THE ANALYSIS ON GENETIC FACTORS OF FEED ENERGY AND PROTEIN EFFICIENCY OF *Chinese Simmental*

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SUMMERY
Data on daily dry matter intake(DMI),daily feed energy intake(DEI),daily feed crude protein intake(CPI),feed total energy efficiency(EFF),feed energy efficiency for milk(EFFM),feed energy for daily gain(EFFD),feed crude protein efficiency(ECP),ECP for milk(ECPM),ECP for body gain(ECPD), milk yield(MY),milk fat yield(FY),milk protein yield(PY),milk fat plus protein plus lactose yield(FPL),daily gain(DG) and mean liveweight(MLW) were obtained. These records, from 151 lactating daughters of 31 bulls,distributed over 5 selecting and breeding farms,which are all operated at principle as open nucleus breeding system(ONBS) by *Chinese Simmental* Assosiation,were analysed by iteration maximum quadratic variance unbiased estimation(I-MQVUE) fitting a sire model with farm,parity,calving season as fixed effects and sire as random effect.The animals were managed with half confined system in 1st,2nd,3rd and 4th farm while confined system in 5th farm and concentrates were given according to milk yield for all. When cattle in half confined system, DMI was measured with combined inner(AIA of feed and excrement) and outer (Cr_2O_3) indicator method. Heritability estimates for EFF, EFFM, EFFD, ECP, ECPM, ECPD, MY, FY, PY, PFL, DG and MLW were 0.56±0.16, 0.46±0.15, 0.12±0.13, 0.05±0.12, 0.13±0.13, 0.41±0.15, 0.30±0.14, 0.73±0.17, 0.63±0.16, 0.20±0.14, 0.56±0.16 and 0.03±0.12 respectively. The genetic correlations between efficiency traits and intake traits were negative highly(-0.23~ -0.67) while that between efficiency traits and their respective output traits were high positive(0.10~0.99), and that between DG and milk output traits, MLW and all output traits ranged from -0.59 to -0.92,-0.02 to -0.60 respectively. The results indicate that the correlation response in efficiency may be higher and more suitable for dual purpose breeding objective had layed down when selection on an index including PY,FY and DG than on the index including MY and DG in effect now for *Chinese Simmental.*
Keywords: *Chinese Simmental* feed efficiency genetic factors indirect selection

INTRODUCTION
Feed cost is most important part in cattle industry and is about 35-55% of total cost(Qin, 1981), so it is necessary to improved feed efficiency in cattle breeding, however, direct selection on efficiency is impractical due to the high cost of measuring efficiency traits. instead of that, breeders have had to rely on the correlated responses in feed efficiency with selection on milk or milk solids production or daily gain. Several analysis on genetic factors of feed intake, intake traits and efficiency traits indicated that higher efficiency could be gained with selecting on milk solid

model with farm, parity, calving season as fixed effects and sire as random effect.

RESULTS

Heretabilities and standard erro, correlation was given in table 1. The genetic correlations between total efficiency traits(ECP, EFF) and all production traits are positive, and that between efficiency traits and response production traits are high positive respectively. but efficiency traits of milk production traits and these of weight change traits are negative. All the efficiency traits have negative correlation to mean liveweight over the experiment periods.

Table 1. Estimates of Heritability (last column), Genetic correlation(above digoal), and phenotypic correlation(below digonal) for DMI, DEI, CPI,MLW, DG, MY, PY, PFL, EFFM, EFFD, EFF, ECPM, ECPD, ECP

	DMI	DEI	CPI	MLW	DG	MY	PY	FY	PFL	EFFM	EFFD	EFF	ECPM	ECPD	ECP	$h^2\pm$ se
DMI		0.96	0.98	0.79	0.79	0.32	0.16	0.03	0.67	-0.67	-0.27	-0.23	-0.67	-0.61	-0.47	0.04± 0.12
DEI	0.99		0.49	0.53	0.88	0.99	0.36	0.23	0.42	-0.34	-0.34	-0.91	-0.42	-0.43	-0.51	0.03±0.12
CPI	0.97	0.98		0.57	0.15	0.57	0.34	0.07	0.46	-0.63	-0.31	-0.19	-0.48	-0.49	-0.42	0.16± 0.13
MLW	0.78	0.78	0.73		-0.55	-0.06	-0.20	-0.02	-0.30	-0.36	-0.68	-0.70	-0.44	-0.27	-0.43	0.03±0.12
DG	0.34	0.34	0.30	-0.06		-0.75	-0.92	-0.91	-0.59	-0.45	0.53	0.78	-0.14	0.60	0.18	0.56±0.16
MY	0.08	0.04	0.02	0.03	-0.14		0.17	0.18	0.93	0.96	-0.94	0.82	0.23	-0.75	0.25	0.30±0.14
PY	0.08	0.05	0.01	0.08	-0.08	0.84		0.89	0.16	0.84	-0.09	0.70	0.62	-0.79	0.99	0.63± 0.16
FY	0.11	0.08	0.02	0.13	-0.08	0.81	0.91		0.13	0.90	-0.19	0.89	1.01	-0.13	0.90	0.73±0.17
PFL	0.11	0.07	0.01	0.08	-0.11	0.89	0.94	0.93		0.28	-0.82	0.65	0.87	-0.79	0.79	0.20±0.14
EFFM	-0.28	-0.31	-0.37	-0.24	-0.01	83	0.82	0.83	0.84		-0.23	0.46	0.53	-0.14	0.88	0.04± 0.15
EFFD	-0.42	-0.42	-0.40	-0.12	0.86	-0.11	-0.06	-0.06	-0.08	-0.07		0.74	-0.65	0.98	0.09	0.12±0.13
EFF	-0.47	-0.49	-0.52	-0.22	0.62	0.45	0.48	0.49	0.48	0.65	0.68		0.88	0.67	0.52	0.56± 0.16
ECPM	-0.09	-0.05	-0.01	0.08	-0.08	0.85	0.98	0.91	0.94	0.82	-0.06	0.48		-0.23	0.36	0.13±0.13
ECPD	-0.41	-0.41	-0.38	-0.14	0.88	-0.10	-0.05	-0.06	-0.08	0.87	0.87	0.67	-0.05		0.06	0.41±0.15
ECP	-0.02	-0.02	-0.07	0.06	0.02	0.82	0.96	0.89	0.92	0.09	0.09	0.59	0.76	0.10		0.05± 0.12

Table 2. Contrast among correlation response of direct and indirect selection for efficiency traits

	MLW	DG	MY	PY	FY	PFL
EFFM	-0.08	-0.50	+0.77	+0.98	+1.10	+1.18
EFFD	-0.31	+1.14	-1.47	-0.20	-0.46	-1.05
EFF	-0.15	+0.78	+0.60	+0.74	+1.01	+0.39
ECPM	-0.19	-0.29	+0.34	+1.35	+2.34	+1.07
ECPD	-0.07	+0.70	-0.64	-0.98	-0.17	-0.55
ECP	-0.32	+0.62	+0.79	+3.50	+0.17	+1.63

Note: 1. Assistant traits will be selected upward, assistant traits in first row and indirect selection traits in first column

2. "+" stand for increase, "-" stand for decrease

3. selection intensity is equal for all assistant selection traits

production traits, and that is practical(see Mcallister A. J., 1990, Wilmink B. M., 1987, Gibson, J. P. 1986). The results mentioned above were almost all from beef or dairy data cattle, and not from dual purpose breed ,once more,they didn't consider dual purpose breeding scheme.

The aim of this study was to estimate genetic parameters of feelyd efficiency traits and productive traits under fed regime in active and expect to serve for selection and breeding for *Chinese Simmental.*

MATERIALS AND METHODS

1. Animals and Management 151 lactating daughters of 31bulls, distributed over 5 breeding farms , which are all operated at principle as open nucleus breeding system(ONBS) by Chinese Simmental Association.These cattle are at range from 1st to 8th parities and half confined system (grazing+supplement concentrate and roughage indoor) was in effect in 1st, 2nd, 3rd and 4th farms while confined system(no grazing) was in effect in 5th farm. In all of the five farms, "complete diet" feed was given according to milk yield and additional 2kg concentrate was offered for one cattle maintance per day.

Daily milk yield , offered concentrates and roughage intake indoor were weihted over the experiment period and a single bin were offered for one individual. Liveweight was recorded at beginning and ending of experiment period(90 days).

2. Estimation of dry matter intake in grassland The dry matter intake was measured with combining inner(AIA in feed and excrement) and outer (Cr_2O_3) indicator in four half confined system farms, and the same trial was done in order to check the accurance of measuring DMI since it is easy to be measured the true DMI value in 5th farm where confined system was used. Protein, energy and AIA content of sampled concentrates, roughage indoor and forage grass in grassland was analysised in laboratory, If concentrate dry matter intake was DMI_1, roughage dry matter intake indoor DMI_2 and all dry matter intake was DMI of one individual, so dry matter intake in grassland $DMI_0=DMI-DMI_1-DMI_2$, because the amount of AIA intaken from feed and Cr_2O_3 given are equal to that outputted from excrement respectively.

3.Calculation of traits and their code

MLW=mean liveweight(kg) DG=mean weight change(daily gain)(kg)

DMI=daily dry matter intake(kg) DEI=daily gross energy intake(MJ)

CPI=daily crude protein intake(kg) MY=daily milk yield(kg) PY=daily milk protein yield(kg)

FY=daily milk fat yield(kg) PFL=PY+FY+daily milk lactose yield

ECPM=PY/CPI EFFM= MY×4.184×(750+387.98F+163.97P+55.02L)/(1000×DEI)

F, P, L are the percentage of fat, protein and lactose of milk respectively

ECPD(intaken protein efficiency for energy deposition)

$=DG\times(170.22-0.1731\times MLW+0.00017\times MLW^2)(1.12-0.1258DG)/CPI$

ECP=ECPM+ECPD EFFD=DG×(1.5045+MLW)/((1-0.30DG)×DEI)

EFF=EFFM+EFFD

An assumption was made that all milk protein came from feed, because the coefficient of weight lost protein converting into milk protein was not known.

4.Iteration maximum quadratic variance unbiased estimation analysis(I-MQVUE)(Harvey-1990) were conducted on each traits and on their sums to estimate variance and covariance fitting a sire

DISCUSSION

The size of this material is small for separate genetic variance from phenotypic variance, and degree of data unbalance is another important factor to affect the accuracy of estimating genetic parameters, These factors lead to high standard erro of genetic parameter estimation(see table 1), but the correlation tendency among traits considered in this paper is almost the same as results of some study(Persuad *et al.* 1990, Sevendsen *et al.* 1990, *etc.*)

The main difficulty in such work is accurate measurement of coefficient of body tissue lost converted into productions of milk, especially the coefficient of tissue protein convert into milk protein, so, the assumption that all the milk nitrogen came from feed had to be made, the other coefficient was from "Chinese dairy cattle feed standard", although they may be not very suitable for dual purpose breed.

Measuring DMI accurately is the base to calculate other traits records, especially the measurement of roughage intake in field in half confined system farms. Inner(AIA of excrement and feed) and outer(Cr_2O_3) indicator method was taken to measure DMI. Comparing the estimate DMI with this method and true DMI value weighted in 5th farm, the correlation coefficient was 0.91.

According to genetic parameters in this paper, efficiency of selection and inselection for efficiency traits was compared(see table 2), Freeman(1967) showed that selection milk yield is expected to give between 70 and 95% of the response from direct selection on efficiency, when selection intensities are equal for the two traits. Using the genetic parameters estimated in this study, the expected correlated responses in EFF, from selection on DG, PY, FY and PFL, are 28, 74, 101 and 39% of predicted improvement for EFF with direct selection respectively, while the expected responses in ECP would be gained with direct selection on DG, PY, FY and PFL, are 62, 350, 17 and 163% of predicted improvement for ECP with direct selection respectively.

These results indicate that the correlation response in efficiency may be higher and more suitable for dual purpose breeding objective had layed down when selection on an index including PY,FY and DG than on the index including MY and DG in effect now for *Chinese Simmental.*

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