Analysis of the Correlation between the Fodder Receipts and the Economical Performances of the Pig Breeding Units

Adrian Anica-Popa[1], Ionuţ-Florin Anica-Popa[2], Liana-Elena Anica-Popa[3]

[1,2,3]*Faculty of Accounting and Management Information Systems, Bucharest University of Economic Studies, Bucharest, Romania*
[1]*E-mail: adrian.anica@cig.ase.ro (Corresponding author)*

Abstract

Respecting the European Union normative regarding the average weight of carcasses processed in the slaughter-houses, as well as the quality of the delivered meat, impose the search for the optimum variants for pig breeding. The present study aims at the identification of the correlations between the fodder receipts and the performances of the pig breeding farms through the pursuit of the effects of different fodder variants on the daily weight increase, on the moment when the optimum sacrifice weight is reached, and on the probability to reach a certain level of increase in weight. There are presented several considerations regarding the performance expressed with the help of the profit, the commercial profitability ratio, the profitability ratio of the consumed resources. Based on the results of the research, several conclusions are presented, regarding the influences of the fodder receipts on the production cost and of the performances of the pig breeding farms, as well as future research directions.

Key words

Pig breeding, fodder quality, daily weight increase, performances

JEL Codes: D24, Q12, M11, M21, M40

1. Introduction

The final purpose of each activity is resumed to the measuring of the benefits generated by it. In order to measure the performances the profit will be taken into consideration on one hand, and on the other hand the profitability ratios. The profit represents the main component that reflects the performances of the enterprise, as well as its capacity to re-invest. The variables than can impact on the profit and implicitly on the profitability ratios of a pig breeding farm could be: the selling price, the demand, the cost of the fodder, the daily weight increase, the evolution of the salaries, the productivity of the labor etc.

According to the EU standards, the average mass of the carcasses processed at the slaughter houses is 90 kilos, with a variation between 80 and 105 kilos. Many times, animals with a greater weight are sacrificed, but this may vary in accordance with the pig meat demand on the market, and subsequently, the producers are forced to

make early sales, before the animals can reach the optimum weight considered for sacrifice. This decisional behavior of the producers can lead, on a national scale, to losses in the meat production capacity, with unfavorable consequences, leading to the increase of import.

Aligning to European standards has determined the analysis, inside pig breeding facilities, of the main quantitative aspects of a carcass:

- the hygiene (the veterinary ascertainments);
- the organo-lepthyc value of the meat;
- the proportion of raw meat, expressed in muscular tissue (%CM) of total carcass weight).

As the percentage of raw meat in the carcass is higher, its economical value increases, because the resulting quantity of meat is higher (from previous studies, it results that 1% CM in the carcass is corresponding to 0.9 kilos of meat) and in can be easier commercialized.

2. Methodology of research

For analysis, I have used the data supplied by a pig breeding farm that acts in Romania. The research methodology is based on sensitivity analysis, comparative analysis of the evolution alternatives for the indicators studied, but also on the analysis-synthesis of results achieved.

The main steps in the approach of the research theme were:

- analysis of the correlations between the nutritional capacity of the fodder and the performances of the pig breeding farms;
- analysis of the correlations between the quality of fodder and daily increase in weight;
- calculation of relative and cumulated probabilities to reach the increase in weight for the tow fodder variants;
- analysis of the correlations between the fodder receipt and the performances of the agricultural farm;
- elaboration of the conclusions.

3. Analysis of the correlations between the nutritional capacity of the fodder and the performances of the pig breeding farms

In the analysis of the performances of the pigs exploitations, the correlation between the production costs, the quality and quantity of raw meat in the carcass. Most of times, the production costs for pigs with high contents of raw neat in the carcass are not greater than the production costs of more fat pigs, if the fodder receipts according to the EU normative are respected.

The optimum moment for sacrifice is given by the reach of a weight of some 100

kilos. At that weight, a pig can reach during a 180-220 days from birth, if they are also grown by the nutritional quality of the fodder.

The nutritional quality of the fodder has a direct influence on the percentage of raw meat. For example, for the E quality class (>55% RM), at a pig weighing 100 kilos and a efficaciousness of 80%, the result is a carcass of at least 80 kilos, with a proportion of more than 56% raw meat (Suhoverschi, Clasificarea carcaselor, 2007).

The choice of the optimal moment for sacrifice, respectively of the optimal mass of the carcass, is determinative for the realization of the profit, and subsequently represents a managerial decision that is important for the growers. Through an optimal decision, the productive potential can be augmented as well.

The economical tendencies in pig breeding request to the producers to become more efficient in all the aspects of meat production. The main factors leading to the profits are the nutrition and the reproduction of the pigs, between which a strong correlation exists. In order to maintain and increase the level of meat production it is necessary to realize two series of baby pigs in fat process and an index for the use of sows at 2-3 births per year.

In order to reach the optimal sacrifice weight, the pigs weaned at 35 days and with a weight of 8.5-9 kilos are moved in the youth sector until the age of 90 days and weight of 30-35 kilos. After that, the fat process follows, and after approximately 180-200 days, the weight of 90-100 kilos is reached.

This situation can be achieved only by using fodders with high energetic value that are allowing for a daily increase in weight of 750 grams at most.

The average daily increase in weight represents the economical efficiency indicator in the breeding and fatting of pigs. It results, therefore, that the economical efficiency depends, mostly, on the fodder mode. In the same time, the average daily consumption of combined fodder needed to achieve an increase in weight of one kilo varies between 3.1-3.6 kilos.

In order to choose the most profitable variant of fodder and fat for pigs, the management team of the farm must take into account a set of criteria, both economical and technical: the labor force, the financial resources, the number of animals, the fodder resources, the spaces designated for the reproduction and breed of the pigs etc. in function of this criteria, it can be chosen one of three breeding variants: extensive, semi-intensive or intensive.

Each of these systems presents certain characteristics (Gazeta de agricultură, Sisteme de creștere a porcilor, 2008):

- *the extensive system* – the sow gives birth to baby pigs only once a year. In very few cases, three births during two years are encountered, producing 8-10 baby pigs at birth. In this system, the average increase is 330-380 grams, and the percentage of meat in the carcass is below 50%.

- *The semi-intensive system* – presents economical performances superior to the extensive system. In these conditions, the sows can realize 1,8-2 births per year, resulting 16-18 baby pigs per year. The average increase is of 480-500 grams.
- *The intensive system* is specific to the industrial complexes of birth and fat of the pigs, with great effectives. The sows can realize 2.3-3 births per year, the result being 20-21 baby pigs born yearly. The average increase in weight is 500-750 grams.

The pig breeding is influenced by a series of exogenous and endogenous factors:

- *the exogenous factors* refers to the quantity, quality and mode of delivering the food, the caring conditions, the technology for breed and fat;
- *the endogenous factors* include: the race, the level pf improvement for animals, the prolific degree, the capacity to suckle, the number and weight of wean baby pigs, the value of the fodder, the health, the efficaciousness of the scarification and the quality of the carcasses.

Fatting the pigs is more effective at a young age. The fodder that composes the daily food of the pigs must be easy digestible, to be assimilated by the organism and transformed into meat. When the food is based on barley and corn with protein, mineral and vitamin additives, the best quotient of food digestibility is obtained, of approximately 80-90% of the total quantity.

4. Analysis of the correlations between the quality of fodder and daily increase in weight

In order to emphasize the correlation between the quality of fodder, increase in weight and performances of the pig-breeding farms, we will analyze two variants, in which different fodders (with different compositions) will be used.

Table 1. Consumption of fodders in the farm

Fodder consumption	Variant 1		Variant 2	
	Tones	Percentage in total	Tones	Percentage in total
Total/year	434.64	100%	412.908	100%
- barley	164.00	37.73%	61.94	15.00%
- wheat	83.20	19.14%	82.58	20.00%
- corn	124.80	28.71%	139.15	33.70%
- pea	21.04	4.84%	41.29	10.00%
- soybean	-	-	49.55	12.00%
- sunflower	-	-	20.65	5.00%
- MVP (mineral vitamin premixes)	41.60	9.57%	17.76	4.30%

The effects of endogenous factors, referring mostly to the species, suckling capacity, health of the animals will be eliminated through the pursuit of the evolution for the same pig race. However, the suckling capacity is determined, mostly, by the quality of the fodder given to the sows (Suhoverschi, Furaj care asigura spor maxim la porci, 2007).

Table 2. Technical indicators at the level of pig breeding farms

Indicators	UM	Variant 1	Variant 2
Sows	head	60	60
Baby pigs born/sow[*]	head	21	18
Baby pigs wean/sow[*]	head	18.9	16.2
Baby pigs fatten at 100 kilos delivered/sow/year [*]	head	17.9	15.4
Meat delivered carcass	Kg	100	100
Average fodder consumption/sow/year	kg	1.100	1.130
Average fodder consumption/kg increase between 1-100 kg	kg	3.6	3.1
- How much of the consumption/sow/year relates per wean baby pig	kg	0.62	0.6
Average consumption per kilo of living weight, that includes the consumption of the sow	kg	4.22	3.7

[*] *Note: average values per sow.*

Even if the activity of fatting the pigs is less pretentious (form the technological point of view) than in the other sectors, the attentive application of the fodder technologies is necessary, in order to realize a maximum increase in weight, with a minimal consumption of fodders.

From the performed analysis, it results the existence of a correlation between the *quantity and quality of the food* and *the evolution of the fatting process*. The *quantity and quality of food influences the quality of obtained products* as well. The diet of the pigs that are to be fatten must have a high degree of digestibility, to include at most 6-7% of cellulose, the necessary of nutritive units, of digestible protein and indispensable amino-acids.

For the pig breeding farms, the most important stage refers to the meat-oriented fatting. This is the most effective from the economical point of view and aims the putting to value the growing potential of young animals that eat the smallest quantity of food per 1 kilo of weight increase. It starts when the baby pigs have reached 90 days of age and approximately 30-35 kilos of live weight and states until they reach 100-11o kilos. In the figures below, the evolution of the daily increase is presented, along with the weight of a pig in correlation with the two fodder variants.
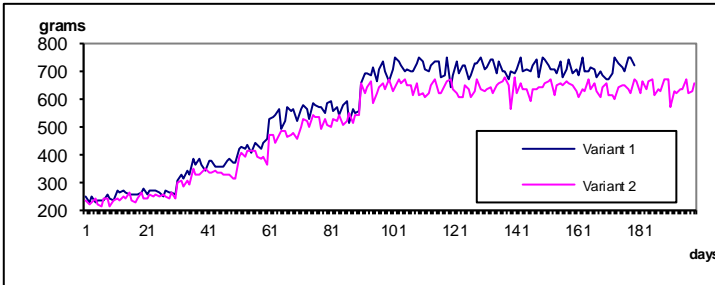
Figure 1. Evolution of the weight increase for the two fodder variants

For the meat animals, the requirements are to provide a carcass with more than 56% of muscular tissue and a level of fat of less than 15 mm, as well as special taste qualities for the meat.
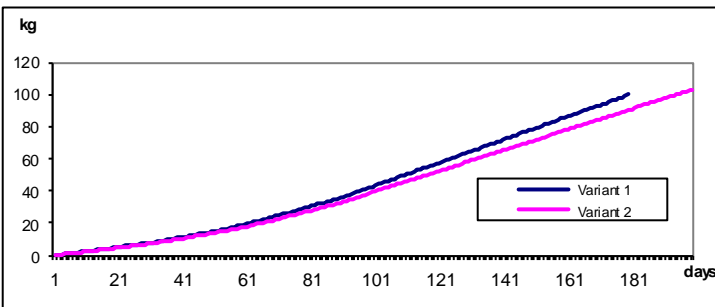

Figure 2. Evolution of a pig's weight for the two fodder variants

From the data analysis, it can be observed that Variant 1, the optimal weight for sacrifice is reached in approximately 180 days and in Variant 2 in 200 days. The choice for the optimal fodder variants will lead to the achievement of a daily increase in weight. The managerial decisions taken on this line must take into account the performances of the fodder. The figures below present the relative and cumulated probability[1] to reach a certain value for the daily weight increase in the two fodder variants.

---

[1] Garvey, P.R. (2000), *Probability Methods for Cost Uncertainty Analysis* New York: Marcel Dekker, Inc.

- Relative probability: $Pi = f_i \Big/ \sum_{i=1}^{N} f_i$, $i = \overline{1, m}$, $p_0 = 0$ (1)

- Cumulated probability: $P_k = \sum_{i=1}^{k} p_i$, $k = \overline{1, m}$ (2)
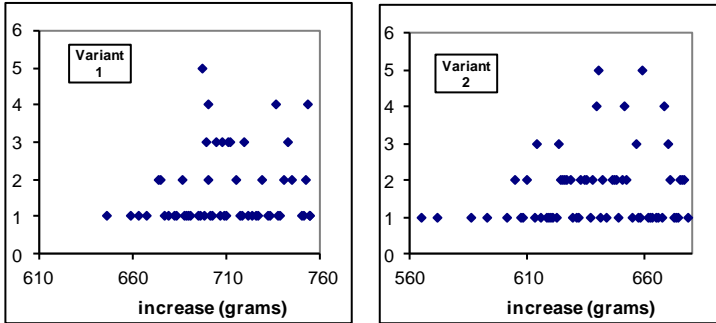

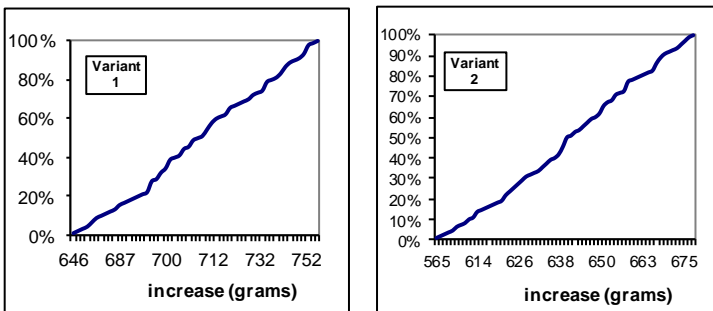*Figure 3.* Relative probability to reach the daily increase in weight for the two fodder variants

Figure 4. Cumulated probability to reach the increase in weight for the tow fodder variants

The utility of the performed analysis is the estimation of the probability that a pig during the fat period might reach a certain daily increase in weight. The values obtained will be enclosed in the $[V_{min}; V_{max}]$ interval, and the minimal and maximal values will be determined as follows:

$$V_{min} = \overline{x} - t_{\alpha/2,N-1} \times \frac{\sigma}{\sqrt{N}} \qquad V_{max} = \overline{x} + t_{\alpha/2,N-1} \times \frac{\sigma}{\sqrt{N}} \qquad (3)$$

Where:

$\overline{x} = \dfrac{\sum\limits_{i=1}^{N} x_i}{N}$ - the average;

$\sigma = \sqrt{\dfrac{\sum\limits_{i=1}^{N} \left(x_i - \overline{x}\right)^2}{N-1}}$ - the standard deviation of the provisioned level of the daily increase in weight;

$t_{\alpha/2,N-1}$ - the trust interval of the prognosis with a degree of significance of $\alpha=0,05$ according to the *Student* repartition*;

$Cv = \dfrac{\sigma}{\overline{x}}$ - the variation quotient.

Table 4. Establishing the minimal and maximum value for the daily increase in weight

Name	Average $\overline{x}$	Standard Deviation σ	Variation quotient Cv	Minimum value V_{min}	Maximum value V_{max}
Variant 1	710.89	25.98	0.0365	709.28	712.51
Variant 2	639.72	75.25	0.1176	635.06	644.39

From the analysis of data, it results that in Variant 1 there is the possibility to reach an average daily increase in weight between 709.28 – 712.52 grams and of 635.06 – 644.39 grams in Variant 2. The decision to choose Variant 1 of fodder must be considered optimal, having into account the correlation with the moment of delivery on the market of the finished product (the meat carcass).

5. Analysis of the correlations between the fodder receipt and the performances of the agricultural farm

The difference between the two fodder variants has no consequence only on the moment of reach of the optimal sacrifice weight, but also on the performances at farm's level.
On one hand, the change of the fodder receipts determinates the identification of other fodder-related expenses, that represents the raw materials, due to the different procurement prices, and on the other hand, there are occurring

modifications at the level of the commercial profitability ratio and of the profitability ratio for the consumed resources. However, inside the pig breeding units, the mortality phenomenon manifests itself also, thus occurring losses of about 10% in the group of born baby pigs, 5% at the level of the groups of wean and fatten baby pigs. Many times, this phenomenon is slowed down especially by the food administered, at least for the wean and fatten baby pigs.

Therefore, for the two analyzed variants, the results are the economical indicators presented subsequently:

Table 5. Economical indicators obtained at the pig breeding farm level

Indicators	UM	Variant 1	Variant 2
Born baby pigs	head	1.260	1.140
Wean baby pigs	head	1.134	1.026
Fatten and delivered baby pigs at 100 kilos	head	1.077	975
Meat carcass delivered	kg	107.730	97.470
Incomes from selling meat	**lei**	**861.840**	**738.720**
Total water consumption/year	lei	594	864
Total fodder consumption/year	lei	350.752	327.477
- barley	lei	73.800	27.871
- wheat	lei	62.400	61.936
- corn	lei	37.440	41.745
- pea	lei	27.352	53.678
- soybean	lei	0	59.459
- sunflower	lei	0	20.645
- MVP (mineral vitamin premixes)	lei	149.760	62.143
Salaries and related contributions	lei	337.920	276.480
Waste disposal	lei	1.306	1.296
Energy	lei	8.541	7.118
Depreciation	lei	20.743	20.743
Other expenses	lei	5.857	5.857
Total expenses	**lei**	**725.713**	**639.835**
Profit	**lei**	**136.127**	**98.885**
Commercial profitability ratio	**%**	**15,79**	**13,39**
Consumed resources profitability ratio	**%**	**18,76**	**15,45**

From the analysis of the two fodder variants, it results that, for the use of fodders with elevated efficaciousness, there is a greater volume of meat delivered ion carcass and a higher level of the commercial profitability ratio and consumed resources profitability ratio. In this case, the realization of a fodder with higher nutritional value will determinate a greater daily increase in weight and the reach of

the optimal sacrifice weight approximately 20 years earlier when compared to Variant 2. even if the fodder expenses for a year in Variant 1 are greater than those in Variant 2, this is compensated with the decrease of losses for fatted and delivered baby pigs, this way, a surplus of delivered meat of more than 15,39 tons is obtained. Also, in variant 1, a supplementary profit will be generated, of 37.242 lei (37.66%), a value of the commercial profitability ratio with 2.4 percentage points greater for the consumed resources profitability ratio.

6. Conclusions

After the research, it results that on the performances of agricultural farms that breed pigs, there are acting, besides the external factors, a series of internal factors as well, such as the quantity, quality and delivery mode for food, the pig breeding and fatting technology. All these can form the basics for the decisions of maintaining or changing the fodder receipts, with implications on the benefits provided by the meat carcass production when put to use.

The elaboration of an optimum model for the pig fodder receipts and its implementation within an information system for the adoption of profit-driven managerial decisions shapes itself as a set of various research directions, imposed by a business environment affected by an increasingly developed competition and by the exigencies of the EU standards regarding the quality of the meat.

References

Boardman, A., Greenberg, D., Vining, A., Weimer, D. (2005), *Cost-Benefit Analysis: Concepts and Practice*, 3nd edition, Englewood Cliffs, NJ: Prentice Hall

Bursa agricolă (2008), *Creşterea porcinelor*, Accessed 15th July, 2015 URL http://www.bursaagricola.ro/Info-CRESTEREA_PORCINELOR-4-24988-1.html;

Cohen, E. (1997), *Analyse financiere*, Ed. Economica, Paris

Gazeta de agricultură (2008), Ingrasarea porcinelor, Accessed 10th July, 2015 URL http://www.gazetadeagricultura.info

Nistor, C. (2003), *Riscul în comerţul exterior (cu aplicaţie la mărfuri agroalimentare)* – teză de doctorat

Manole, A. (2008), *Sistemul informatic pentru modelarea deciziei financiar-contabile,* Artifex, Bucharest

Saltelli, A., Chan, K., Scott, E.M. (2000), *Sensitivity Analysis,* West Sussex, UK: John Wiley & Sons, Ltd, 2000

Suhoverschi, M. (2007), Solutii tehnologice in cresterea porcilor URL Accessed 15th July 2015, http://www.gazetadeagricultura.info

Tănăsoiu, O., Iacob, A.I. (1998), *Econometrie*, ASE, Bucharest.