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Research Article

Genetic Gain in Productive Traits and Nonproductive Traits through Selection Indices in HF×Gir Halfbreds

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ABSTRACT

The present investigation entitled, "Genetic gain in productive and non productive traits through selection indices in HF xGir halfbreds" undertaken to asses the magnitude of different factors along with generations affecting the reproductive and productive traits. The data pertaining to HF x Gir halfbreds maintained from year 1972 to 2016 at RCDP on cattle, M.P.K.V., Rahuri were used for present investigation.

In HF x Gir halfbred cows the heritability of AFC, SP, PMY, LMY, LL, DP< CI, MY/CI, MY/LL was 0.521 ± 0.517, 0.132 ± 0.104, 0.432 ± 0.433, 0.259 ± 0.227, 0.330 ± 0.031, 0.430 ± 0.430, 0.087 ± 0.066, 0.077 ± 0.060 and 0.056 ± 0.061, respectively.

Out of 28 selection indices constructed for HF x Gir halfbreds, index $I_{24}$to I_{28} from four traits combination were found to be relatively efficient indices and rated as the most useful indices for their high reliability and expected genetic gain.

Keywords: *Economics, Animals, Genetic, Halfbreds*

INTRODUCTION

The economics of dairy industry is based on productivity of animals which is governed by several productive traits. The dairy animals are kept for milk production and their selection is done for their breeding value (genetic worth). The aim of the present day livestock breeder is to raise the animals on commercial line based on the principle of maximum gain from minimum input. It means that the animals which will bring maximum economic returns are kept while the rest unwanted low profitable stock culled at an earliest to reduce pressure on space and resources and also to increase efficiency of management. For proper selection and culling, a kind of yard stick is needed to discriminate the animals likely to bring maximum economic returns from those less profitable. To develop this kind of discriminating yard stick, all economically important traits are taken into account and combined according to their relative economic weights into a net economic score for each animal.

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The relative weight of a trait depends upon its heritability, relative economic value and association with other traits. The animals which rank best on this scale are retained and other culled for maximum returns from a livestock enterprises.

MATERIALS AND METHODS

The data of HF x Gir halfbreds maintained at Research Cum Development Project on Cattle, M.P.K.V., Rahuri for a period of 44 years (1972 to 2016). The data were classified according to genetic groups, period of birth/ calving and season of birth/calving. The data collected according to period of birth classified into 6 groups as P_1(1972-1978), P_2(1979-1985), P_3(1986-1992), P_4(1993-1999), P_5(2000-2006), P_6(2006 and above). Period of calving P_1(1974-1980), P_2(1981-1987, P_3(1988-1994), P_4(1995-2001), P_5(2002-2008), P_6(2008 and above) Viz., 5 order of lactation viz. L1 lactation order 1, L2 lactation order 2, L3 lactation order 3, L4 lactation order 4, lactation order 5; Season of birth coded as Rainy (June – September) coded S_1, Winter (October – January) S_2, Summer (February – May) S_3 Peak milk yield group (kg) as Y_1<12.00kg, $Y_2$12-14kg, Y_3>14kg.

Model – I

The least squares means of age at first calving estimated by considering period of birth and season of birth effects.

The following model used for estimation,

$$Y_{ijk} = \mu \pm P_i \pm S_j \pm e_{ijk}$$

Model – II

The least squares means of service period, calving interval, lactation milk yield, lactation length, dry period, milk yield per day of calving interval and milk yield per day of lactation length were estimated by considering period of calving, season of calving, lactation order and peak milk yield effects.

The following model used for estimation,

$$Y_{ijklm} = \mu \pm A_i \pm B_j \pm C_k \pm D_l \pm e_{ijklm}$$

Model – III

Least squares analysis of some reproduction and production traits as affected by generation carried out by using following statistical model.

$$Y_{ij} = \mu \pm G_i \pm e_{ij}$$

Duncan's Multiple Range Test

$$(\bar{Y}_i - \bar{Y}_j) \times \sqrt{2/C_{ii} + (C_{jj} - C_{ij})} \geq \sigma^2_e \, Z\,(P, n_e)$$

Construction of selection indices

Selection indices constructed by using different traits in different combinations according to Cunningham (1969).

Model for estimation of relative efficiency of index

The relative efficiency of the index Ii was computed as per Hogsett and Nordskog (1958).

$$\text{Relative efficiency} = \frac{\Delta H\,(Ii)}{\Delta H\,(Is)}$$

Where,

Ii = i^{th} index whose relative efficiency was estimated

Is = Standard index with maximum aggregate genetic gain

RESULT AND DISCUSSION

An index method is more efficient for selection of an animal than tandem method or independent culling method, because it results in more genetic improvement for the time and efforts put in it's use. The rate of genetic gain

besides other factors depend upon the selection intensity.

Selection indices were constructed by incorporating age at first calving (AFC), service period (SP), calving interval (CI), lactation length (LL), dry period (DP), lactation milk yield (LMY) and milk yield per day of calving interval (MY/CI) and milk yield per day of lactation length (MY/LL). Total 150 selection indices were constructed in all possible combinations of four traits. However, out of them only 28 have given precise estimates and are presented in Table 1.

Partial regression coefficient of different traits (b values) and measure of the accuracy (rIH value) of different indices have been presented in Table 1 The partial regression coefficients of different traits (b values) in an index are a function of their relative economic values, heritability and correlations with other traits.

Efficiency of selection indices

The chief measure of utility of an index is it's correlation with aggregate breeding value, rIH. The genetic response to selection is proportional to this correlation. Out of 28 selection indices constructed for HF x Gir halfbreds, index I_{24} to I_{28} four traits combination were found to be relatively efficient indices and rated as most useful indices for high reliability and expected genetic gain.

On incorporating the relative measures of accuracy out of all the indices for HF x Gir halfbreds, index I_{24} [(-9.907) (CI) + (-0.5409) (LL) + (-15.287) (DP) + (89.66) (PMY)] was observed to be the most accurate (rIH = 0.89).

The index I_{24} with four traits combination [(-9.907) (CI) + (-0.5409) (LL) + (-15.287) (DP) + (89.66) (PMY)] was found to be the most useful index. Using this index the response in each trait per generation was expected to be -1.76 days in calving interval (CI), 70.29 days in lactation length (LL), -84.4 days in dry period and 0.049 kg in peak milk yield (PMY).

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Out of 28 selection indices constructed for HF x Gir halfbreds, index $I_{24}$to I_{28} from four traits combination were found to be relatively efficient indices and rated as the most useful indices for their high reliability and expected genetic gain.

Table 1: Selection indices for HF x Gir halfbreds (four traits combination)

Index	Particulars	Traits				
		AFC	**CI**	**SP**	**LMY**	
I_1	B Value	-0.422	0.01319	0.1959	1.071	rIH=0.6892
	R.E.V.	-10.88	-15.52	-12.35	1	Δ H=193.59
	Δ gi	-168.63	-19.27	55.018	-7.2938	
		AFC	**PMY**	**MY/LL**	**MY/CI**	
I_2	B Value	-3.0304	-8.9906	5.6594	-0.9930	rIH=0.5284
	R.E.V.	-10.88	1	-12.35	-15.52	ΔH=539.63
	Δ gi	-296.8	-0.445	-0.375	-0.013	
		AFC	**CI**	**SP**	**DP**	
I_3	B Value	-3.5998	1.260	-0.075	-1.545	rIH=0.5808
	R.E.V.	-10.88	-15.52	-12.35	-12.02	Δ H=664.96
	Δ gi	-294.99	-1.921	-3.326	-0.436	
		AFC	**CI**	**SP**	**PMY**	
I_4	B Value	-3.4088	0.410	-0.2465	-2.034	rIH = 0.5778
	R.E.V.	-10.88	-15.52	-12.35	-11.05	ΔH = 609.68
	Δ gi	-294.99	-1.921	-3.326	-0.436	
		AFC	**SP**	**LMY**	**MY/LL**	
I_5	B Value	-3.1609	-0.6345	0.08289	-22.014	rIH = 0.5229
	R.E.V.	-10.88	-12.35	12.00	10.38	ΔH = 569.77
	Δ gi	-295.21	-3.3135	-9.5747	-0.0354	
		AFC	**SP**	**LL**	**MY/LL**	
I_6	B Value	-3.1825	-0.6086	0.59789	3.4898	rIH = 0.5172
	R.E.V.	-10.88	-12.35	14.49	10.98	ΔH = 572.48
	Δ gi	-295.61	-3.1993	-0.329	-0.0342	
		AFC	**SP**	**PMY**	**MY/LL**	
I_7	B Value	-3.2549	-0.2445	-8.9768	6.24738	rIH = 0.5365
	R.E.V.	-10.88	-12.35	-11.05	10.98	ΔH = 580.48
	Δ gi	-298.4	-3.1644	0.438	0.0369	

Index	Particulars	Traits				
		AFC	**SP**	**PMY**	**MY/CI**	
I_8	B Value	-3.1337	-0.231	-0.2911	1.4512	rIH = 0.5369
	R.E.V.	-10.88	-12.35	-11.05	10.96	ΔH = 580.48
	Δ gi	-298.1	-3.2013	0.054	0.0022	
		AFC	**CI**	**LMY**	**LL**	
I_9	B Value	-3.0448	-0.2825	0.02128	0.4052	rIH = 0.50738
	R.E.V.	-10.88	-15.52	12.00	14.49	ΔH = 544.62
	Δ gi	-293.67	-1.7556	-121.96	-0.532	
		AFC	**CI**	**LMY**	**PMY**	
I_{10}	B Value	-3.1081	-0.044	0.016	0.0815	rIH = 0.53492
	R.E.V.	-10.88	-15.52	12.00	-11.05	ΔH = 553.303
	Δ gi	-295.89	-1.8284	-103.96	-0.0399	
		AFC	**CI**	**LMY**	**MY/LL**	
I_{11}	B Value	-3.1082	-0.0465	0.01703	-0.5248	rIH = 0.53521
	R.E.V.	-10.88	-15.52	12.00	10.98	ΔH = 553.36
	Δ gi	-285.80	-1.827	-101.61	-0.0344	
		AFC	**CI**	**LMY**	**MY/CI**	
I_{12}	B Value	-3.1337	-1.7536	0.2665	-107.97	rIH = 0.5437
	R.E.V.	-10.88	-15.52	12.00	10.96	ΔH = 562.178
	Δ gi	-290.43	-2.7358	-123.01	0.00684	
		AFC	**CI**	**LL**	**PMY**	
I_{13}	B Value	-3.1214	-0.0727	0.16374	-8.5277	rIH = 0.5292
	R.E.V.	-10.88	-15.52	14.49	12.00	ΔH = 557.19
	Δ gi	-296.10	-1.7623	-0.6563	-0.465	
		AFC	**CI**	**PMY**	**MY/LL**	
I_{14}	B Value	-3.1912	0.0715	-3.2407	6.1567	rIH = 0.5468
	R.E.V.	-10.88	-15.52	-11.05	10.98	ΔH = 567.75
	Δ gi	-276.03	-1.8606	-0.41	-0.0353	

Index	Particulars	Traits				
		AFC	**CI**	**PMY**	**MY/CI**	
I_{15}	B Value	-3.1912	0.0715	-1.8127	-6.3585	rIH = 0.5476
	R.E.V.	-10.88	-15.52	-11.05	10.96	ΔH = 525.82
	Δ gi	-277.75	-14.107	-0.434	-0.0043	
		AFC	**CI**	**MY/LL**	**MY/CI**	
I_{16}	B Value	-3.2249	-0.3718	50.6335	-55.369	rIH = 0.5534
	R.E.V.	-10.88	-15.52	10.98	10.96	ΔH = 554.033
	Δ gi	-293.23	-2.298	-0.0335	-0.00043	
		AFC	**LMY**	**LL**	**DP**	
I_{17}	B Value	-3.0843	0.0445	0.04733	-1.5698	rIH = 0.4767
	R.E.V.	-10.88	12.00	14.49	-12.02	ΔH = 588.32
	Δ gi	-277.78	324.45	0.00964	-5.288	
		AFC	**LMY**	**LL**	**MY/CI**	
I_{18}	B Value	-2.8796	-0.0416	0.3945	24.714	rIH = 0.5041
	R.E.V.	-10.88	12.00	14.49	10.96	ΔH = 516.71
	Δ gi	-234.88	-320.36	-0.5605	-0.0027	
		AFC	**LMY**	**DP**	**MY/CI**	
I_{19}	B Value	-3.1392	0.11971	-1.8111	-46.234	rIH = 0.5024
	R.E.V.	-10.88	12.00	-12.02	10.96	ΔH = 593.90
	Δ gi	-281.09	312.22	-5.5636	0.03933	
		AFC	**LMY**	**MY/LL**	**MY/CI**	
I_{20}	B Value	-2.9408	-0.0145	-7.4477	18.946	rIH = 0.5245
	R.E.V.	-10.88	12.00	10.98	10.96	ΔH = 525.81
	Δ gi	-279.578	-431.81	-0.0335	-0.0335	

Index	Particulars	Traits				
		AFC	**LL**	**PMY**	**MY/CI**	
I_{21}	B Value	-2.9699	-0.1611	-15.702	10.7546	rIH = 0.5215
	R.E.V.	-10.88	14.49	-11.05	10.96	ΔH = 530.89
	Δ gi	-233.69	-0.6305	-0.0485	-0.0046	
		AFC	**PMY**	**MY/LL**	**MY/CI**	
I_{22}	B Value	-3.0304	-8.9906	56.594	-0.9931	rIH = 0.5284
	R.E.V.	10.88	-11.05	10.98	10.96	ΔH = 539.63
	Δ gi	-233.68	-0.0445	-0.0375	0.0013	
		AFC	**DP**	**PMY**	**MY/LL**	
I_{23}	B Value	-3.2398	-0.8399	-2.8814	1.0691	rIH = 0.5193
	R.E.V.	-10.88	-12.02	-11.05	10.98	ΔH = 530.39
	Δ gi	-244.55	-0.5723	-0.0335	-0.0049	
		CI	**LL**	**DP**	**PMY**	
I_{24}	B Value	9.90784	-0.5409	-15.287	89.667	rIH = 0.8901
	R.E.V.	-15.52	14.49	-12.02	-11.05	ΔH = 1149.46
	Δ gi	-1.7614	70.2902	-84.481	0.04922	
		CI	**LL**	**PMY**	**MY/LL**	
I_{25}	B Value	0.05506	0.47866	1.1793	-0.2477	rIH = 0.82678
	R.E.V.	-15.52	14.49	-11.05	10.98	ΔH = 44.179
	Δ gi	-1.401	1.5686	-0.0269	-0.0051	
		CI	**LL**	**PMY**	**MY/CI**	
I_{26}	B Value	-0.0866	0.67155	1.89038	-8.8312	rIH = 0.80063
	R.E.V.	-15.52	14.49	-11.05	10.96	ΔH = 51.216
	Δ gi	-59.908	1.3825	-0.0335	0.055372	

Index	Particulars	Traits				
		CI	**LL**	**MY/LL**	**MY/CI**	
I_{27}	B Value	-1.3031	2.1377	72.6337	-94.184	rIH = 0.98694
	R.E.V.	-15.52	14.49	10.98	10.96	ΔH = 90.831
	Δ gi	-60.729	-37.94	-0.0086	0.05544	
		CI	**DP**	**MY/LL**	**MY/CI**	
I_{28}	B Value	0.82212	-1.9008	72.3355	-80.755	rIH = 0.90083
	R.E.V.	-15.52	-12.02	10.98	10.96	ΔH = 163.388
	Δ gi	-4.7436	-119.55	0.1139	0.1693	

Abbreviations: AFC= Age at first calving, SP= service period, LL= lactation length, DP= dry period, LMY= lactation milk yield
CI= calving interval MY/CI= Milk yield per day of calving interval.
R.E.V. = Relative economic weights, Δ gi= Gain in each trait, ΔH= Overall genetic gain
rIH= Correlation between genetic worth and indeX

REFERENCES

Banerjee, Sandip & Banerjee, S. (2002). Correlation between some reproduction and production traits in Holstein Friesian x Sahiwal crossbred cows. *Indian Vet. J. 79*(2), 927-930.

Cunningham, E. P. (1969). Animal Breeding Theory. Landbruck Sokbhandelen Universities, Forlaget Yollabekk, 0510.

Deokar, D. K., & Ulmek, B. R. (2001). Studies on lactation length in Jersey cattle. *J. Maharashtra Agric. Univ*. *26*(1), 104-106.

Hazel, L. N., & Lush, J. L. (1942). The efficiency of three methods of selection. *J. Heridity*. *33*, 393-399.

Hogsett, M. L., & Nordskog, A. W. (1958). *Poult. Sci*., *37*, 1404-1419.

Krammer, C. Y. (1957). Extension of multiple range test to group related adjusted mean-Biometrics *13*, 20.

Smith, C. (1983). Effect of changes in economic weights on the efficiency of index selection. *J. Anim. Sci*., *56*, 1057-1064.

Swiger, L. A., Harvey, W. R., Everson, D. O., & Gegory, K. E. (1964). The variance of interclass correlation involving groups with one observation. *Biometrics. 20*, 818-826.