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Application of Simplex Method with Exel Program (Solver) to Optimize Sales of Cabbage Chili

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ABSTRACT
In the world of trading, optimization problems include maximizing profits or minimizing costs, both of which can be solved using the simplex method. The purpose of this study is to maximize the profits of Mr. Sahri's cayenne pepper household production located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. This study was conducted at Mr. Sahri's house as the owner of the cayenne pepper household industry. The analysis carried out in this study is an analysis using the simplex method with the Microsoft Excel solver function. The instruments used are observation and interviews. The results of the study indicate that the optimal production amount of each product (small, medium, large cayenne pepper) in Mr. Sahri's cayenne pepper household production so as to obtain maximum profit.

Keywords: *Excel, Optimization, Production*

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INTRODUCTION

Every individual as a member of society must be able to survive, namely being able to maintain their existence in the community. Entrepreneurship is one of the choices in earning a living. Along with the development of the times, more and more companies are established and more and more competitors, both large companies and small businesses (home industries). Efforts and strategies are needed to gain profit. One of the home industries that started its business from the bottom is the cayenne pepper industry owned by Mr. Sahri, which is located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. In Sumber Anyar, there are several home industries, especially cayenne pepper production. The research was conducted at Mr. Sahri's place because only his place produces cayenne pepper in various sizes (small, medium, large). Other industrial places only produce one type of size (small chili only). With the existence

of several industries in the same village, it means that there are more competitors. Therefore, home industry owners must implement strategies to gain maximum profit. One way to maximize profits is to use linear programming with the simplex method.

The simplex method is one of the mathematical methods of operations research. According to Frederick S. Hillier & Gerald J. Lieberman, the general stages of an operations research study are:

1. Formulating the problem
2. Create a mathematical model that describes the core of the problem
3. Lowering a solution
4. Testing models and solutions
5. Determine controls over model completion
6. Running the solution

Linear programming is programming that concerns problems where the relationship between variables is linear (Rahmi and Mulia Suryani, 2018:32). In linear programming, two types of functions are known, namely:

1. The objective function, describes what the company wants to achieve using existing resources, usually expressed in Z notation.
2. The constraint function describes the constraints faced by the company in achieving these goals (Rahmi and Mulia Suryani, 2018:32).

The simplex method is a method that systematically starts from a feasible basic solution to another solution that is done repeatedly (iteration) with a limited number of repetitions, until finally an optimum basic solution is achieved (Ulfasari Rafflesia and Fanani Haryo Widodo, 2014:8). In using the simplex method to solve linear programming problems, the linear programming model must be changed into a general form called the "standard form". The characteristics of the standard form of the linear programming model are: a. All constraints are equations with negative right-hand sides b. All non-negative variables c. The objective function can be maximum or minimum (Sri Mulyono, 2017:29).

RESEARCH METHODOLOGY

This research is a type of Applied Research, namely research to collect information and help solve a problem in everyday life. The population in this study is small businesses in the field ofcayenne pepper production in Sumber Anyar village. The sample in this study was the cayenne pepper production business owned by Mr. Sahri in Sumber Anyar village. The sampling technique used in this study was purposive sampling, namely a sample determination technique with certain considerations. (Sugiyono, 2013:124) [7]. The research instruments used in this study were observation, interviews, and literature studies from articles relevant to the research theme.

The research conducted uses primary data types and sources, meaning using data obtained directly based on the results of observations and interviews at the research site, namely at Mr. Sahri's house. The data collection technique used in this study is to conduct field research and library research. In field research, the author collects data needed and

related to the research through observation and interviews. Observations were conducted at Mr. Sahri's house as the owner of cayenne pepper production located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. Interviews were conducted directly with Mr. Sahri with the aim of obtaining data that will be resolved using the simplex method (solver function) in Excel. In library research, the author takes information related to the research theme through print and electronic media such as articles, and other relevant literature. The analysis technique used in this study is analysis using the simplex method with Microsoft Excel solver function. The simplex method has the advantage of being able to solve linear programming problems with two or more variables. The optimization problem to be solved in this study is to maximize profits (maximization) in the production of cayenne pepper at Mr. Sahri's place in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency.

RESULTS AND DISCUSSION

From the data obtained through observation and interviews with the owner of the cayenne pepper home industry, Mr. Sahri, the following calculations can be made.

1. Sales Results Total sales = number of cayenne peppers x price per kg of cayenne peppers, so the following data is obtained:

a. cayenne pepper with 1kg

: 200 x IDR 500.00 = IDR 100,000.00

b. cayenne pepper with 2 kg

: 50 x Rp 2,500.00 = Rp 125,000.00

c. cayenne pepper with 3 kg

: 40 x Rp 5,000.00 = Rp 200,000.00 So, the total sales result is: 1kg + 2kg + 3kg

: Rp. 100,000.00 + Rp. 125,000.00 + Rp. 200,000.00 : Rp. 425,000.00

2. Production Costs

Production costs = production costs of cayenne pepper with 1 kg + production costs of cayenne pepper with 2kg + production cost of cayenne pepper with 3kg.

= Rp. 56,000.00 + Rp. 69,000.00 + Rp. 112,000.00

= Rp. 237,000.00

Profit = total sales – total production costs

= Rp. 425,000.00 – Rp. 237,000.00

= Rp. 188,000.00

Mr. Sahri's cayenne pepperin one production produces 200kg of small cayenne pepper, 50kg of medium cayenne pepper and 40kg of large cayenne pepper. Based on the amount of cayenne pepper production, the cost for each packing is as follows:

small cayenne pepper =Rp56,000.00 /200 = Rp. 280.00

medium sized cayenne pepper =Rp. 69,000.00 /50 = Rp1,380.00

large cayenne pepper =Rp112,000.00 /40 = Rp2,800.00

ΔZThe increase in profit per kg of cayenne pepper is as follows:

Small cayenne pepper = Rp. 500.00 – Rp. 280.00

= Rp. 220.00

medium sized cayenne pepper = Rp. 2,500.00 – Rp. 1,380.00
= Rp. 1,120.00
Large cayenne pepper = Rp. 5,000.00 – Rp. 2,800.00
= Rp. 2,200.00

The total amount of time needed to produce cayenne pepper is as follows: 1.) small cayenne pepper: 2 months
2.) medium sized cayenne pepper : 3 months
3.) Large cayenne pepper: 4 months +
Total: 8 months

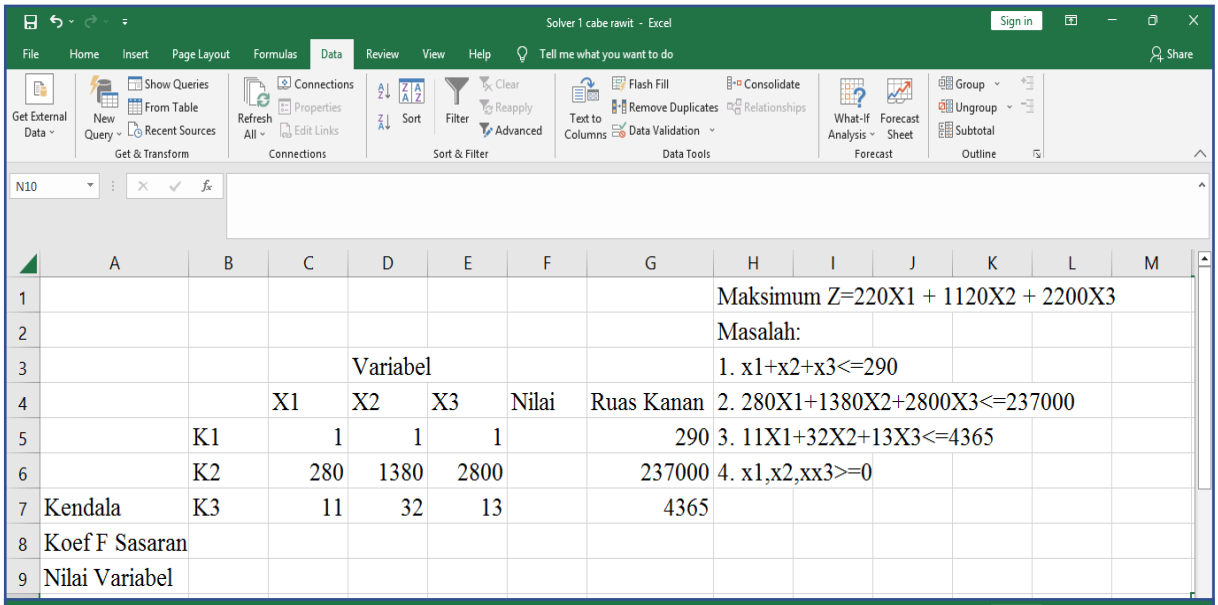
If the data for the calculation is all known, then the next step is to enter the data into the linear programming table to solve the problem. The linear programming table is as follows.

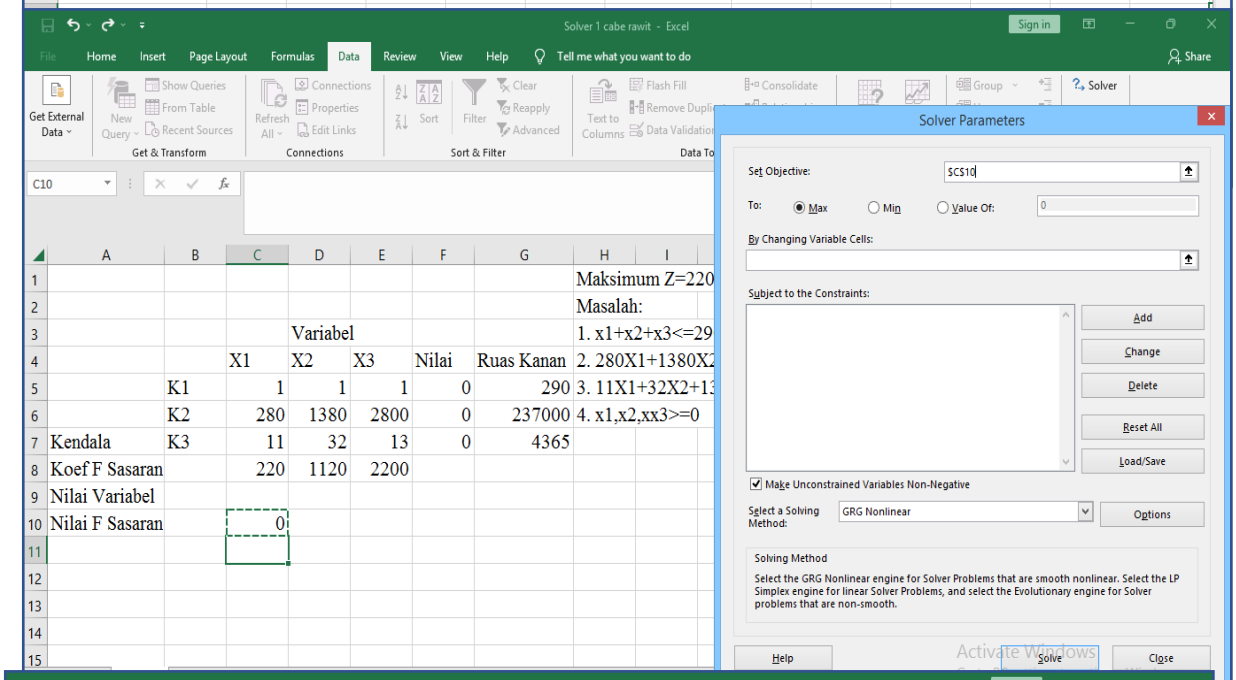
Table 1.1 Linear Program Table

Type Size / Part	Small Size (X1)	Medium Size (X2)	Large Size (X3)	Capacity Activity
Many Units	1	1	1	290
Cayenne pepper Production cost	280	1380	2800	237,000
Cayenne pepper Time	2 months	3 months	4 months	8 months
ΔZ Addition		profit each	2201.120	2,200 Cayenne pepper

The mathematical model used to solve the linear programming problem is as follows. Objective function: Maximize Z = 220x1 + 1,120x2 + 2,200x3 Constraint function: x1 + x2 + x3 ≤ 290 280x1 + 1,380x2 + 2,800x3 ≤ 237,000 11x1 + 32.4x2 + 13, 12x3 ≤ 4,365 x1, x2, x3 ≥0

Simplex Method Work With Microsoft Excel Solver Function





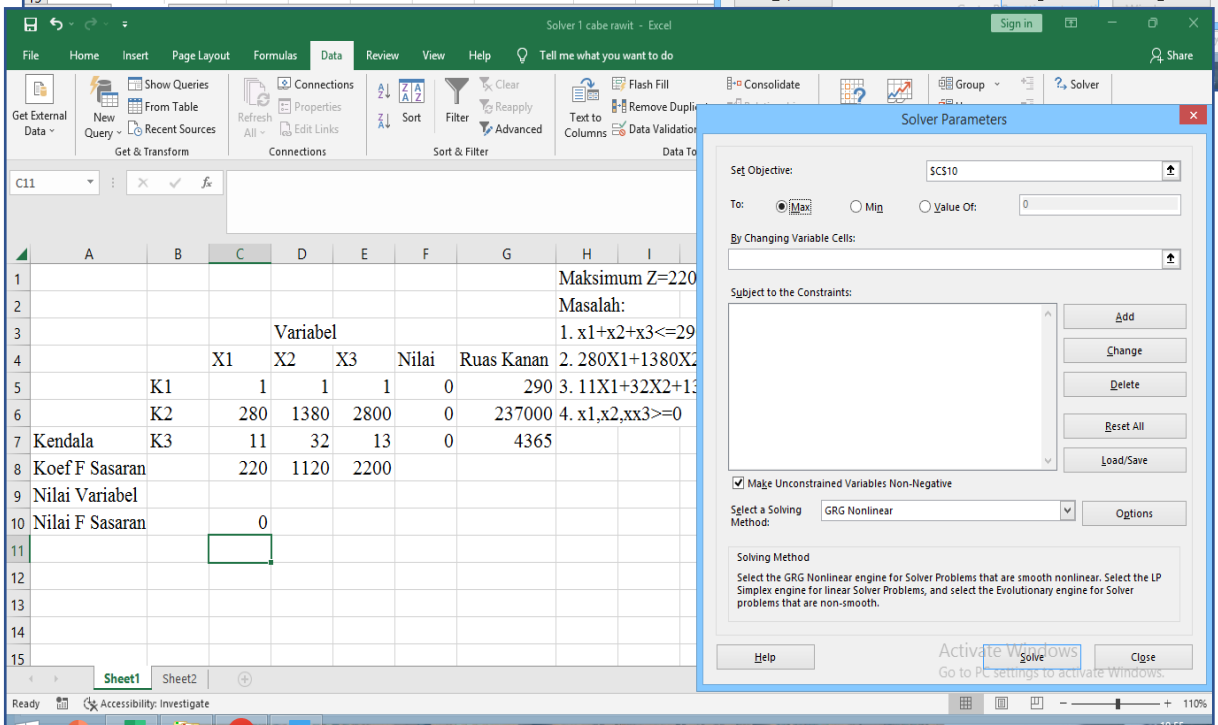


Figure 3. Select max, according to the objective function

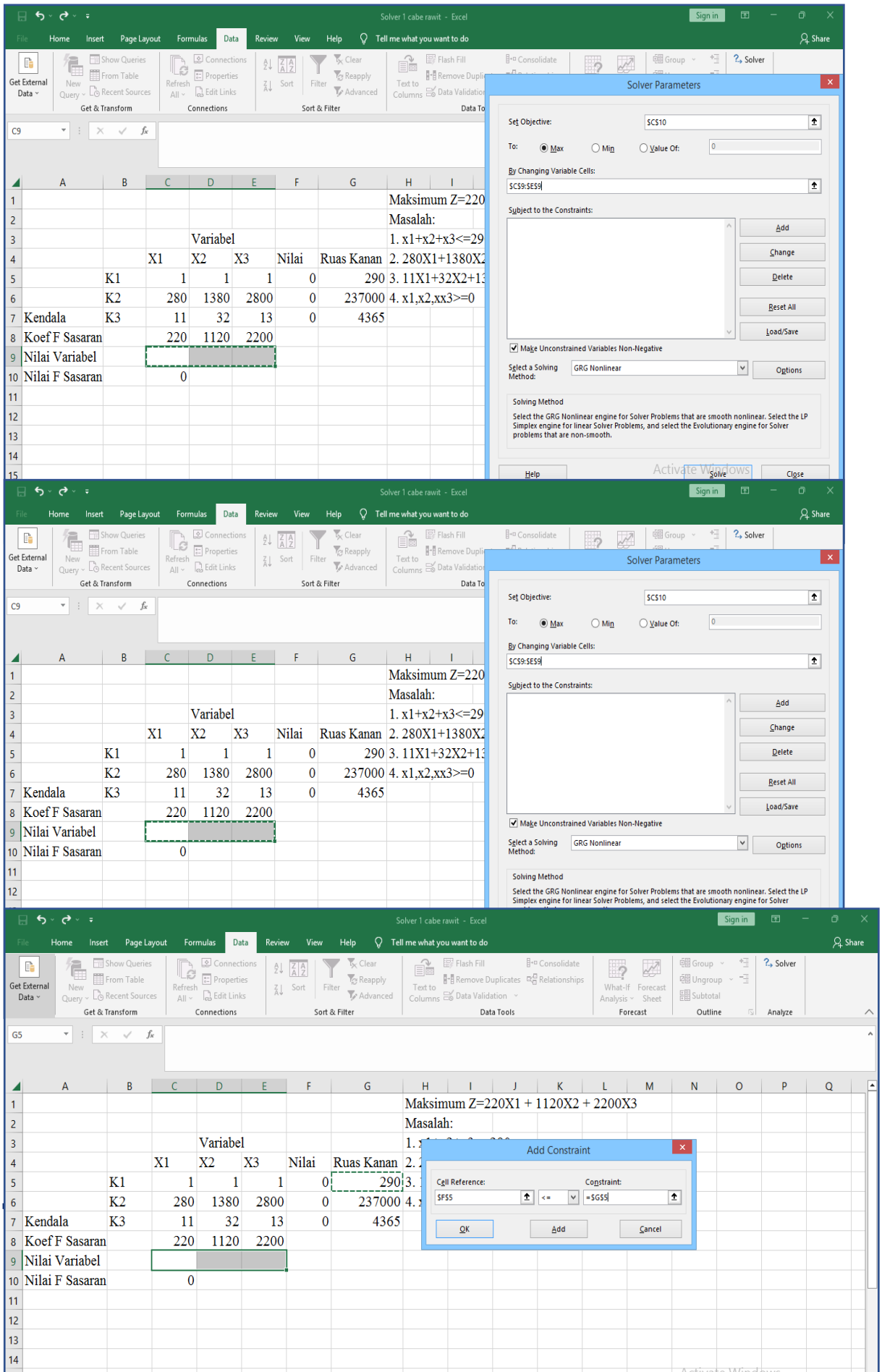


Figure 6. Enter the value cells and the right side of constraint 2.

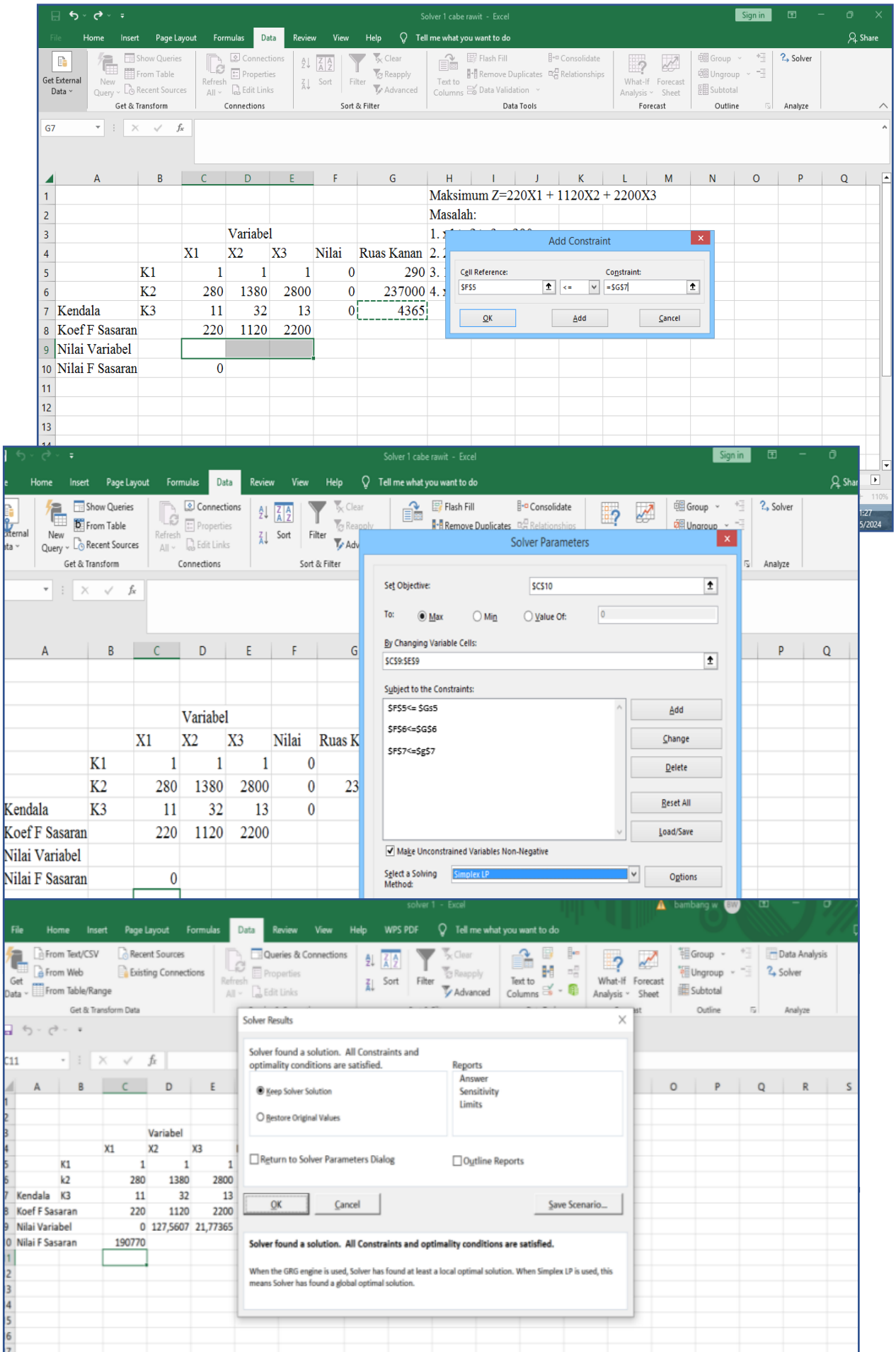


Figure 9. The last step, click OK.

CONCLUSION

Based on calculations using the simplex method with Microsoft Excel Solver function, the results obtained that without changing the allocation of production capital, the application of the simplex method can maximize the profit of Mr. Sahri's cayenne pepper home industry. The results of calculations using the simplex method show the optimal solution, namely Z = Rp190,770.00, with x2 = 127.5607 (rounded to 128) and x3 = 21.77365 (rounded to 22). Medium-sized cayenne pepper is produced as much as 128 kg, and large-sized cayenne pepper is produced as much as 22 kg, so the maximum profit obtained is Rp190,770.00. Overall, it can be concluded that to maximize profits in optimizing production results can be done through the application of linear programming simplex method with Microsoft Excel Solver function. This can help determine the amount of optimum production that can be achieved to achieve maximum profit.

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