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Farming Optimization of Superior Commodities in Nganjuk Regency

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***Abstract**: The study had the objective of getting the optimization of agricultural products, especially in the four superior commodities in Nganjuk Regency using analysis of Linear Programming.The object of study of this research are farmers in Nganjuk Regency. The results showed that the optimal condition is farmer's maximum total revenue obtained by planting corn combination of 0.2469, Rice of 0.7940 Ha, and Red Onion 0.2831 ha from 1,324 ha that available, with the amount of revenue is around Rp 49. 802. 000 per year per hectares. From 6 villages which made for the object of this study, the total wetland area is 1531.65 Ha, and the optimization recommendation products is to plant 285.62 Ha of corn commodity, 918.53 Ha for Rice commodity, and 327.50 Ha for Red Onion commodity. Therefore the total agricultural income in the six villages is Rp 57.6 billion per year. If translated by each commodity, then the corn commodity revenue (285.62 Ha) in the amount of to Rp 6.08 billion per year; rice commodity revenue (918.53 ha) in the amount of to Rp 20.82 billion per year; onion commodity revenue (327.50 Ha) in the amount of to Rp 16.32 billion per year. On the whole Gondang Sub-District (17 villages), the total land area is 3578.66 Ha. Therefore the total agricultural revenue in the whole Gondang Regency is Rp 110.9 billion per year.*

***Keywords:** Optimization of Agricultural Products*

I. Introduction

Indonesia's agricultural sector is a sector that is still a considerable contribution to the national economy development (Syafa'at, 2000). Indonesia is a country with very large agricultural commodities business. One source of the Indonesian state main revenue is in the agricultural sector. There are three major problems (*big problem*) that Indonesia faces now and in the future in economic development, namely: (1) high productivity gap between agriculture and non-agriculture (*industry*); (2) high levels of unemployment, and (3) the growing balance of payments deficit (*balance of payment*). Within the framework of the national economy, East Java is one of the provinces that has a fascination with its own particular characteristic especially Nganjuk Regency, where the agricultural sector is the *leading sector* of development. This area is one of the national industrial development area and an agrarian area that partly very well be used as a commercial horticulture and plantation development.These conditions, supported by the potential of natural resources and ecosystems that support. Nganjuk Regency has special characteristics which are two (2) main sectors namely food agriculture, and horticulture. Table 1 below presents the superior commodities for the two sectors:

Table 1. Details of Superior Commodities Per-Sectoral in Nganjuk Regency

Sektor	Ranking	Commodities	Total Area (Hectare)	Production (Quintal)	Productivity (Quintal per Hectare)
Food	1	Corn	29.345	1.887.160	64,31
	2	Rice	81.938	5.203.874	63,51
	3	Soybean	9.293	583.189	62,76
	4	Cassava	7.689	462.719	60,18
	5	Grogo/Tegal	5.897	321.720	54,56
	6	Sweet potatoes	487	20.857	42,83
	7	Peanut	2.683	46.854	17,46
Horticulture	1	Red Onion	10.071	1.196.601	118,82
	2	Collards	93	10.585	113,82
	3	Watermelon	348	33.672	96,76
	4	Eggplant	17	1.612	94,82
	5	Garbis	136	6.839	50,29
	6	Chili	227	8.523	37,55
	7	Long Beans	74	2.472	33,41

The Main sector of Nganjuk Regency is food, while the superior commodity is corn amounted to 64.31 quintal per hectare, although the total area of this commodity is much lower than the rice, but the production of corn in Nganjuk Regency the proportion is higher when associated with the planting area. Besides, in this study the focus is also on the second rank (rice and soy). For the horticultural sector, in terms of highest productivity (118.82 quintal per hectare), even the highest total area (10.071 ha) is in red onion commodity. Agribusiness will face challenges that is shrinkage of land, so the production is not optimal and the additional agricultural products also reduced. On the other side agribusiness demanded to spur the roduction to meet the needs of domestic market which is keep growing. Spur the production by giving more fertilizer is not an economic measures, because it is very expensive and sometimes unstable, because some of the material is imported while the material in their own country is competing with other needs. To face these challenges, the development of agribusiness in the future may rest on the optimization of agricultural products, in particular on superior commodities. Phenomena associated with the optimization of agricultural products. Field conditions showed the agricultural products in Nganjuk Regency is less than optimal. Ideally, in the Sustainable Agricultural Development Theory (Steers, 1985), if it is associated with the objectives of agricultural development in addition to increase production and income of farmers as producers, is also aiming for self-sufficiency, exports, employment and equity as well as the utilization of natural resources in an optimal and sustainable, so the optimization of agricultural commodities in Nganjuk Regency is necessary.

II. Theoretical Study

Optimization Concept

Optimization is a topic that is always discussed in agricultural economics. This Optimization reflects the behavior of rational economic actors.This means that as consumer will always maximize the revenue and as manufacturer will always maximize the profits or minimize losses by pressing the cost. The Optimization theory is always concerned with the maximization problem, minimization or combination of both (Heady, 1952). Soekartawi (1995) stated that optimization is normative approach to identify the best solution of a problem that is directed at the maximum or minimum objective function point. Optimization theory is often used for solving problems in economics, operations research and agricultural economics. Linear program or better known as *linear programming* can be used to solve various problems when has optimized goal. In addition, these problems have limited resources expressed in system of equations or inequalities. According to Taha (1996), basically the optimization problem is a problem to make or functions of several variables to a maximum or minimum by taking into account the existing restrictions. *Linear programming* issue is a question to determine the magnitude of each variable value so the objective function value (*objective function*) becomes optimum. According to Agrawal and Heady (1972), *linear programming* is a method that is more systematic and rigorous mathematics to determine the optimal combination of business branches or *input* such as revenue maximization or costs minimization in accordance with the limited resources available.

According Siswanto (2002), model of linear programming has three main elements, namely: (1) Decision variables; (2) Objective function; and (3) Constraints function. Decision variables are variables issues that will affect the value of the objective. In the modeling process, the determination of decision variables must be done first before formulating the objective function and constraints. Decision-making in the production can also be analyzed using *linear programming*. *Linear programming* is a model of analysis which focuses on short-term election in a production process to achieve the value of products that produced (profit) as high as possible by issuing minimmum costs at a certain level of restriction. In these activities, there is always an alternative process that would produce the same product. From many available alternatives there are small numbers of such alternatives should be considered to be implemented. With *linear programming*, the best alternative provision can be identified easily.In using this *linear programming*, required the basic assumption which is the characteristic of linear programming. The basic assumption by Nasendi and Anwar (1985) are as follows:

1. Linearity

This assumption means that the objective function and limiting factors should be expressed as linear function. This assumption also wants the comparison between one *input* with another *input* or an *input* to *output*, the amount is fixed and detached (not dependent) on production levels.

2. Proportionality

This assumption means that the ups and downs of objective value (Z) and the use of resources or facilities provided will change in proportion with the changes in the level of activity.

3. Aditivity

This assumption means that the objective value of each activity doesn’t affect each other, or in *linear programming* is considered that the increase of objective value (Z) caused by the rise of an activity can be added without affecting the part of the value of Z obtained from other activities.

4. Divisibility

This assumption states that the *output* generated by each activity can be fractions, as well as Z value that generated.

5. Deterministic

This assumption states that all parameters contained in the linear program is fixed, known, and can be estimated with certainty.

6. Decisions and resources variable are countable

This assumption means that all available resources can be ascertained the amount so it can be known with certainty how many parts which are used by a decision variable.According Siswanto (1993), as general mathematical model of *linear programming* can be expressed as follows:

Objective Function:

Maximize/Minimize $Z = C_1X_1 + C_2X_2 + ... + C_jX_j$

Constraint Function :

$$a_{11}X_1 + a_{12}X_2 + ... + a_{1j}X_j \leq b_1$$

$$a_{21}X_1 + a_{22}X_2 + ... + a_{2j}X_j \leq b_2$$

$$a_{i1}X_1 + a_{i2}X_2 + ... + a_{ij}X_j \leq b_i$$

Assumption :

$$X_1, X_2 ... X_j \geq 0$$

Where ;

Z = scalar value decision making maximum / minimum criteria of the objective function

Cj = parameters are used as criteria of optimization, decision makers or variable coefficients in the objective function

Xj = decision or activity variable (to search, unknown)

ajj = technological coefficient decision variables (activity concerned) within the constraint to-i

bi = limited resources, which makes the activity or business concerned, also called the constant value of the right side of constraints to-i

Z function is revenue that should be maximized and variable Xj is farming activities that divided into various patterns and integrated with the cattle business. A number of resource constraints must be met, which is denoted with bi. Coefficients aij and Cj each is the number of resources required for each activity and the amount of each activity revenue to-j.

In build linear programming model, there are four important components (Beneke and Winterboer, 1973), namely:

1. Activities

The real activity which consists of several kinds of them: production and plant growth, maintenance and or feeding cattle, product sales, purchase or rental of inputs or services, including labor and capital, harvesting crops, transfer inputs or products between one activity or time period and the payment of fixed cost and or family life expenses.

2. Constraints

According with the objective, constraints can be classified into (1) inputs constraint, such as land, labor, and capital, (2) external, such as land permitted by the government to work on, or credit limit is determined by the lender, and (3) subjective constraints, that is constraints specified by the farmers themselves.

3. Production Coefficients

As estimation able to see coefficients as connection between harvest and woof, labor and capital that needed in the budgets. Production coefficient always expressed in the number of inputs required per unit of activity.

4. Objective Function

Objective Function is a function form for model that arranged. This function can be maximization of net income, the use of labor, land or cost minimization. Programing procedure designed to make agriculture planning that will generate the maximum acceptance by the barrier, prices and production. This does not mean to ignore the risk of interest, or run the farm, which gives satisfaction.

III. Method

Place and Study Time

This study was conducted in Nganjuk Regency. More specifically, the place of the study located on rice farming, soybean, red onion and corn in Nganjuk Regency, particularly in the irrigation area Senggowar, Gondang Sub-district. Research locations were selected based on the consideration that the region is the main irrigation areas in Nganjuk Regency, and the area has four superior commodities such as corn, rice, soybeans, and red onion.

Sampling Method

The study had the objective of getting the optimization of agricultural products, especially in the four superior commodities in Nganjuk Regency using ***Linear Programming* analysis**.The object of study of this research are farmers in Nganjuk Regency. Thus, the population in this study were all rice, soybean, onion and corn farming communities in Senggowar Irrigation Area Nganjuk Regency which includes six villages which are Gondang Kulon, Pandean, Senggowar, Campur, Sumber Rejo, and Balong Gebang.

Study Variable

Solimun (2003) one of the characteristics of quantitative approach in addition to the identification of the population, study sample and data, also need to identify the study variables. The study variables are the characteristics of the objects of study relevant to the problems, where data will be measured at it. In the study needs to be tested for the optimization (maximization) of the agricultural income based on resources which are in agricultural area, the capital investation, the use of Tenaga Kerja Keluarga (TKK), as well as Tenaga Kerja Luar Keluarga (TKLK).

Data Analysis Method

The analytical method that used is ***Linear Programming* analysis** that used to obtain the optimization of agricultural products, especially in the four main commodities in Nganjuk Regency.

IV. Result of the Study

The results of the study is to get the optimization of agricultural products, especially in the four superior commodity in Nganjuk Regency using ***Linear Programming* analysis** are outlined below. There are four decision variables as follows:

X1: optimized corn acreage (ha)
X2: optimized rice acreage (ha)
X3: optimized soybean acreage (ha)
X4: optimized red onion acreage (ha)
To achieve optimization, used to maximize the objective.
Z: Maximize the revenue (Rp/ year)
The objectives above in the form of maximization. To achieve these objectives, there are four constraints as follows:

K1.Lack of extensive land ownership (ha)
K2. Lack of labor from within family (TKDK) (person)
K3. Lack of labor from outside of family (TKLK) (person)
K4. Lack of adequate capital (Rp)
K5. Constraints of agricultural land use

Table 2. *Linear Programming* Analysis Optimization.

	X1	**X2**	**X3**	**X4**	**Sign**	**RHS**
Objectives						
Z	a_1	a_2	a_3	a_4	Max	
Constraints						
K1	b_{11}	b_{12}	b_{13}	b_{13}	<=	c_1
K2	b_{21}	b_{22}	b_{23}	b_{23}	<=	c_2
K3	b_{31}	b_{32}	b_{33}	b_{34}	<=	c_3
K4	b_{41}	b_{42}	b_{43}	b_{44}	<=	c_4

With the translation of each coefficient as follows:

Coefficient a_s (s = 1,2,3,4) are coefficients that link between land area with revenue (land area X_s in units of Ha), thereby the coefficient a_s is (Rp / year / ha), so that the objective function Z (total revenue) in unit of Rp /year).

Coefficient b_{1s} (s = 1,2,3,4) are coefficient that link between the utility of land use (land area X_s in units of Ha) with the availability of land, therefore b_{1s} in unit of (%), so that the coefficient c_1 which is available land area in the unit of (% ha), which is 100% times the average land availability.

Coefficient b_{2s} (s = 1,2,3,4) are coefficients that link between limitations of available TKDK with optimal cultivated land (land area X_s in units of Ha), thereby coefficient b_{2s} in unit (persons / ha) so that the coefficient c2 is available TKDK in unit (person).

Coefficient b_{3s} (s = 1,2,3,4) are coefficients that link between limitations of available TKLK with optimal cultivated land (land area X_s in units of Ha), thereby coefficient b_{3s} in unit (persons / ha) so that the coefficient c_3 which is available TKLK in unit (person).

Coefficient b_{4s} (s = 1,2,3,4) are coefficients that link between the lack of capital available with optimal cultivated land (land area X_s in units of Ha), thereby coefficient b_{4s} in unit of (Rp /year/ ha) thus coefficient c_4 that is the available capital in the unit of (Rp /year).

As has been stated that coefficients of the objective function is coefficients a_s (s = 1,2,3,4) are coefficients that link between land area with revenue (land area X_s in unit of Ha), thereby coefficient a_s is (Rp /year / ha), so that the objective function Z (total income) in unit Rp /year).

Table 3. Objective Function Coefficient

Commodities	Revenue of each commodity(Rp/year)	Average of Land Use (Ha)	Each Commodities Revenue Per Hectare (Rp/Year/Ha)
Corn	4.895.381	0,330	14.567.030
Rice	12.588.846	0,507	26.223.686
Soybean	2.677.143	0,190	10.129.008
Red Onion	10.119.978	0,297	34.074.000

Source: Data Processed in 2015

Therefore the objective function in this study is
Maks **Z** = $14.567.030\ X_1 + 26.223.686\ X_2 + 10.129.008\ X_3 + 34.074.000\ X_4$
Coefficient meaning above shows that red onions (BM) is commodity that has the highest revenue levels for it is able to reach Rp. 34.074.000 per hectare. On the other side, Soybean (J) is commodity that has the lowest revenue levels for only reach Rp. 10.129.008 per hectare.
On the second section of LP analysis, presented the result of calculation of the first constraint function coefficient (KI), which is the lack of extensive land ownership. Coefficient b_{1s} (s = 1,2,3,4) is coefficient that link between land use utility(land area X_s in unit of Ha) with the availability of land. The average of the land use in this study is 1,324 Ha per farmer. Therefore, constraint function 1 as follows
K1 : $X_1 + X_2 + X_3 + X_4 \leq 1{,}324$

On the third section of LP analysis, presented the result of calculation of the second constraint function coefficient (K2) which is lack of labor from within family (TKDK). Coefficient b_{2s} (s = 1,2,3,4) is coefficient that link between the limitation of TKDK that available with optimal cultivated land (land area X_s in unit of Ha), therefore coefficient b_{2s} in the unit (person/HA), so coefficient c_2 which is TKDK that available in unit (person).

Tabel 4 Coefficient of Constraint Function 2

Commodities	Average of TKDK use (Persons)	Average of Land Use (Ha)	Average of TKDK use Per Hectare (Persons/Ha)
Corn	3,343	0,330	12,473
Rice	7,895	0,507	19,267
Soybean	3,029	0,190	15,092
Red Onion	17,457	0,297	115,493

Source: Data Processed in 2015

Average TKDK is 79,21 persons/ha, therefore coefficient c_2 which is TKDK that available in unit (person), TKDK that available in unit (person) is 79,21 persons/ha x 1,3238 ha = 94 persons.
Therefore the constraint function 2 as follows:
K2 : $12{,}473X_1 + 19{,}267X_2 + 15{,}092X_3 + 115{,}493X_4 \leq 94$
The meaning of coefficient above shows that on the red onion business (BM) requires the most TKDK which is almost 116 persons for one hectare of red onion cultivation (BM). On the other side,for corn commodity (J) requires lowest TKDK which is only 12 persons per hectare.
On the fourth section of LP analysis, presented the result of calculation of the third constraint function coefficient (K3) which is lack of labor from outside of family (TKLK). Coefficient b_{3s} (s = 1,2,3,4) is coefficient that link between TKLK limitation that available with with optimal cultivated land(land area X_s in unit of Ha), therefore coefficient b_{3s} in unit (person/ha) so coefficient c_3 which is TKLK that available in unit (person).

Table 5 Coefficient of Constraint Function 3

Commodities	Average of TKLK Use (Person)	Average of Land Use (Ha)	Average of TKLK Use Per Hectare(Person/Ha)
Corn	22,162	0,330	70,540
Rice	52,010	0,507	108,714
Soybean	9,229	0,190	45,687
Red Onion	52,400	0,297	275,397

Source: Data Processed in 2015

Average TKLK is 279.08 persons/ha, therefore the coefficient c_3 is TKLK available in unit (person), TKLK that available in unit (person) are 279.08 persons / ha x 1.3238 ha = 200 persons.
Therefore the constraint function 3 as follows:
K3 : $70{,}540X_1 + 108{,}714X_2 + 45{,}687X_3 + 275{,}397X_4 \leq 200$
The meaning of the coefficient above shows that red onion business (BM) requires the highest TKLK which are 275 persons for one hectare of red onion cultivation (BM). On the other side, for soybean commodity (K) requires lowest TKLK for only 46 persons per hectare.

In the fifth part of LP analysis, presented the results of calculation of the fourth constraint function coefficient (K4) which is lack of adequate capital. Coefficient b_{4s} (s = 1,2,3,4) are coefficients that link the lack of adequate capital that available to the optimal cultivated land (land area X_s in units of Ha), thereby coefficient b_{4s} in units (Rp /year / ha) so that the coefficient c_4 is capital that available in units (Rp/year).

Table 6. Coefficient of Constraints Function 4

Commodities	Average of Available Capital (Person)	Average of Land Use (Ha)	Average of Available Capital Per Hectare (Person/Ha)
Corn	5.220.762	0,330	9.721.328
Rice	9.428.341	0,507	18.596.332
Soybean	2.761.802	0,190	13.923.577
Red Onion	12.027.920	0,297	40.498.047

Source: Data Processed in 2015

The average capital is 45,235,363 Rp / year / ha, thus the coefficient c_4 is available capital in units (Rp / year), the available capital in units (Rp /year) is 45,235,363 persons / ha x 1, 3238 ha = 29,125,704.
Therefore the constraint function 4 as follows:
K4 : $9.721.328X_1 + 18.596.332X_2 + 13.923.577X_3 + 40.498.047X_4 \leq 29.125.704$
The meaning of the coefficient above shows that red onion requires the highest capital in the amount of Rp. 40,498,047 per year for one hectare of red onion. On the other hand, corn commodity has the lowest capital among other commodities, Rp. 9,721,328 per year for one hectare of corn cultivation.
In the next section stipulates that agricultural land for rice is the main, and at least 60% of agricultural land in Nganjuk is planted with rice, therefore the fifth and sixth constraints are as follows:
K5 : $X_2 \geq 0,794$ Ha (60% x 1,324 Ha)
K6 : $X_1 + X_3 + X_4 \leq 0,530$ Ha (40% x 1,324 Ha)
<u>Objective Function.</u>
Maks **Z** = $14.567.030\ X_1 + 26.223.686\ X_2 + 10.129.008\ X_3 + 34.074.000\ X_4$
<u>With Constraint:</u>
K1 : $X_1 + X_2 + X_3 + X_4 \leq 1,324$
K2 : $12,473X_1 + 19,267X_2 + 15,092X_3 + 115,493X_4 \leq 94$
K3 : $70,540X_1 + 108,714X_2 + 45,687X_3 + 275,397X_4 \leq 200$
K4 : $9.721.328X_1 + 18.596.332X_2 + 13.923.577X_3 + 40.498.047X_4 \leq 29.125.704$
K5 : $X_2 \geq 0,794$ Ha (60% x 1,324 Ha)
K6 : $X_1 + X_3 + X_4 \leq 0,530$ Ha (40% x 1,324 Ha)
Nonnegatif $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0$

$\mathbf{X_1}$: optimized corn acreage (ha)
$\mathbf{X_2}$: optimized rice acreage (ha)
$\mathbf{X_3}$: optimized soybean acreage (ha)
$\mathbf{X_4}$: optimized red onion acreage (ha)

The analysis results using WinQSB software presented as follows:

Table 7. First Optimization Product with the Objective Function and Assigned Constraints

Function	Symbol	Solution	Unit
Decision	Corn (X_1)	0,2469	Ha
	Rice (X_2)	0,7940	Ha
	Soybean (X_3)	0	Ha
	Red Onion (X_4)	0,2831	Ha
Objective	Revenue (Z)	49.802.320	Rp/year
Constraints	Land (K1)	1,324	Ha
	TKDK (K2)	51,078	Persons
	TKLK (K3)	181,708	Persons
	Capital (K4)	29.125.700	Rp/year

Source: Data Processed in 2015

Optimization of the initial stage is to consider the objective function and constraints specified in the previous section, the maximum revenue obtained by Corn cultivation 0.2469, Rice cultivation 0.7940 Ha, as well as Red Onion Cultivation 0,2831 Ha of 1,324 Ha that available. The optimization resulted in total revenue (corn,rice and red onion) in the amount of Rp. 49.802.320. Further optimization analysis considering the combination of the commodities. There are as many as 16 combinations tested as follows: (1) Corn commodity only (J), (2) Rice commodity only (PS), (3) Soybean commodity only (K), (4) Red Onion commodity only (BM), (5) The combination of Corn-Rice commodities (J-PS), (6) The combination of Corn-Soybean commodities (JK), (7) The combination of corn-Red Onion commodities (J-BM), (8) The combination of Rice-Soybean commodities (PS-K), (9) The combination of Rice-Red Onion commodities (PS-BM), (10) The combination of Soybean-Red Onion commodities (K-BM), (11) The combination of Corn-Rice-Soybean commodities (J-PS-K), (12) The combination of Corn-Rice-Red Onion commodities (J-PS-BM), (13) The combination of Corn-Soybean-Red Onion commodities (J-K-BM), (14) The combination of Rice-Soybean- Red Onion commodities (PS-K-BM), and (15) The combination of Corn-Rice-Soybean-Red Onion commodities (J-PS-K-BM). The result of the combination shown in Table 8 as follows:

Table 8. Optimization Product of Each Combination

Num.	Combination	Corn (J)	Rice (PS)	Soybean (K)	Red Onion (BM)	Revenue (Z)
1	J	1,3240	-	-	-	44.747.130
2	PS	-	1,3240	-	-	47.950.160
3	K	-	-	1,3240	-	42.530.010
4	BM	-	-	-	1,3240	44.174.133
5	J-PS	0,1000	1,2240	-	-	47.794.500
6	J-K	1,2240	-	0,1000	-	44.174.130
7	J-BM	0,8512	-	-	0,4728	49.309.330
8	PS-K	-	1,2240	0,1000	-	47.550.690
9	PS-BM	-	1,1183	-	0,2057	49.595.200
10	K-BM	-	-	0,9217	0,4023	47.384.550
11	J-PS-K	0,1000	1,1240	0,1000	0,1000	47.395.030
12	J-PS-BM	0,2469	0,7940	-	0,2831	49.802.320
13	J-K-BM	0,7588	-	0,1000	0,4652	48.992.000
14	PS-K-BM	-	0,9970	0,1000	0,2270	49.355.350
15	J-PS-K-BM	0,1545	0,7940	0,1000	0,2755	49.484.980

Source: Data Processed in 2015

From the combination products above shows the exact same results with initial optimization, which only considers corn (J), rice (PS) and red onion (BM). The initial solution are the cultivation of combination corn 0.2469, rice 0.7940 Ha, and Red Onion 0,2831 Ha of 1,324 Ha available. The optimization resulted in total revenue (corn, rice and red onion) in the amount of Rp. 49.802.320 years for the cultivation of 1,324 hectares. If each village revenue specified consider agricultural area (Table 5.1), so the total revenue of each village and the whole 6 study villages as follows:

Table 9. Calculation of Total Revenue

Num	Village	Land Area (Ha)	Land Area of Each Commodity (Ha)			Revenue (Rp/Year)
			Corn	Rice	Red Onion	
1	Gondang Kulon	114,89	21.42	68.90	24.57	4.321.564.789
2	Pandean	197,02	36.74	118.15	42.13	7.410.868.610
3	Campur	313,95	58.55	188.28	67.13	11.809.167.598
4	Senggowar	56,82	10.60	34.07	12.15	2.137.273.142
5	Sumberejo	273,50	51.00	164.02	58.48	10.287.648.792
6	Balonggebang	575,47	107.31	345.11	123.05	21.646.191.042
	Total	1531,65	285.62	918.53	327.50	57.612.713.973

From the 6 villages which made for object of this study, the total area is 1531.65 Ha, and the optimization recommendation products are to plant 285.62 Ha for Corn commodity, 918.53 Ha for Rice commodity, and 327.50 Ha for Red Onions commodity. Thus the total agricultural revenue in the six villages in the amount of Rp 57.6 billion per year. If translated by each commodity, the revenue of corn commodity (285.62 Ha) in the mount of Rp 6.08 billion per year; the revenue of rice commodity (918.53 Ha) in the amount of Rp 20.82 billion per year; the revenue of red onion commodity (327.50 Ha) in the amount of Rp 16.32 billion per year. On the whole Gondang sub district (17 villages), the total land area is 3578.66 Ha. Therefore the total agricultural revenue in the whole Sub-District of Gondang is Rp 110.9 billion per year.

V. Discussion Of Optimization Analysis Results

The third objective of this study is to analyze the optimization of the superior commodity in Nganjuk Regency, with Optimization Techniques analysis tools with *Linear Programming* approach.The product of the optimization analysis in previous chapters provide recommendations in accordance with the following picture:

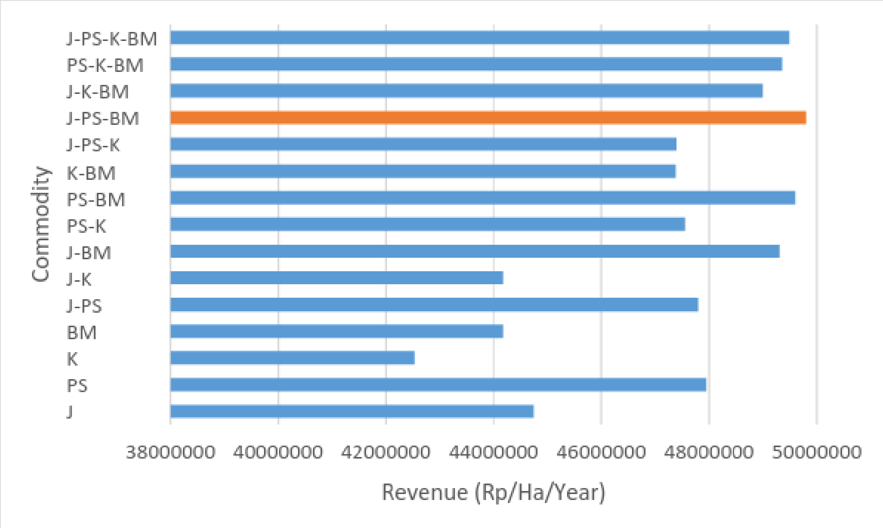

Figure 1. Optimization Analysis Results

The results show that the solution which is combination of total area cultivation is 1531.65 Ha, and the optimization recommendation is to plant 285.62 Ha for corn commodity, 918.53 Ha for Rice commodity, and 327.50 Ha for Red Onion commodity, Therefore the total agricultural revenue in the six villages is Rp 57.6 billion per year. If translated each commodity, the corn revenue (285.62 Ha) in the amount of Rp 6.08 billion per year; rice commodity revenue (918.53 ha) in the amount of Rp 20.82 billion per year; red onion commodity revenue (327.50 Ha) in the amount of Rp 16.32 billion per year. On the whole Gondang sub district (17 villages), the total land area is 3578.66 Ha. Therefore the total agricultural revenue in the whole Gondang Sub-District is Rp 110.9 billion per year. Optimal results above show that the allotment of the land for rice commodity is higher than for red onion and corn, given the results of the optimization based on constraint of the land use.In the theory of sustainable development (Marten, 1998; and Yanto, J, 2008) there are four important aspects, namely productivity, stability, sustainability, and equity. Optimization results above accentuate the aspect of productivity,consider aspects of land allocation for more superior commodities in terms of productivity, considering that in this study the objective of optimization is to gain maximum income, from various constraints such as land area ownership, capital, and labor. This study found the productivity of an agro-ecosystem (sustainable agriculture) involving two leading commodities which are rice paddy and red onion. If the productivity of the agricultural product is high then should the necessities of life for humans will be fulfilled, and sustainable farming conditions deserved to be pursued and obtain high productivity. Therefore it is recommended to accommodate the two commodities, which are rice and red onion as the superior commodity in Nganjuk.The optimization results are also considering the fourth aspect that is equitability. Equitability aspect used to describe of agricultural products enjoyed by all levels of society. By optimizing the two major commodities as a weapon to raise agricultural productivity in Nganjuk Regency, expected equitability or high social equity will be occur considering the population attain enough earnings, food, and others and equally from existing resources.

Commodities of corn, rice and red onion, are the best commodities eligible to do in Nganjuk Regency farm. No one seems, corn, rice and red onion become the excellent, because 60% of farmers in Nganjuk Regency, especially in 6 villages in Gondang Sub-District seek rice to be planted, and 21.4% work on red onion to be planted, as well as 18, 6% work on corn to be planted.The pattern of planting corn, rice and red onion in accordance with the conditions of the natural resources. Rice and corn are the main commodities then followed by red onion commodity. But the red onion product is higher than rice for the irrigation flow is more widely used for red onion. Rice and corn are the superior commodities because of the treatment is not too hard and durable to be stored while the red onion with regard to the price, higher the price the higher the capital required. With the food self-sufficiency the rice farmers will plant which initially only double planting will be three times planting with the records of water discharge is sufficient.

Interesting facts from the optimization results that soybean is not recommended to be planted, considering various factors such as land availability constraints, availability of labor (both outside and within the family), and the availability of capital. These results are quite unique, especially for soybeans commodity, which have been known for a long time, this commodity is famous through cooperation with Unilever. If it is associated with the objective results 1, role of government is required, the role of cooperation and the role of the community itself in order to increase the revenue of superior commodities such as rice and red onion.These three roles over significant effect in increasing rice and red onion revenue. Better the role of government, would lead to better revenue for farmers of rice and red onion superior commodities. Therefore the policy to be formulated and implemented by government is necessary which are 1) increase the food stability program, especially for rice and red onion commodities, 2) keep the harvest price from the hands of middlemen, especially for rice and red onion commodities, 3) take the production directly from farmers, especially for rice and red onion commodities, 4) the need for right price subsidy mechanism of rice and red onion commodities, and 5) control and supervision for rice and red onion price at the farmers level.

VI. Conclusion

The optimal condition which is maximum of the farmer's total revenue obtained by corn combination cultivation 0.2469 Ha, Rice 0.7940 Ha, and Red Onion 0.2831 Ha from 1,324 Ha that available, with the amount of revenue is around Rp 49.802 .000 per year per hectare. From 6 villages which are made for the object of this study, the total wetland area is 1531.65 Ha, and the optimization recommendation product is to plant 285.62 Ha for corn commodity, 918.53 Ha for Rice commodity, and 327.50 Ha for Red Onion commodity. Therefore the total agricultural revenue in the six villages is Rp 57.6 billion per year. If translated by each commodity, the corn commodity revenue (285.62 Ha) in the amount of Rp 6.08 billion per year;the rice commodity revenue (918.53 ha) in the amount of Rp 20.82 billion per year; the red onion commodity revenue (327.50 Ha) in the amount of Rp 16.32 billion per year. On the whole Gondang Sub-District (17 villages), the total of wetland area is 3578.66 Ha. Therefore the total agricultural revenue in the whole of Gondang Sub-District is Rp 110.9 billion per year. The analysis results show that the role of 'community is very influential against the increase of farmer's income, but there are some undervaluing or low rating. Therefore, to increases the agricultural product it requires improvement primarily such as, 1) the need for land suitability improvement that supportthe business, 2) the sufficient labor outside the family that adequate, 3) availability of labor within the family, and 4) Need to increase the availability of fertilizers and pesticides.

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