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Araştırma Makalesi

Broyler Beslemesinde En Düşük Maliyetli Rasyon Formülasyonunun Uygulanması

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Anahtar Kelimeler

Hayvan besleme,
Rasyon optimizasyonu,
Yem maliyeti,
Optimal çözüm

Öz: Bu çalışmada matematiksel modellemenin hayvan beslemede faydası ve üreticilere faydaları üzerinde durulmuştur. Uygulama kısmında ise, Microsoft Excell for Windows Version 2010 programı, çözücü modül kullanılarak etlik piliçlerin (etlik piliçler) 25. günden itibaren kesime kadar en ekonomik şekilde nihai rasyon formülasyonunu hazırlamıştır. Bununla birlikte bu çalışma diğer hayvan ırklarında da yapılabilir. Son zamanlarda bilgisayar teknolojisindeki gelişmeler hayatımızın hemen her alanında yaygın olarak kullanılmaya başlanmış ve hayvan yetiştiricileri rasyon hazırlamada bilgisayarlardan faydalanmaktadırlar. Bu durum üreticilerin karlarını maksimize ederken, yem maliyetlerini minimuma indirmiştir. Ayrıca, hayvanın ihtiyaç duyduğu enerji, protein, vitamin ve mineral değerleri bilimsel olarak hesaplanmış ve en düşük maliyetli hammade ile karşılanmıştır. Nitekim hayvanın ihtiyaç duyduğu enerji, protein, vitamin ve mineral değerlerinin düşük veya fazla olması durumunda birçok beslenme hastalığına yakalanması kaçınılmazdır. Bu durum çiftçilere ciddi zararlar vermekte ve üreticileri hayal kırıklığına uğratmaktadır. Sonuç olarak, bu tür modellerin ve bilgisayar teknolojisinin ve bunların uygulanmasına yönelik yazılımların sürekli gelişimi, hayvan üretimini geliştirmek ve bunun çevre üzerindeki zararlı etkisini azaltmak için temel besleme bilgisinin uygulanabileceği göstermektedir.

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Application of Lowest Cost Ration Formulation on Broiler Nutrition

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Abstract: In this study, the usefulness of mathematical modelling in animal nutrition and its benefits to producers were emphasized. In the application part, Microsoft Excell for Windows Version 2010 program prepared the final ration formulation in the most economical way from the 25th day to slaughter for broilers (broiler chickens) by using the solver module. An application had been made in experiment. This study could be done in other animal breeds. Recently, developments in computer technology were widely used in almost all areas of our lives, and animal breeders have had benefited from computers in preparing rations. This situation maximizes the profits of the producers were reduced the cost of feed to a minimum. In addition, the energy, protein, vitamin and mineral values needed by the animal were scientifically calculated and met with the lowest cost feeds. As a matter of fact, in case of low or excess of energy, protein, vitamin and mineral values needed by the animal, it was inevitable to have many nutritional diseases. This situation causes serious damage to the farmers and frustrates the producers. Consequently, the continued development of such models and computer technology and the software for their application holds great promise for improvements in effectiveness at which basic animal function knowledge can be applied to improve animal agriculture and reduce its impact on the environment.

Keywords

Animal nutrition,
Ration optimization,
Feed cost,
Optimal solution

1. Introduction

With the increase in the world's population over time, it causes many problems. The most important of these problems is the nutrition problem. Since plant-based products are insufficient to solve this problem alone, there is a need for animal products. Therefore, animal nutrition has an important place in almost all countries, regardless of the level of economic development of the countries (Doğan, et.al., 2003). Today, animal husbandry has become an important sector and contributes significantly to the economic development of countries. As a matter of fact, this sector has become an industry branch in developed countries. This situation reveals that agriculture and therefore animal husbandry is a strategic sector that needs to be developed at the national level (Aydemir and Pıçak, 2007). As it is known, agriculture is an important source of livelihood in most countries, and animal husbandry constitutes the most important share in agriculture. Unfortunately, it is a well-known fact that animal husbandry, which is so important, is low in animal yield (Doğan, et al., 2000).

Animals should take all the nutritional components (protein, energy, vitamins, minerals, etc.) needed by the animal in sufficient amounts in order to fulfil their vital physiological activities (for their growth, reproduction, and health) (Practicalsha, 2011). For these reasons, we can say that it is very important to formulate the nutrients needed by the animal during the feeding stages of the animal. It is closely interested in the combination of different nutrients to meet the energy and nutritional needs it needs during the development stages. At the same time, the most important issue of the big companies that keep animals is the feed combination, which is the ration. It is a difficult task due to reasons such as adequate intake of nutrients. The main purpose of the feed ration prepared for small and bovine animals is to meet the nutritional needs of the animal in a sufficient and balanced amount with the least cost (Saxena, 2012]. The cost of the feed ration of the enterprises established to feed the animals is the least cost. It is as important as meeting animal nutritional needs (Bahadır and Spring, 2018).

Feed costs account for 50-80% of the total costs of animal breeders. This rate leads to more than 60% of poultry and feed costs are the highest in farms established to produce milk (Gianluigi 1997). This ratio in feed costs increases further. Another issue is that animal breeders' knowledge of which feeds the animals need is cheaper than which feeds affect the cost in animal production. One of the areas that can be used to reduce feed costs is ration formulation (Nabasirye et.al. 2011).

In 1878, At water expressed how to reduce feed costs: “proper feeding of herds is not about how much grass or grain is given to them, but how much water, starch, gluten, etc. they contain (Kellems, 2002). This interpretation, which was made approximately 140 years ago, is valid in today's modern animal husbandry. Based on this, the ration should be prepared in accordance with the nutritional needs of the animal in accordance with scientific methods. It is a fact that it is possible to obtain maximum efficiency from the animal with a correct ration prepared with conscious scientific methods. In the ration formulation made unconsciously, some feed nutrients that enter the formulation are thrown out without evaluation (Alpet.al., 1996).

There are some methods for formulation of rations. Some of them are Pearson Square Method, trial and error method, linear programming and goal programming. For these modelling applications, it is very important to have sufficient knowledge of how these models work (Ediz and Yagdiran, 2009). Among these mathematical models, target programming, which was developed for the solution of multi-objective problems, is often preferred because it has a flexible structure, is easier to use than others, and gives relatively good results (Fylstra et.al., 1998)

Consequently, the continued development of such models and computer technology and the software for their application holds great promise for improvements in effectiveness. Basic animal function knowledge can be applied to improve animal agriculture and reduce its impact on the environment.

2. Material and Method

In this study, was prepared the finishing ration formulation in the most economical way from the 25th day to slaughter for broilers (Figure 1). For this, try to calculate the energy and protein needed by the broiler from ross-308 and find it with the help of an excel solvent with the feed materials (Fylstra et.al., 1998).

A	B	C	D	E	F	G	H	I
Feed formulation for broilers								
	X_i (gr)	Hp (gr/kg)	Hp Mixture	Energy mj/kg	Energy Mixture	Energy kcal/kg	price mix	Price
maize	20	8,11	1,62	15,1	3,02	3612,44	0,736	3,68
soybean (full fat soy)	60	35,12	21,07	17,1	10,26	4090,91	3,42	5,7
Soy sauce	10	48,5	4,85	11,20	1,12	2679,43	0,47	4,7
barleycorn	10	10,27	1,03	11,3	1,13	2703,35	0,32	3,2
	0	0	0,00	0	0	0,00	0	0
Total	100		28,57		15,53	13086,1244	**4,946**	0
Need			20,00		13,39			

Figure 1. Feed Raw Materials and Nutrient Contents to be used in the sample solution

Parameters

X_i: i=1,2,3,4; i. Amount of feed type in ration (gr)

H_p: i=1,2,3,4; i. The amount of digestible protein of the feed type (gr / kg)

$H_p\ Mixture$:i=1,2,3,4; i. Amount of digestible protein in the mixture of the feed type (gr)

$Energy\ (mj/kg)$: i=1,2,3,4; i. Metabolic Energy amount of feed type (mj/kg)

Energys from feedsstuff : i=1,2,3,4; i. The amount of Metabolic Energy in the mixture of the feed type (Mj/kg)

Price: i=1,2,3,4; i. Price of feed type (TL)

Price Mix: i=1,2,3,4; i. The price of the amount of feed type in the mixture:

Modelling

The solvent module of the Microsoft Excel for Windows Version 2010 program was used. For example, a broiler (broiler) feed ration was prepared. It was predicted that there would be at least 20 % protein and 13.39 MJ/kg metabolic energy in the prepared ration.

Ration Solution

In the excel environment, the "Solver" wizard was used to prepare the lowest cost rations. For this, there were some data that need to be entered and edited in the Excel spreadsheet environment. In this example, the ration composition was given first.

Step1

As a result of running the analyser wizard, the Solver Parameters window, which was shown on the screen in Figure 2, appears. Necessary definitions were made about the parameters on this window.

The first parameter on this window was the set target cell parameter. This parameter was the cell containing the purpose function definition ($H$8) and was located in Figure 1 and Figure 2. As can be seen, ratio ($H$8) was the cost, and experiment goal was to keep it minimal.

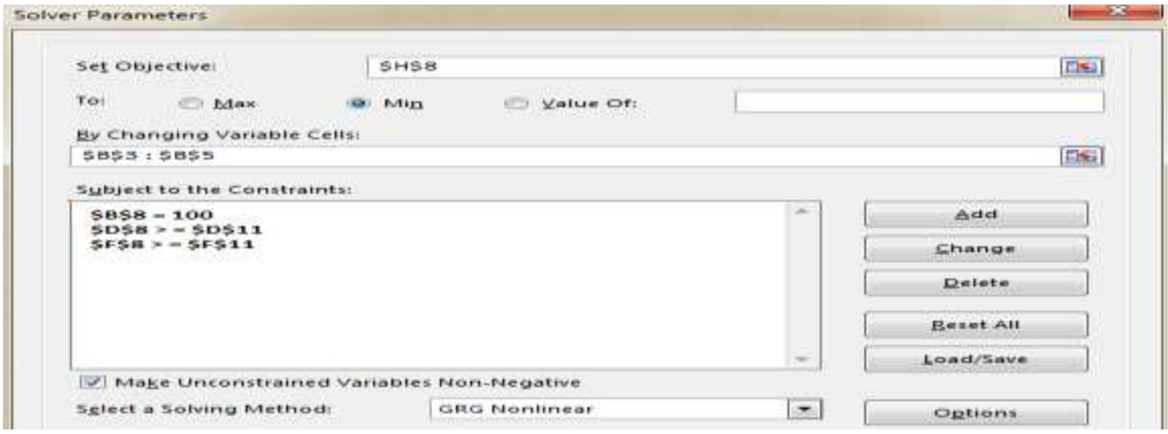

Figure 2. The parser parameters window

Step 2

At this step, the "Smallest" option seen in the "Target" section was selected. Because, in linear programming, minimization was performed. If in any activity, for example, profit maximization was aimed, then the "Biggest" option was selected.

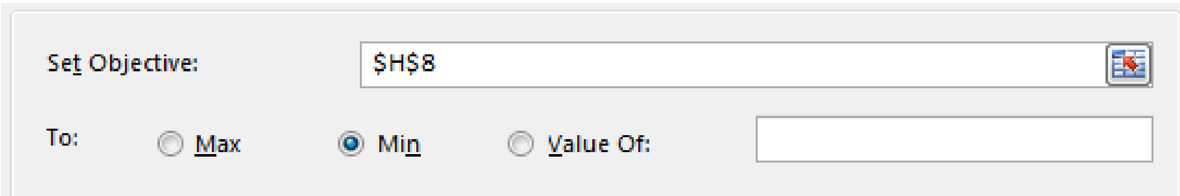

Figure 3. The target part of the parser parameters

Step 3

In this step, it was the by changing cell (by changing the variable cells) parameter. In the example a field definition ($B$3:$B$5) had been made for this parameter in Figure. This field defines the amounts of feeds that was included in the ration and specified in Figure 1.

In other words, the amount of feed that will enter the mixture as a result of the analysis was obtained in this area.

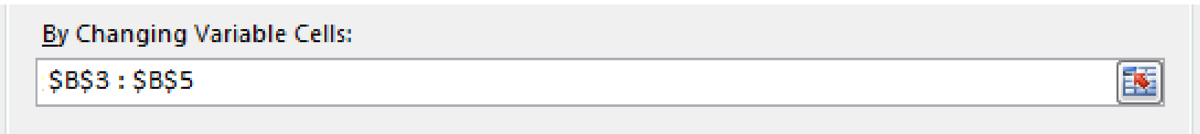

Figure 4. Variable cell part of the parser parameters window

Step 4

In this step, another parameter that must be defined for the optimization process was the constraints (Figure 4). There were three buttons on the window to be used to define the constraints, namely add (add), change (change) and delete.

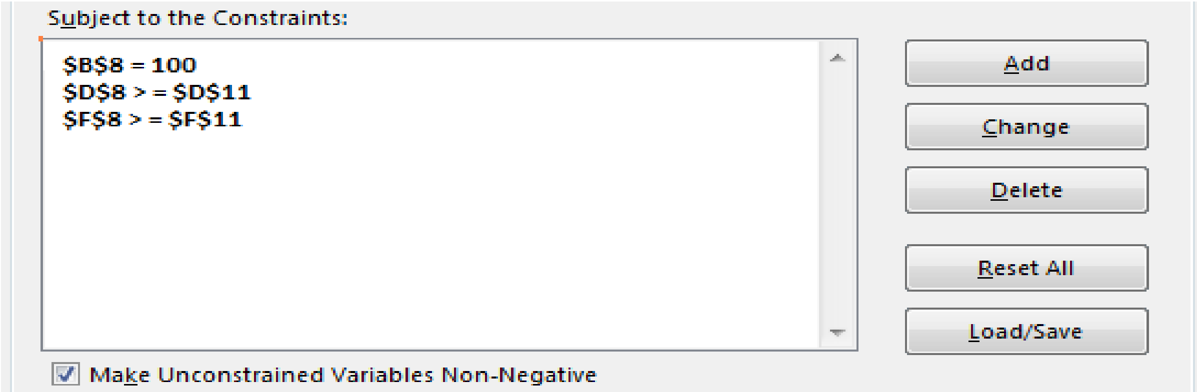

Figure 5. Constraints section of the parser parameters window

When the add button was clicked with the mouse of the computer, appears the window in Figure 5. Here, in the cell reference field, it was specified which cell value was limited to what.

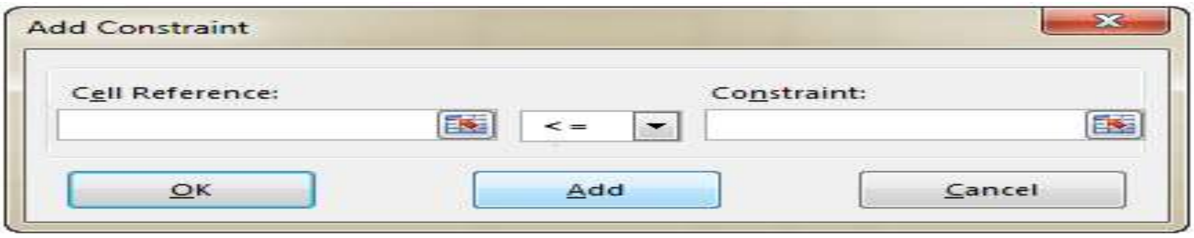

Figure 6. Adding constraints section of the parser parameters window

Here, enter the constraints in Figure 6, first constraint was that the percentage amount of feed in the mixture was equal to 100 ($B$8=100), second restriction was that the amount of crude protein was more than 20 g ($D$8 ≥ $D$11), third limitation was that metabolic energy amount should be more than 13.39 Mj/kg ($F$8≥$F$11).

Step 5.

In the last step, the solution was found when the solve command was clicked as in figure 6.

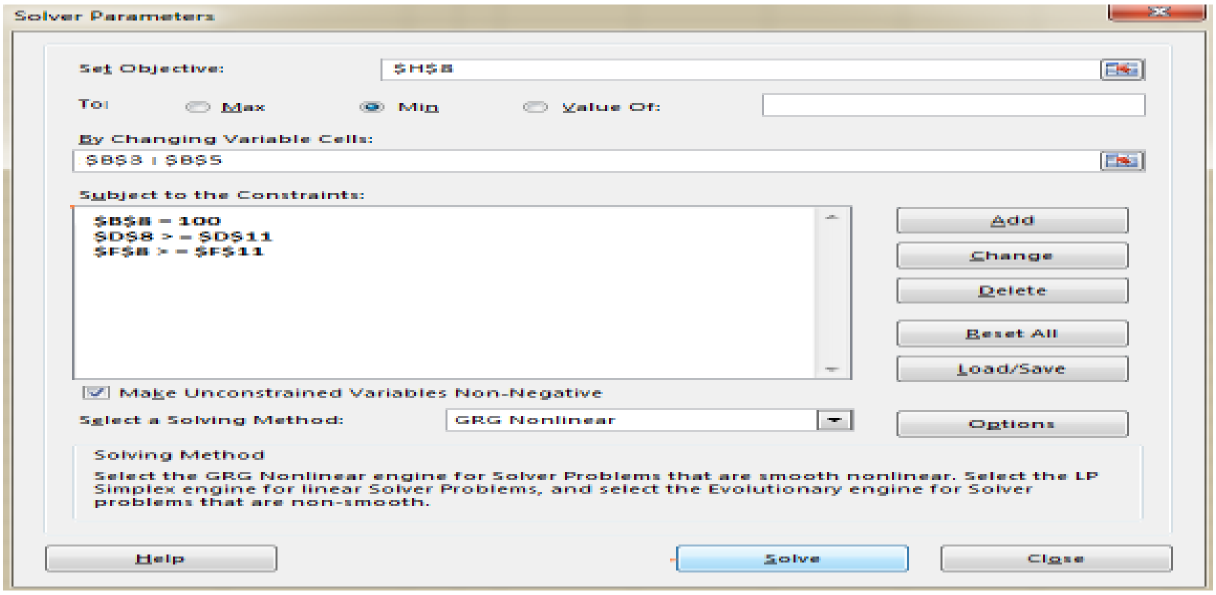

Figure 7. Final version of the parser parameters window

Step 6
The end found when clicking the Solve command

Feed formulation for broilers								
	Mixture %	Hp	Hp Mixture	Energy mj/kg	Energy Mixture	Energy kcal/kg	price mix	Price
maize	55,75	8,11	4,52	15,1	8,42	3612,44	2,05	3,68
soybean (full fat soy)	0,00	35,12	0,00	17,1	0,00	4090,91	0,00	5,7
Soy sauce	28,60	48,5	13,87	11,20	3,20	2679,43	1,34	4,7
barleycorn	15,65	10,27	1,61	11,3	1,77	2703,35	0,50	3,2
	0,00	0	0,00	0	0,00	0,00	0,00	0
Total	100,00		20,00		13,39	13086,12	3,90	0
Need			20,00		13,39			

Figure 8. Ration optimization screen output

3. Result and Discussion

When the results obtained in the solution of the model was examined in below,

Crude protein

When we look at the solution of the model, corn constitutes 55.75% of the ration amount. There was 8.11 g protein in a kg of corn, of which 55.75% make 4.52 g protein, 28.60% was soy sauce and one kg soybean There was 48.5 gr protein in the sauce, 28.60 % of which was 13.87 gr protein, in the same way 15.65% was barley, and there was 10.27 gr protein in one kg of barley, 15.65% of which was. It make 61 grams of protein, the sum of which provided the 20 grams of protein we need.

Metabolic energy

When we looked at the solution of the model, corn constituted 55.75% of the ration amount. There was 15.1 Mj/kg of energy in one kg of corn, 55.75% of which was 8.42 Mj/kg, 28.60% was soy sauce. One kg of soy sauce contained 11.20 Mj/kg of energy, of which 28.60% was Mj/kg of energy, in the same way 15.65% was barley, and one kg of barley contained 11.3 Mj/kg of energy, of which 15% .65 was 1.77 Mj/kg of energy, and when we added them together, it becomed 13.39 Mj/kg, which was equal to the minimum 13.39 mj energy we need ($F$8≥$F$11), which satisfies our constraint.

Cost

When we looked at the solution of this model, corn was 2.05 TL, soy sauce was 1.34 TL, barley was 0.5 TL, and when were added them, it was 3.90 TL. In other words, the feed cost of the broiler (broiler chickens) one-day finishing ration formulation (in the period from 25 days to slaughter) was 3.90 TL.

4. Conclusion

An application was made for broilers (broiler chickens) with the help of an excel solvent. In the study, the minimum cost feed requirements of broilers (broilers) for one-day finishing ration formulation (in the period from 25 days to slaughter) were determined to provide the nutrients needed by the animals in the most economical way.

Producers whose aim was to make a profit, in a diet devoid of unconscious scientific methods, inevitably incur a lot of damage, alone making a profit (Kellems and Church, 2002). Because, it was not possible to get efficiency from an animal that was not feed adequately balanced. Therefore, animal feed ration formulation was learned in the light of scientific methods. As a matter of fact, it was possible for the animal to be healthy in the livestock sector with a balanced and economical diet sufficient to obtain the desired yield and profit (Saxena et.al., 2012).

Based on the results of this study, we can say that scientific methods can be used in animal nutrition and that these methods provide an effective and useful solution to feeding problems.

Modelling provides serious benefits to the country's livestock, as it is more practical and economical to routinely determine the content of animal feeds (protein, energy, mineral vitamins, etc.) and include them in the feed content table. In addition, modelling could analyse a large number of feed materials at the same time and can be included in the study.

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