seen as additive genetic variation in the crossbred.

Thus the study reveals that in general crossbreds were slightly superior to the purebreds for most of the performance traits. In most of the cases the C×H cross was somewhat superior to its reciprocal cross H×C. The results suggest the use of 'C' strain as male and 'H' strain as female line for the production of a hybrid layer. Differences in generation means for different traits may be accounted for by the effect of both selection and environmental factors. Also, existence of non-additive genetic variation for various components of both these traits is suggestive of exploitation of this type of genetic variation through schemes based on crossbred selection.

REFERENCES

Brah GS, Chaudhary ML and Sandhu JS. 1995. Quantitative genetics of hatching traits and their interrelations with economic traits in chickens *Indian Journal of Poultry Science* 30: 179-184.

Brah GS, Chaudhary ML and Sandhu JS. 2002. Inheritance of changes in body weights over the laying cycle and their interrelations with economic traits in White leghorn. *Indian Journal of Poultry Science* 37: 215-220.

Chaubal DV, Solanki JV, Shukla RK, Rank DN, Mishra RK and Khanna K.1994.Performance of White leghorn pullets under reciprocal recurrent selection for two generations. *Indian Journal of Poultry Science* 9: 211-217.

Chaudhary ML, Brah GS and Sandhu JS. 1997. Genetic inferences from comparison of pure and crossline White leghorn. *Indian Journal of Poultry Science* 32: 28-32.

Gowe RS and Fairful RW. 1985. The direct response to long term selection for multiple traits in egg stocks and changes in genetic parameters with selection. Poultry Genetics and Breeding. British Poultry Science Symposium, 18.

Harvey WR. 1987. Mixed Model Least-squares Maximum Likelihood Computer Program. PC version – 1.

Kumararaj R, Kothandaraman P and Ulaganathan V. 1990.Heterosis for growth, reproduction and egg quality in an inter-strain cross of White leghorn. *Indian Journal of Poultry Science* 25: 13-20.

Reddy PM, Krishna VJ, Rao PV, Sharma PLN, Satyanarayana A and Mohapatra SC. 1990. Evaluation of 3-way, 4-way, 3-strain, F2 and back-cross White leghorn pullets for production traits. *Indian Journal of Poultry Science* 25: 235-240.

Reddy VD, Mohapatra SC, Ayyagiri V, Chaudhary D, Thiagasundaram TS and Shyamsunder G. 1980. Evaluation of 2-way and 3-way White leghorn strain crosses for production and egg quality traits. *Indian Journal of Animal Science* 50: 1104-1109.

Singh DK, Singh CSP and Mishra HR. 1981.Egg parameters in reciprocal crosses of two strains of White leghorn birds. *Indian Journal of Poultry Science* 16: 156-158.