Advantages of using economic weights in animal production

REVISIÓN SISTEMÁTICA

Danny Julio Cruz[1], Chessyra Ninoska Ticona Huaroco[2], Mariam Pascual Amoros[3]

[1] *Magister en Producción animal/ Universidad Politécnica de Valencia. Docente Universidad Nacional del Centro del Perú*
[2] *Estudiante Universidad Nacional del Centro del Perú*.
[3] *Doctor en ciencia animal/Universidad Politécnica de Valencia. Research & Technology Food &Agriculture. Barcelona- Spain (IRTA)*

cruzfloresdj@gmail.com

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ABSTRACT. Introduction: The economic evaluation of the production systems can be performed using the gain function technique. **Objective:**To carry out a review of the literature on the use of the profit function technique in production systems. **Methods:** A literature review on the profit function technique and its usefulness in the economic analysis of production systems was performed.**Results and conclusion:** The profit function allows to calculate the cost of production with greater precision, but at the same time it can facilitate the calculation of the economic weights of the features. These economic weights represent the economic value of each trait, which is used in the selection indices. This function allows to calculate the sensitivity analysis, which is intended to make economic balances against possible changes in the market.

Key words: economic weights, profit function, production costs, sensitivity analysis

Ventajas del uso de pesos económicos en la producción animal

RESUMEN. Introducción: La evaluación ecónomica de los sistemas de producción puede ser realizada mediante la técnica de función de ganancia. **Objetivo:** Realizar una revisón de literatura sobre el uso de la técnica de función de ganancia en sistemas de producción. **Métodos:** Se realizó una revisón de literatura sobre la técnica de función de ganancia y su utilidad en el anális económico de

sistemas de producción. **Resultados y conclusión:** La función de ganancia permite calcular el costo de producción con mayor precisión, pero a su vez puee facilitar el cálculo de los pesos económicos de los rasgos. Estos pesos económicos representan el valor económico de cada rasgo, que se utiliza en los índices de selección. Esta función permite calcular el análisis de sensibilidad, el cual tiene la intención de hacer equilibrios económicos contra posibles cambios en el mercado.

Palabras clave: ponderaciones económicas, función de ganancias, costos de producción, análisis de sensibilidad

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Introduction

The animal production makes sense when it is referring to the economic retribution it gives us; that is, the decision to produce this or that species (cattle, sheep, etc.), breed or line is based on its profitability.

For a product to be profitable, the costs of production should not be greater than the income. The profit, costs and revenues can be expressed through a profit function:

$$Profit = Income - Costs \qquad (1)$$

- ✓ The profit is given by the difference between income and costs.
- ✓ Income is determined by sales, whether it is number of rabbits, kg of milk, kg of meat, reproducers, discard, etc.
- ✓ The costs are divided into two: Fixed costs (labor, opportunity cost, amortization, interest, office costs) and variable costs (food, health, reproduction, replacement).

The above function allows us to calculate the profit, production costs and revenues, estimate the economic weights and make sensitivity analyses.

Economic weights

The economic weights are considered as the increase of the profit due to the genetic increase of a trait in a unit, keeping the rest of the traits constant (Blasco, 1995).

The economic weights (as ΔP in equation 4 and vi in equation 5) are calculated as the partial derivatives of the profit function with respect to each character considered in the improvement objective and value the changes in profit due to the genetic changes in these traits (Dekkers et al., 2004; Ramón et al., 2005).

From equation (1) we can break down into:

$$Profit = f(x_1, x_2, \ldots . x_n; p_1, p_2 \ldots ., p_m) \qquad (2)$$

Where:
x_i= traits of interest
p_i = prices

In the profit function, it must be considered that the prices are constant, regardless of the level of production that is had; therefore, the traits are the only ones that can vary due to genetic improvement (Blasco, 1995).

$$Profit = f(x_1, x_2, \ldots, x_n) \qquad (3)$$

Deriving the equation (3) in function to x2, for example, it is obtained:

$$\frac{\partial Profit}{\partial x_2} = f(x_1, x_3, x_4, \ldots, x_n) \rightarrow \Delta Profit = f(x_1, x_3, x_4, \ldots, x_n) \quad (4)$$

This expression is equivalent to saying that: "the economic weight is the increase of the profit due to the increase in a unit of the trait, keeping the rest of traits (x1, x3, x4, ...,xn) constants".

Utility of economic weights

The objectives of genetic improvement are established according to the economic importance of the traits. This economic importance is given, among other factors, by the economic weights (Falconer & Mackay, 1996). It will also depend on the additive deviation of the trait. The economic weight of each trait would be multiplied by the additive deviation of the same, thus obtaining the standardized economic weight. It would be chosen as a criterion of selection that trait that of greater standardized economic weight. It is necessary, therefore, to know first the economic weights to decide what the trait by which we select.

For example:

Once we have obtained the economic weights by trait, we can choose the traits with the highest standardized economic weight. For example, if we obtain the economic weights and additive deviations:

- Daily weight gain +4.20 0.16
- Lean content +0.52 1.91

The standardized economic weights would be 4.20 x 0.16 = 0.67 for the daily weight gain, and 0.52 x 1.91 = 0.99 for the lean content.

In this case, we would choose the improvement of the lean content, since its standardized economic weight is higher.

It must be emphasized that the construction of the profit function must be correct, because it describes the current economic situation of production, which will be decisive in the selection of the objectives and the selection criteria, these last steps being the most important points for the success of the genetic improvement program (Cartuche et al., 2014). It should be emphasized that the selection must be of characteristics that may not be improved with improvements in management (Ramón et al., 2005).

It should be pointed out that further considerations have to be taken into account to decide the traits to improve; for example, if the trait is recorded in one or both sexes, if then trait is expressed before or after animals go to slaughter, or if the trait is expensive to measure and have to be selected though a correlated trait (Cartuche et al., 2014).

The economic weights are also necessary in the selection indexes when it is intended to select for more than one trait (Cartuche et al., 2014; Hazel, 1943 cited by Herselman & Olivier, 2009). When selecting by a single trait, the individuals with the best genetic value for that trait are selected. However, if you want to select for more than one trait, it is necessary to know the relative importance that should be given to each trait at the time of selection (Van de Werf, 2005). This relative importance is given by the economic weights. For each animal, the added genotype is calculated as the sum of the animal's genetic values for each characteristic, weighted by the economic weight of each character. For each animal j and considering n traits in the selection:

$$H_j = \sum_{i=1}^{n} v_i g_{ij} \quad (5)$$

Where:
H_j= Aggregate genotype of the animal **j**
v_i= Economic weight of the trait ***i***
g_{ij}= Genetic value of the traiti for the animal ***j***

Sensitivity analysis

The economic weights are valid in the short term and specific for each species and market. The economic weights can change if there are changes in the market; on one hand, the markets could change depending on the cultures of consumption; on the other hand, livestock companies are conditioned to the prices of inputs and labor imposed by

the markets (e.g. the price of the balanced food or labor that we demand for our production). To obtain more control over those future scenarios, which may affect economic income, the sensitivity analyzes are performed.

The sensitivity analyses allow us to respond and anticipate various positive scenarios (profit) or negative (loss) scenarios, both productive and economic, and is posed with the premise: **"what would happen if ..."**. The questions raised habitually in cattle are:

- What would happen if the price of food or the cost of labor increases?
- What would happen if the price of the product decreases (meat, milk, etc.)?

It is therefore necessary to calculate the economic weights that would be obtained when an important and possible change occurs in the market, such as an increase in the price of the feed or a significant reduction in the price paid for the product. These possible scenarios may alter the value of the economic weights of certain traits and prioritize others. In that case, we would have to direct our improvement schemes and select the traits with the higher economic remuneration, which is mainly indicated by the standardized economic weight.

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