

DETERMINATION OF THE OPTIMAL TECHNICAL AND ECONOMIC LEVEL AMONG DORPER LAMBS IN CONFINEMENT

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ABSTRACT

Production function, as a technical input-output relationship, is useful for demonstrating that maximum production does not always imply maximum monetary profit. In order to determine the optimal technical and economic level among Dorper lambs in confinement, a second-degree polynomial production function was applied, from December 2022 to February 2023, with information from eighteen male Dorper lambs confined in individual cages, at the facilities of Rancho El Salitre, of the UAEM University Center (Autonomous University of the State of Mexico) Temascaltepec, distributed completely at random, with an initial live weight of 30.4 ± 3.4 , final live weight 58.7 ± 2.8 and fed for nine weeks on a commercial diet. Results indicated that the amount of accumulated feed, weight and monetary gain at the technical optimum level was 242.4 kg of feed, 59.4 kg of final live weight and 981.1 pesos, average per head and at the economic optimum level of 109.6 kilograms of feed, 50.6 kg of final live weight and 2,521.9 pesos. We conclude that the maximum weight of lambs in confinement does not necessarily result in maximum monetary gain.

Key words: Dorper lambs, maximum monetary gain, maximum production, optimization, production function.

INTRODUCTION

The production of meat from livestock species, both of zootechnical and economic interest, is considered essential for human nutrition and constitutes an important source of income generation for those dedicated to this activity (Calderón *et al.*, 2023). In 2022, 274.3 million tons (t) of meat from all livestock species of economic and zootechnical interest were produced worldwide, of which 113.8 million (41.5%) t of carcass meat came mainly from pigs, 36.9% from chicken and the rest from beef cattle. During the last six years, that is, from 2017 to 2022, chicken meat registered greater growth, compared to pork and beef. In this context, the main global meat producers in 2022 were China, the United States, Brazil, Russia and Mexico, who contributed 76.4% of the total, of which Mexico contributed 2.8% (Mexican Meat Council-COMECARNE, 2023).

In the same year, 2022, global meat consumption stood at 268.6 million t, with China in first place, at (30.5%), followed by the United States (15.1%) and the European Union (13%). Correspondingly, the highest meat intake per capita in the world was in the United States, with 119 kilograms; however, considering type of protein, this country leads in chicken meat, with a per capita consumption of 52 kilograms (kg), Argentina led for beef with 50 kg and the European Union led for pork, with 45 kg per capita (COMECARNE, 2023).

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In 2022, 76.9 kg of meat were consumed in Mexico, of which, considering type of protein, chicken stood out in first place, followed by pork, and finally beef. Undoubtedly, the total per capita consumption of meat includes other sources of protein such as lamb and goat, whose intake per person has not exceeded 500 grams per year. In Mexico, lamb is the fourth source of animal protein for consumers, after poultry, pork, and cattle (Calderón *et al.*, 2023).

In this same year (2022), Mexican production of lamb stood at 67,235 t extracted from an *in vivo* volume of 8.7 million head, with first position represented by the State of Mexico, which contributed 13.7% of the national total, in second place, was the state of Hidalgo with 10%, in third position was the state of Veracruz with 8.8%, Jalisco 7.5%, Puebla with 6.7%, Zacatecas 6.6%, Tlaxcala 4.6%, San Luis Potosí 4.5%, Oaxaca 3.7% and Guanajuato with 3.6%. As part of total consumption, the country undertook external purchases for a total of 1,375 t of lamb, mainly from Australia, the United States, New Zealand and Chile; it also made external sales of this meat, consisting of 644 t to its main clients, which were the United States, Hong Kong and the United Arab Emirates, together with Apparent National Consumption of 67,966 t, corresponding to a per capita consumption or intake per person of 500 g (COMECARNE, 2023).

This work aimed to determine the optimal technical and economic level of Dorper sheep in confinement. The hypothesis is that, under a fattening system in confinement, the maximum weight of the sheep does not necessarily correspond to generating maximum monetary profit at sale.

THEORETICAL FRAMEWORK

Undoubtedly, meat production represents an activity that is totally necessary to cover the nutritional needs of human beings, but it also acts as a primary or secondary activity that generates income and job creation (Food and Agriculture Organization of the United Nations - FAO, 2023). Besides this, lamb has nutritional and organoleptic characteristics that increase its value (Sañudo *et al.*, 2012) and is appreciated for the contribution it makes to energy, proteins, amino acids, fatty acids, minerals and vitamins (FAO, 2020). In intensive production systems, the feeding of lambs allows the accumulation of more intramuscular and subcutaneous adipose tissue, which impacts the performance, morphometric characteristics, conformation and quality of carcasses (Guedes *et al.*, 2018). In Mexico, lamb is derived from production systems of the *Ovis aries* species, applying zootechnics, to generate products; mainly meat, milk and wool (De Lucas *et al.*, 2003). The type of products and the way in which they are obtained depends on each production system. These have very diverse characteristics; likewise, these production systems depend on the resources available and the production strategies of the agricultural producer (Vázquez *et al.*, 2009), which can be identified by analyzing systems, (Borroto *et al.*, 2011). In Mexico, we can identify three sheep farming systems based on the extent producers use available resources, technology and production capacity for their production: the most predominant is known as the extensive system or social sheep farming, or traditional

system, in which their feeding is focused on grazing on the periphery of local roads and pastures in conservation areas; but there is also supplementary mixed feeding (semi-intensive), based on oats and vetch, grown on sheep farmers' land, and then the intensive system, in which the animals are confined in facilities equipped with corrals, feeders and water troughs (Herrera *et al.*, 2019).

Every productive process of any kind necessarily employs inputs, in order to obtain a final product rapidly. When these inputs are used over a certain period of time for production, it is said that the latter is then a function of these inputs, also known as a production function (Portillo *et al.*, 2015). Thus, from microeconomic theory, every production function, expressed as the technical input-output relationship, has its application in the short term, understood as that period of time in which at least one of all the inputs is fixed (Parkin and Loría, 2015; Rebollar *et al.*, 2022).

Therefore, given the technology, fixed inputs and production system in question, meat from live lambs requires variable inputs, mainly food (whether this comes from a pre-prepared or commercial diet), which is transformed into meat over a certain period of time (Rebollar *et al.*, 2008). Therefore, during the production process, biologically, the input that most impacts the weight gain of animals is the type of feed (Rebollar *et al.*, 2015).

As the fattening period progresses and considering the initial live weight (LW) and final live weight (FW) of the animal, during the first weeks of the process the rate of live weight gain of the lamb is increasing; then, at some point during that time and as the use of feed continues, the weight gain of the animal decreases, then, despite the fact that it continues to be fed, it no longer gains weight, meaning it presents decreasing rates (Rebollar *et al.*, 2008).

This situation and taking the approach of the microeconomic theory of production, means that it is possible to generate two optima, the first known as the technical optimum level (TOL) (or point of maximum production and also, as maximum weight of the lamb) and the second, known as economic optimum level (EOL), point or level of maximum profit in money. At this level of optimization, that is, at the TOL, this does not necessarily correspond to, nor is it associated with maximum production (Rebollar *et al.*, 2008; Rebollar *et al.*, 2014).

The production function is considered an important part of the economic analysis of the company (Parkin and Esquivel, 2015). Within the microeconomic theory of production, this technical (*input-output*) relationship, known as the *production function* is conceived as a list, table or mathematical expression, which shows the maximum amount of total product that can be obtained, with a certain amount of fixed and variable inputs, given the technology and the state of the art of the producer (Pindyck and Rubinfeld, 2013; Nicholson and Snyder, 2015; Rebollar *et al.*, 2022).

In general, all productive activity requires the use of both fixed and variable inputs; the former do not change when production changes, nor do they depend on the market; they persist whether or not there is a product for sale and they do not change in the short term;

on the contrary, the latter depend on production, they change when production changes and they vary in relation to the period of time during which the final product is generated; that is, they are inputs whose use changes in the short term (Portillo *et al.*, 2015).

Complying with the logic of temporality, it is stated that the short term is that period of time, generally less than or equal to one year, or a production cycle, in which at least one of all the factors involved in production fulfills the characteristic of being fixed; contrastingly, the long term is conceived as a period of time in which all inputs are variable. Therefore, the long term requires an investment decision or a situation, characterized by investment planning. During that period, a decision on whether to invest, reinvest or simply close a production process is taken (Leroy and Meiners, 1990; Graue, 2006; Parkin and Loría, 2015; Rebollar *et al.*, 2021a).

In the context of the microeconomic theory of the company (Portillo *et al.*, 2015), there are situations in which production must go through certain temporal stages. In the short term, this production goes through three stages, each with identifiable characteristics (Leroy and Meiners, 1990; Mankiw, 2012). In the first, production presents increasing rates that are positive and exceed the unit, returns increase to scale, the marginal product (MgP), defined as the increase in the total product, before the unit increase in the use of the variable input, exceeds the amount of the product average or average product (PMe). At this stage, each additional unit of input (for example, food), produces an additional amount of output that increases, due to improved use of fixed inputs. Mathematically, this is evident when the slope of the production function (marginal product) is increasing (Reeza and Farhi, 2019); when elasticity of production exceeds 1.0, the stage is considered not to be profitable, because the technical efficiency of the input variable provides no benefit (Leroy and Meiners, 1990).

During stage II, returns to scale are decreasing but positive, the MgP is less than AP (Rebollar *et al.*, 2022); both positive, but the marginal product of the input variable begins to decrease. This is where most companies operate, because efficiency is maximized, which occurs due to limitations in fixed inputs, which do not make possible optimal use of the additional input variable (Barreto, 2009); elasticity of production shows values above zero, but below 1.0; this is the profitable stage of the production process, because the maximum efficiency of the input variable is taken advantage of (Doll and Orazem, 1984; Rebollar *et al.*, 2021b). In the short term, stage III of the production process shows negative decreasing returns to scale. At this stage, adding more of the input variable reduces total output, due to the over-saturation of input variables, causing inefficiencies; the PgM, in addition to registering values below zero, is lower than AP; elasticity of production shows values below zero, so successive additional amounts of the input variable at this stage of the process, no longer translates into an increase in production, which is why this is considered to be an unprofitable stage (Rebollar *et al.*, 2008; Rebollar *et al.*, 2022).

During the three stages of production, an empirical statement that has gained prominence is the law of diminishing marginal physical returns, which states that at some point during the short term, units of input variable added to production, start to produce diminishing

products. It has been stated that this law does not represent a logical proposition, so it is not susceptible to mathematical verification or refutation and is translated only into an assertion oriented to physical relationships that, based on what has been observed, are manifested in the real world (Leroy and Meiners, 1990).

METHODOLOGY

To determine the technical optimum (TOL) and economic optimum (EOL) levels (Rebollar *et al.*, 2008), in vivo weight gain and *ad libitum* feed consumption information was used, considering eighteen male Dorper lambs, randomly distributed and confined in individual pens for nine weeks (December 2022-February 2023), at the facilities of the Posta Zootécnica of the UAEM University Center (Autonomous University of the State of Mexico) Temascaltepec. The lambs underwent a five-day adaptation period, prior to the start of the experiment and data collection. The initial live weight (ILW) was 30 ± 3.7 kilograms (kg). The lambs consumed balanced feed during the finishing stage, which met the nutritional requirements for lambs of 30 kg of live weight (Table 1).

The animals were weighed individually, every seven days in the morning, using weighing scales with an error of 20 grams (g) and with capacity for 50 kg. Likewise, the amount of individual food consumed in terms of the food offered was measured, minus the rejected (or wasted) food. In the first week of the experiment, the animals consumed, on average, 21 ± 1.5 kg; subsequently, the amount was gradually increased.

Data collection ended at week nine because, biologically, the animal was already showing a lower weight gain than that observed in the previous week (decreasing marginal return). The statistical model (Rebollar *et al.*, 2008) that best fit the data set is shown in equation 1.

$$Y = \beta_0 + \beta_1 A + \beta_2 A^2 + \varepsilon \tag{1}$$

where Y : Weekly weight of the sheep, in kilograms; β_i for $i=0, 1, 2$ are the model parameters; A : average weekly amount of balanced feed assigned to the sheep, in kilograms; ε : statistical or random error.

Table 1. Composition of the diet consumed by lambs; values in kg. Posta Zootécnica del CU UAEM Temascaltepec, December 2022 to February 2023.

Input	Base diet A	Cost, input, \$/kg, B	Cost of feed AxB
Sorghum (kg)	0.585	8.5	5.0
Stubble (kg)	0.100	3.5	0.4
Alfalfa hay (kg)	0.100	7.0	0.7
Soybean meal (kg)	0.185	13.0	2.4
Calcium carbonate (kg)	0.005	2.0	0.0
Mineral base (kg)	0.025	36.0	0.9
Total (kg)	1.000		9.3

Source: self-elaborated.

Notably, we also tested the additive cubic model, linear in terms of parameters and non-linear in terms of variables, but this was not adjusted because the signs preceding the parameters were contrary to what was expected; consequently, the model provided in equation 1 was chosen. Thus, for the statistical significance of the model, the calculated F, the adjusted R-squared and the predicted R-squared were considered; the latter in order to present more evidence of the forecasting power of the regression model and t-calculated for each estimator. The economic significance considered obtaining the negative sign that preceded the quadratic component of the model, which made it possible to generate the concavity of the curve (production function) and with it, the analysis of the TOL and the EOL (Gujarati and Porter, 2010).

The technical optimum level (TOL) was obtained by employing the first mathematical derivative, known as the marginal product (MgP) of the production function equal to zero (Rebollar *et al.*, 2008; Rebollar *et al.*, 2014; Rebollar *et al.*, 2018). Likewise, the profit (P) (Rebollar *et al.*, 2022), in money from the TOL, was generated by arithmetically subtracting the total cost (TC) from the total income (expressed in equations 2, 3 and 4:

$$G = IT - CT \quad (2)$$

$$IT = P_Y Y \quad (3)$$

$$CT = P_A A \quad (4)$$

where P_Y : price of the product and P_A : price of each unit of feed consumed by the lambs. For this the price of the product was taken as the price of live lambs for sale in Mexican pesos per kilogram (\$/kg) found in the area, equivalent to 70 \$/kg and the price of the variable input (commercial feed), at 9.2 \$/kg.

The EOL (Rebollar *et al.*, 2008; Rebollar *et al.*, 2018), was obtained by equating the MgP function to the price ratio, both of the product (P_Y) and the input (P_A), calculated with equation 5:

$$PMg = \frac{P_A}{P_Y} \quad (5)$$

This equation provides the value of F (food), which guarantees obtaining the EOL. The results from the statistical model were obtained using the REG PROC procedure for SAS (Statistical Analysis System) using its online version (SAS, 2021). Likewise, for the result of the predicted R-square, the PRESS instruction was used within the REG PROC of SAS.

RESULTS

The statistics for the estimated production function among Dorper lambs are presented in Table 2; the estimator column shows the existence of a response or production function

Table 2. Estimated production function for Dorper lambs in confinement, Temascaltepec, State of Mexico, February 2023.

Predictor	Estimator	EE	cal-t	Significance
Intercept	30.00	0.20	118.30	P < 0.05
F	0.24	0.01	21.05	P < 0.05
F ²	-0.0005	0.0001	-4.82	P < 0.05
Calculated-F	1843.9 (P < 0.05)			
Adjusted-R ²	0.997			
Predicted R ²	0.993			

SE: standard error. cal-T: calculated t.
 Source: self-elaborated.

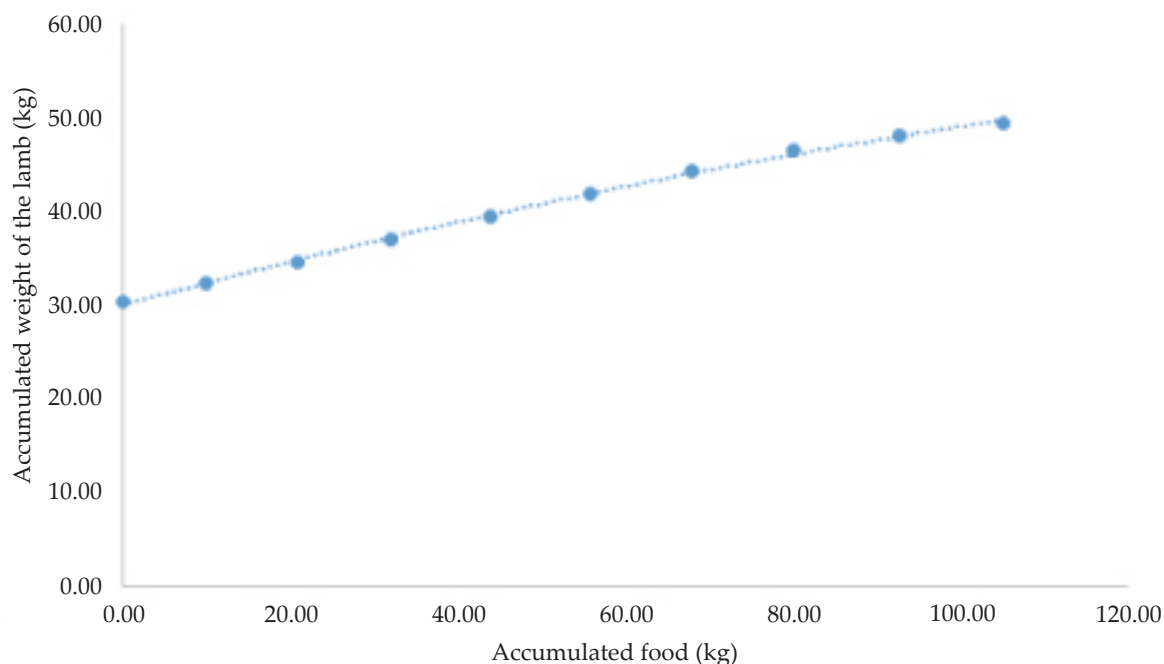
with diminishing marginal returns. The overall statistical significance was high; a high F-calculated (Fc) at 95% confidence (P<0.05). The adjusted R-square coefficient of determination was 0.997, so 99.7% of the total variation in lamb weight was explained by the regression model and represented a satisfactory level of explanation for the model as a whole; likewise, the predicted R-square was 99.3%, which provides evidence of the satisfactory predictive power of the regression.

The value of the accumulated variable input, equivalent to the technical optimum level (TOL), point of maximum production or maximum weight of the lamb, was 242.4 kilograms of feed. This amount of input variable resulted in maximum weight of the animal at 59.38 kg; consequently, successive added units of food consumed by the animal will not translate into an increase in weight. Contrarily, as the lamb continues to ingest more feed, as the weeks of fattening pass, weight gain is expected to present decreasing rates; that is a tendency towards lower weight is apparent, in contrast to optimal weight (Figure 1).

The amount of food corresponding to the maximum weight level of the lamb was greater compared to that recorded at the economic optimum level. Similarly, the animal's weight in kilograms, the income and the total cost at sale were higher compared to those at the economic optimum level; however, the monetary gain related to the maximum weight of the animal was lower than that obtained at the economic optimum level, which proves that the maximum weight of the lamb does not always necessarily mean that the sheep farmer obtains the highest profit in money for the sale of the lamb (Table 3).

As the weeks of fattening of Dorper lambs in confinement passed, it was apparent that the average product (AvP), marginal product (MgP) and elasticity of production (E_p) presented increasing behavior at the beginning, then positive decreasing behavior, followed by negative decreasing behavior at the end, indicating the phases of the production process. When elasticity of production went from being positive to negative, it was the crucial moment in which the lamb transformed from maximum live weight to a situation of decreasing returns or increasingly smaller weight gains (Table 4).

Apparently, during the period of fattening of Dorper lambs; initially, the marginal product (weight of the lamb) grew faster than the average product, then decreased and then became



Source: self-elaborated, with data from the Dorper lamb experiment.

Figure 1. Accumulated input variable (food) and accumulated weight of the lamb. Temascaltepec, State of Mexico, 2023.

negative; even, as the lamb increased its weight, the variable input (feed) required to obtain one kilogram of weight increased, reaching the inflection point of the curve, with 10 kilograms of feed and 240 kilograms of accumulated variable input. Subsequently, the marginal physical product, referring to the weight of the lambs, began to reflect negative values (Figure 2).

DISCUSSION

In this research, based on the analysis of variance (ANOVA) table, it was possible to affirm that the estimated model was statistically significant, because the observed value of the

Table 3. Total cost, total income and monetary gain for Dorper lambs at the technical optimum level and economic optimum level. Temascaltepec, State of Mexico, 2023.

Concept	Technical optimum level	Economic optimum level
Food (kg)	242.4	109.6
Weight (kg)	59.4	50.6
Total input (\$)	4,158.3	3,541.6
Total cost (\$)	2,254.9	1,019.8
Profit (\$)	1,903.4	2,521.8

Source: self-elaborated, based on estimated Production function.

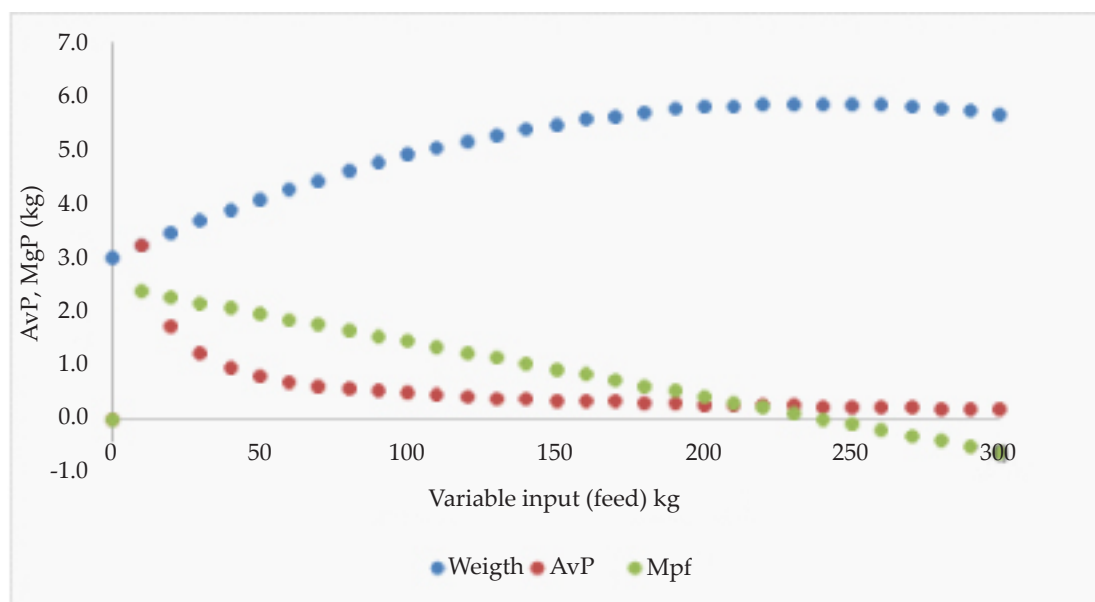
Table 4. Average product, marginal product and elasticity of production among Dorper lambs. Temascaltepec, State of Mexico, 2023

Food	Weight	Average product	Marginal product	E_p
0	30.0	0.0	0.0	0.0
10	32.4	3.24	2.4	0.7
20	34.6	1.73	2.3	1.3
30	36.8	1.23	2.2	1.8
40	38.9	0.97	2.1	2.2
50	40.8	0.82	2.0	2.4
60	42.7	0.71	1.9	2.7
70	44.5	0.64	1.8	2.8
80	46.1	0.58	1.7	2.9
90	47.7	0.53	1.6	3.0
100	49.1	0.49	1.5	3.1
110	50.5	0.46	1.3	2.8
120	51.7	0.43	1.2	2.8
130	52.9	0.41	1.1	2.7
140	53.9	0.38	1.0	2.6
150	54.8	0.37	0.9	2.4
160	55.7	0.35	0.8	2.3
170	56.4	0.33	0.7	2.1
180	57.0	0.32	0.6	1.9
190	57.6	0.30	0.5	1.7
200	58.0	0.29	0.4	1.4
210	58.3	0.28	0.3	1.1
220	58.5	0.27	0.2	0.7
230	58.6	0.25	0.1	0.4
240	58.7	0.24	0.0	0.0
250	58.6	0.23	-0.1	-0.4
260	58.4	0.22	-0.2	-0.9

Source: Self-elaborated, based on estimated Production function.

calculated F was considered high. In other words, when the cF (which indicates the output of the model) exceeds 2.0 (Wooldridge, 2010), as was the case in this work, the model is confirmed as statistically significant. Similarly, it was also apparent that the calculated t -values were greater than at least 2.0, a situation that added statistical significance to the model for the explanatory variables included in it; even the standard error associated with each estimator multiplied by two was actually lower than the value of this estimator, strengthening the model in statistical terms (Gujarati and Porter, 2010; Rebollar *et al.*, 2008).

Thus, considering the estimated model for the production function, the number 30.0 was the weight of the lamb at the beginning of the experiment, when the F variable (feed) has a value of zero. In contrast, 0.24, the estimator for the β_1 parameter, represents the marginal relationship between the F variable (feed) and the Y variable (weight of lamb), during the fattening process in confinement. Therefore, 0.24 expresses that, if the effects of other



Source: self-elaborated, based on estimated Production function.

Figure 2. Total product (weight of lamb, kg), variable input consumed (feed), kg; average product and marginal physical product. Temascaltepec, State of Mexico, 2023.

variables remain constant at 99.7% reliability, each increase per kilogram of assigned feed will cause the (average) weight of the Dorper lamb to increase by 242 g, a result that differs from the finding on the part of Rebollar *et al.* (2015), for lambs at their final stages, reporting 280 g; from 195 g per day reported by Villanueva *et al.* (2019) under confinement, 132 g per day confirmed by Mestra *et al.* (2019) in a semi-intensive system, 213 g found by Rosado *et al.* (2020), 283 g claimed by Mejía *et al.* (2023), among lambs fed on mesquite pods, complying with Mora *et al.* (2002); Buendía *et al.* (2003); Rojo *et al.* (2005); Macías *et al.* (2010) and Pérez *et al.* (2011).

Prices do not interfere with the TOL, because this will be evident at the point where the input variable provides the highest volume of production per unit used, which indicates the technical efficiency of this input (Portillo *et al.*, 2015). When determining the function, apparently the lambs initially presented increasing yields, as successive units of feed input were added, then as the weeks passed, the lambs showed decreasing but positive yields until reaching maximum weight (TOL); subsequently, there were unsatisfactory yields (negative diminishing marginal returns), as shown in Figure 1. Therefore, on the side of maximum production or maximum total product, the TOL, corresponded to an average weight of the lamb (59.4 kg) and accumulated feed (242.4 kg), which was lower than the corresponding EOL (50.6 kg of feed and a weight of 109.6 kg), results consistent with those of Rebollar *et al.* (2008) for Pelibuey lambs, fed with beans. This implied that the economic gain in money was less with the TOL, compared to that obtained with the EOL.

The behavior of the weight of lambs during the finishing stage and the consumption of the input variable (feed) made it possible to distinguish the three stages of production (Figure 2). Thus stage I was characterized by an increasing weight gain and began with the consumption of feed during the finishing stage and ended when the lamb consumed 10 kg of feed. This was considered as the point at which the animal weighed 32.4 kg and the MgP was 2.4 kg. Stage II of the curve began with decreasing performance (in lamb weight). This occurred from the moment the lamb at the finishing stage consumed 10 kg of input variable (feed) and up to 240 kg of accumulated consumption of the input variable; this stage ended when the marginal physical product was equal to 0, which meant that by increasing feed consumption, the lambs maintained their weight and in this case, this occurred when the lab weighed 58.7 kg and consumed 242 kg (accumulated) of the input. The limit to this stage was characterized by the greater efficiency of the input variable; that is the marginal physical product decreased below its average product. Stage III of the curve began with a negative yield, which occurred when the consumption of the accumulated input variable (feed) on the part of the lamb, exceeded 242 kg and the weight of the animal began to decrease, so that the MgP value became negative. Apparently with 260 kg of feed (accumulated), consumed by the lamb during the finishing stage, feed consumption increased by 20 kg and its weight decreased by 0.3 kg, reaching 58.4 kg. AP reached its highest value when the lamb consumed 10 kg of feed and then from that level, it decreased; consequently, the curve began to decline. The point where both curves intersect (the MgP and the AP) was close to 242 kg of input variable consumption; at this point the lamb reached a weight of 59.4 kg.

Based on microeconomic theory (Rebollar *et al.*, 2022), maximum utility for the lamb producer occurred during stage II of the Production Function, implying that lambs exceeding 59.4 kg should not be sold; this finding was similar to that found by Rebollar *et al.* (2008).

However, if for some reason the cost of the input variable (feed) were to decrease, the economic optimum level would increase and would have to shift to the right, approaching the technical optimum level, meaning that in this situation, we would recommend selling lambs at a higher weight; contrarily, if the cost of the input variable increases; meaning the economic optimum level decreases, shifting to the left of the graph, then consequently, we would recommend selling sheep at a lower weight, thus enabling greater monetary gain (Figure 2).

CONCLUSIONS

Both the amount of feed and the weight of the lamb in confinement, corresponding to the technical optimum level, exceeded those at the economic optimum level; however, profit was greater when the animal reached a lower weight in kilograms, compared to the maximum weight of the animals. Therefore, the maximum weight of the sheep did not necessarily imply obtaining the maximum profit in money. The producer, under similar production conditions, should market his sheep at the weight corresponding to economic

optimum level. Limitations of this work related to the number of animals included, the duration of the fattening period and the statistical model used; therefore, this research could be expanded by increasing the period of confinement in corrals, with access to more animals and by adding at least one other independent variable, and employing a model, such as that of Cobb-Douglas.

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