Minufiya J. Agric. Res. Vol.38 No. 1(1): 69 - 76 (2013) "http://www.mujar.net"

NEW METHOD FOR CALCULATING RELATIVE ECONOMIC VALUE (SOLTAN METHOD) ACCORDING TO BREEDER REQUIREMENTS, AND USE IT FOR CONSTRUCTION OF SOME SELECTION INDICES IN SINAI FOWLS

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(Received: Dec. 13, 2012)

ABSTRACT : *Fife method, were used to calculate relative economic value. Kolstad (1975), Sharma (1982), Lamont (1991), regression, and Soltan (2012) methods were compared and used to construct general selection indices. Studied traits were egg number among the first 90 days of laying (EN_{90}), mature egg weight (EW), clutch size (C) and interval between clutches (I). The main objective of the present study were to obtain and discuss different methods of calculating economic values in selection indices. Numerical examples were used to illustrate and calculate Soltan method as a new method for calculating relative economic value for the studied traits and use it in constructed general selection index.*

Key words : *Selection index, economic value, soltan method for calculating (V) economic vectors.*

INTRODUCTION

Many authors observed that selection index considered as the efficient selection method to evaluate the total breeding values, comparing to tandem selection and independent culling levels (Hazel, 1943 and recently Elwardany *et al.* 1992, Enab *et al.* 2000, Ben Naser (2007) and Abou Elawa (2010).

Formula obtained by Hazel (1943) was used to construct the indices and their efficiencies. Relative economic values were measured by different wayes such as Kolstad (1975), Sharma (1982), Lamont (1991), and regression methods.

Some methods were based on the value in terms of the price data and net profit Kolstad (1975), whereas Sharma (1982) calculated the economic weight depending on the standard deviation of the phenotypic variance, Lamont (1991) and Abou-Elewa (2010) applied the selection index by using method depending on the estimates of heritabilities of studied traits. New method was conducted by the author named Soltan method according the phenotypic and genetic variances and the requirement of the breeders and market requirements for the selected traits in order to achieve the ideal strain from view of breeders and producers.

The objective of this study is to compos different ways or method for calculating relative economic values with the new method from Soltan and estimate the expected selection gain in each traits according to these methods.

MATERIALS AND METHODS

Data used in the present study were collected for eight years (2001 – 2007) for Sinai fowls in the poultry farm, Department of Poultry production, Faculty of Agriculture Minufiya University at Shibin El-Kom, Egypt.

About 1600 records were used. Different general selection indices were applied by using fife different methods of calculating economic weights vector. These methods were :

1. Kolstad, 1975 (Cost VS. income for given trait.
2. Sharma (1982) : depending on the phenotypic variance where, $Vi = 1 / \sigma_p$.
3. Lamont (1991) method depending on heritability estimates where, $V_i = T / h_i^2$ and $T = h^2_{En90} + h^2_{EW} + h^2_I + h^2_C$
   En90 = Egg number among the first 90 days of laying (eggs).
   EW = Egg weight (g).

I = Interval between clutches (days).
C = Clutch size (eggs).

4. Regression Method :
Calculated by estimating change in the target trait (Y = 1) per one egg as a marketing weight which determine the profit depends on one unit change per unit in the trait by using the regression.

5. Soltan method (New method) :
The relative economic value was estimated according to the deviation from the ideal strain, which it was characteristic according to the market in the year of estimation and to the requirement of the breeders or producers. So these characterization can by changed every year. These deviation of traits in the actual strain from the ideal strain ware standardized by the standard deviation of each trait and then will be weighted by the heritability of the trait in order to estimate the absolute economic value of the trait. Finally, each estimate of absolute economic value for each trait was relatively weighed by the total absolute economic values of all selected traits. Table (1) explain the steps of estimation. This method was simple and represented the requirements and the wishes of breeders and producers according to the market, and depending on both phenotypic and genetic variances.

Data were analyzed by least squares and maximum likelihood general purpose program mixed model LSMLMW (Harvey, 1990).

The general random model utilized by (LSMLMW) was as follow :

$$Y_{ijk} = \mu + S_i + D_{ij} + e_{ijk}$$

Where :

Y_{ijk} = Observation of the K^{th} progeny of the i^{th} sire and j^{th} dam.

μ = Common mean.

S_i = Random effect of i^{th} sire.

D_{ij} = Random effect of j^{th} d^{dm} within i^{th} sire.

e_{ijk} = Random error.

The general selection index was of obtained in terms of heritability, phenotypic and genetic correlations among the studied traits by solving the following equation in given matrix expression according to Cunningham (1969).

Pb = GV to give b = P^{-1} GV

Where :

P = Phenotypic variance and covariance matrix.
G = Genetic variance and covariance matrix.
V = Economic weights column vector.
b = Weighting factors column vector which is going to be solved.

The expected genetic gain (A_G) in each trait, after one generation of selection was obtained by solving the equation.

$$\Delta_{Gi} = r_{GiI}\ i\ \sigma\ G_i$$

Where r_{GiI} = Correlation of the trait with index, i = selection differential in standard deviation unites, σ_{Gi} = genetic standard deviation of the trait.

RESULTS AND DISCUSSION

Data presented in Table (2) summarize phenotypic and genetic parameter to construct general index (I_G). Means of studied traits were 55.5 eggs, 45.2 (g), 1.61 (eggs) and 2.8 (days) for egg number among the first 90days of laying (EW_{90}) mature egg weight (EW), clutch size (C) and interval between clutches (I), respectively. These were in agreement with those reported by (Soltan *et al.,* 1985), Soltan and El Nady (1986), Soltan and Ahmed (1990), Soltan (1992), El Neney (1996), and recently. Mahgoub (2002) and Soltan *et al.* (2009).

Soltan method shows that (V_I) for interval between clutches (I) was negative. This may be due to the relations between increasing egg number and clutch size and decreasing interval between clutches and these leads to decreasing production cost. Similar findings were reported by Pukhramba *et al.* (2001).

Table 1

Table (2): Means, heritabilities, phenotypic standard deviation (σ_p), phenotypic correlation (r_p) above diagonal and genetic correlation (r_G) below diagonal of EN90 (eggs), egg weight (EW) in grans, clutch size (egg) and interval between clutches (I) in days.

Trait	Means	h^2	σ_p	r_G \ r_P EN90	EW	C	I
EN90 (eggs)	55.5	0.04	10.8	-	- 0.30	0.459	- 0.33
EW (g)	45.2	0.14	4.5	-0.63	-	- 0.50	0.58
C (eggs)	1.61	0.05	0.2	0.87	- 0.40	-	- 0.89
I (days)	2.8	0.02	0.7	- 0.69	0.31	- 0.57	-

It was clear that economic vectors were affected by the method used. Sharma (1982) method had higher economic vector for cultch size and interval between clutches according to lower phenotypic variance of these traits Table (2). But for Lamont (1991) method both traits (clutch size and interval between clutches) had higher economic vector because of lower heritability estimates of these traits. Similar finding was obtained by Abdou *et al.* (2012).

Soltan method (2012) has the highest value of r_{Ti} (0.5861) whereas; the Lamont (1991) method has the lowest one (0.3759). Regression method was near to Soltan method r_{Ti} = (0.4921). The expected genetic gain was higher for EN90 and clutch size and better interval between clutches by using Soltan method. Then followed by regression method, Kolstad, Sharma and Lamont methods respectively (Table 3) and Figure (1).

The constructed general in dices were as follow :

I Kolstad = 0.2032 EN_{90} + 0.1094 EW + 0.5719 C – 0.1473 I

I Sharma = 0.2553 EN_{90} + 0.08603 EW + 0.8726 C – 0.2501 I

I Lamont = 0.0079 EN_{90} + 0.3209 EW + 3.014 C – 1.103 I

I Regr. = 0.2326 EN_{90} + 0.0545 EW + 0.0470 C – 0.1189 I

I Soltan = 0.0319 EN_{90} - 0.01062 EW + 0.1201 C – 0. 0991 I

In conclusion the results of the present study cleared that the economic values used in the general selection index for improving EN_{90}, clutch size, interval between clutches and egg weight of Soltan Method (2012) referred to a good method for these traits. It depends on phenotypic and genetic variance and the requirements of breeders or producers according to market needs.

Also Soltan method will be changed yearly according to the requirements of both breeders and producers after studying the market conditions.

Table (3) : Comparison among results of general indices using different methods of economic value vectors.

Trait	Method (1) Kolstad (1975)	Method (2) Sharma (1982)	Method (3) Lamont (1991)	Method (4) Regression	Method (5) Soltan (2012)
Vector (V)					
EN90	1.000	1.000	1.000	1.000	0.086
EW	2.250	1.200	2.286	0.973	0.011
C	2.594	26.710	6.957	1.021	1.090
I	0.617	11.350	18.82	0.109	- 0.189
Weighting factors					
b1	0.2032	0.2553	0.0079	0.2326	0.0319
b2	0.1094	0.08603	0.3209	0.0545	- 0.01062
b3	0.5719	0.8726	3.014	0.0470	0.1201
b4	- 0.1473	- 0.2501	- 1.103	- 0.1189	- 0.0991
s.d. of the index (σ_I)	1.591	1.9669	1.6307	1.7289	0.2419
s.d. of aggregate (σ_T)	3.546	4.2748	4.3375	3.5131	0.4127
Accuracy of the inkdex $r_{(TI)}$	0.4488	0.4601	0.3759	0.4921	0.5861
Expected genetic Gain (ΔG)					
EN90	2.1360	2.305	- 0.5971	2.3960	2.635
EW	- 0.4779	- 0.6304	0.9726	- 0.7130	- 1.087
C	0.0281	0.02973	0.00146	0.0302	0.03104
I	- 0.0323	- 0.03312	- 0.008	- 0.0344	- 0.03446

The results of fife general indices using different methods of calculating economic value vectors (V) were as follow :

	EN90	EW	C	I
Kolstad (1975)	1	2.250	2.594	0.617
Sharma (1982)	1	1.200	26.710	11.350
Lamont (1991)	1	2.286	6.957	18.82
Regression	1	0.973	1.021	0.109
Soltan (2012)	0.086	0.011	1.090	- 0.189

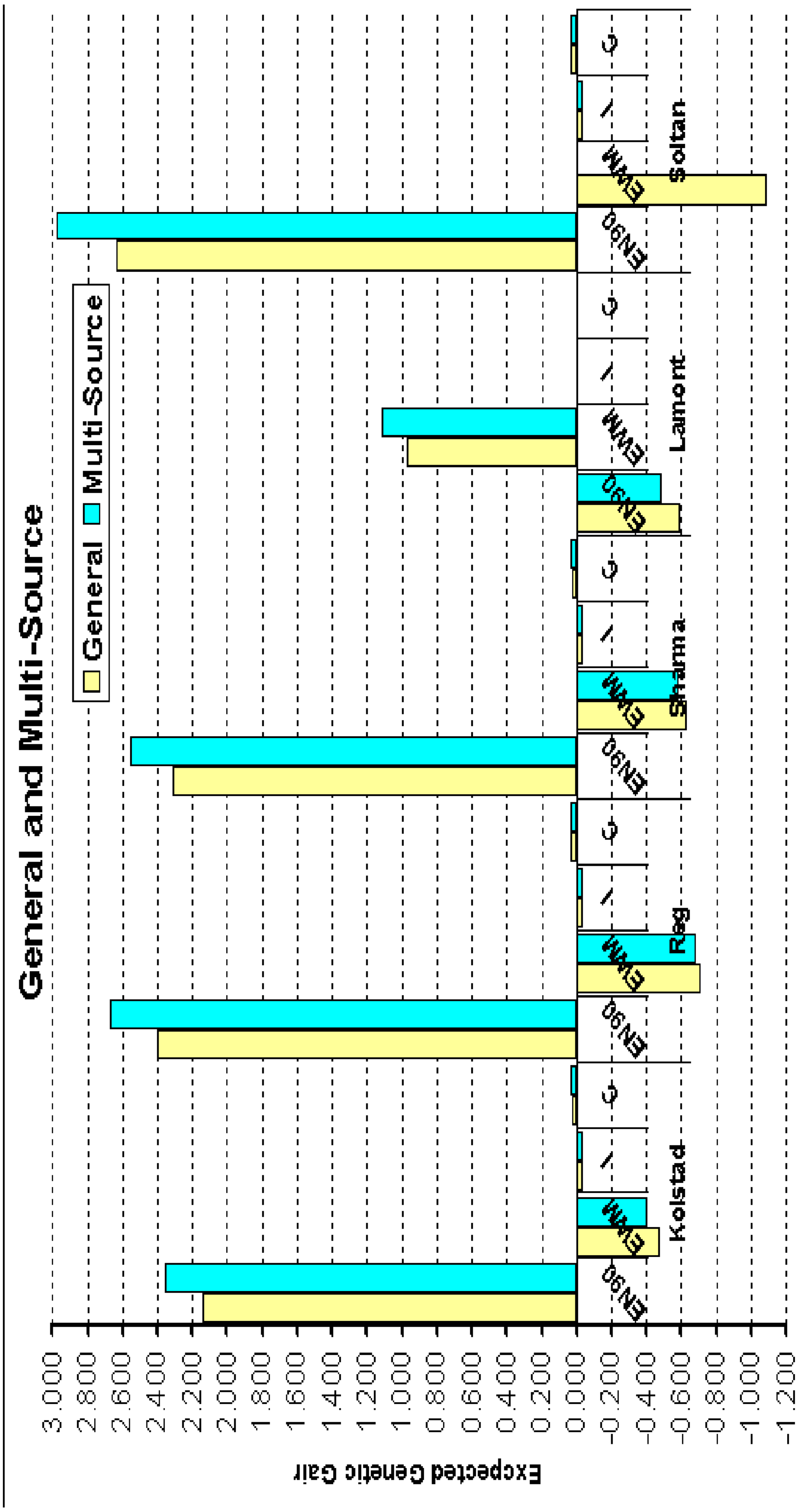

Figure (1): The difference between Expected genetic changes per generation for general and multi-source indices using different economic values under study.

REFERENCES

Abdou, F.H., A.A. Enab and E. Abou-Elewa (2010). Expected genetic gains achieved from applying selection indices using different ways of calculating economic weights in Norfa layers. 3rk Mediterranean poultry summit 5th International poultry conf. 26 – 29 March, 2012 Porto Marina, Alex., Egypt.

Abou – Elewa, E. (2010). Some genetic Parameters of the immune response trait and its utilization in different selection methods in chickens. Ph.D. Thesis Fac. Of Agric., Minufiya Univ., Egypt.

Ben-Maser, K. (2007). selection to improve some economic traits in Norfa chickens. Ph.D. Thesis, Fac. Of Agric., Minufiya Univ., Egypt.

Cunningham, E. (1960). Animal breeding theory. Lamdbruksh of ha-ndelen, Univ. of Orl Age, Vollebek, Oslo.

El-Wardany, A.M. (1997). Breeding for egg quality traits in Gimizah chicken layers. International Conf. on Animal, poultry and Rabbit production and health, The Egyptian International center for Agriculture, Dokki Cairo, Egypt.

Enab, A.A., A. El-Wardany and F.A. Abdou (2000). Genetic aspects of some egg production traits in Norfa under different methods of selection. Egyptian Poultry Sci., 20 : 1017 – 1030.

Harvey, W. (1990). User's guide for LSMLMW. Ohio State Univ. U.S.A.

Hazel, L. (1943). The genetic basis for constructing selection indexes. Genetics 28 : 476 – 490.

EL-Neney, B. (1996). Improvement of some nutritional and productive traits in Sinai fowl. M.Sc.Thesis, Fac. Agric. Minufiya Univ., Egypt.

Kolstad, N. (1975). Selections in sindekser for verpehons. Initute of Poultry and fur Animal Sciences, Agricultural Univ. of Nrway, NLH, Stensi Hxykk no. 72, July, 1475.

Lamont, S.J. (1991). Selection for immune response in chickens. Presented at the 40th Annual National breeder Round Table, May 2 – 3, 1991. St. Louis, Missouri.

Mahgoub, S. (2002). Study of some environmental factors affecting performance in chickens. M. Sc., Facu. Agric., Minufiya Univ., Egypt.

Pukhramba, R., H.N. Singh and R.N. Chatterjee (2001). Efficiency of selection indices with clutch size as a component in White Leghorn. International Journal of Animal Sciences, 16 : 1, 63 – 66.

Soltan, M.E. (1992). Performance of selected Sinai fowl in comparison with Fayoumi and Baladi fowls as standard Egyptian local Breeds. 2. Egg Quality. Minufiya J. Agric. Res., Vol. 17 No. 2 : 513 – 526.

Soltan, M.E., S. Abd El Rahman, F.H. Abdou and Rasha H. Ashour (2009). Direct selection response for feed efficiency of egg production. Minufiya J. Agric. Res. Vol. 34 No 3 : 1011 – 1025.

Soltan, M. E. and B. Ahmed (1990). Performance of selected Sinai fowl in comparison with Fayoumi fowls as standard Egyptian local breeds. 1- Egg production. World Rev. Anim. Prod. Vol. XXV No. 2 : 17 – 26.

Soltan, M.E. and M.M. El Nadi (1986). Studies on the possibility of improvement of body weight, growth rate and vita lity in Bedouin fowl (Sinai). 7th conf. of Egypt. Soc. Of Animal Production, Cairo, Sept., 1986.

Soltan, M.E. (1991). Direct response in egg production from selection on early part records correlated responses in some economic traits as a result of this selection in Sinai (Bedouin) Fowl. Menofyia J. Agric. Res. 16: 373 –417.

Soltan, M.E., M. El-Nady, B. Ahmed and A. Abou Ashour (1985). Studies on the productive performance of Sinai Bedouin fowl. Minufiya J. Agric. Res. 10: 2147 – 2168.

طريقة جديدة لحساب الأهمية الاقتصادية للصفات (طريقة سلطان) طبقا لاحتياجات المربي واستخدامها في تكوين أدلة انتخابية في دجاج سيناء

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الملخص العربي

استخدمت ٥ طرق لحساب الأهمية الاقتصادية النسبية للصفات وهي طريقة كولستاد (١٩٧٥) وشارما (١٩٨٢) و لامونت (١٩٩١) وطريقة الانحدار وطريقة سلطان ٢٠١٢. وتمت المقارنة بينهما واستخدمت في تكوين أدلة انتخابية عامة . الصفات التي درست هي عدد البيض خلال التسعين يوم الأولي من إنتاج البيض (EN_{90}) ، حجم سلسلة وضع البيض (C) ، فترات الراحة بين السلاسل (I) وحجم البيضة الناضجة (EW) .

الهدف الرئيسي من الدراسة هو توضيح ومناقشة طرق متعددة لحساب الأهمية الاقتصادية النسبية في الأدلة الانتخابية واستخدام مثال رقمي لكيفية حساب الطريقة الجديدة (طريقة سلطان ٢٠١٢) وكيفية حسابها واستخدامها في حساب الأهمية الاقتصادية النسبية كطريقة جديدة واستخدامها في تكوين أدلة انتخابية عامة .

Table (1) : Estimates of relative economic value (V) according to Soltan method's.

Trait	Actual strain			Ideal strain	Deviation	Standardized Deviation	Absolute economic value as ratio of D from h^2	Relative economic value
	$\overline{X}_A$	h^2	σ_p	$\overline{X}_I$	$\overline{X}_I - \overline{X}_A = D$	$D / \sigma_p = \overline{D}$	$\overline{D} / h^2 = I_i$	$(V) = \frac{I_i}{\Sigma T}$
Egg number (EN90) (eggs)	55.8	0.04	10.8	81	25.2 $\overline{X}X$	2.33	58.25	0.086
Egg weight (EW) (g)	45.2	0.14	4.5	50	4.8	1.07	7.64	0.011
Clutch size (C) (eggs)	1.6	0.05	0.2	9	7.4	37.0	740.0	1.09
Interval Between clutches (I) (days)	2.8	0.02	0.7	1	- 1.8	- 2.57	-128.5 ΣI_i = 677.30	- 0.189

Where

$\overline{X}_A$ = Average of traits in the actual strain.
h^2 = Heritability estimate of the trait in actual strain.
σ_p = The phenotypic standard deviation of the trait in actual strain.
$\overline{X}_I$ = Average of trait in the ideal strain which it was determined according to the requirement of breeders or produces or market.
D = Deviation of the average of trait in actual strain from the average of the same traits in ideal strain.
$\overline{D}$ = Standardized deviation by the phenotypic standard deviation = D / σ_p.
I_i = Absolute economic value of trait which equal the ratio of the phenotypic standardized deviation to the heritability of the trait ($\overline{D} / h^2$) = I_i.
V = Relative economic value which is the ratio between the absolute economic value of the trait and the total absolute values of all traits in the index (V) = $I_i / \Sigma I_i$