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Optimization of the Integrated Farming Resources to Increase Farmer's Income: A Case Study in Indonesia

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ABSTRACT

Purpose: Farmers of beef cattle in the Regency of Bolaang Mongondow Utara often dealt with fluctuations in the production cost of crops and cattle and restrictions of production factors, resulting in relatively lower production and the obtained income from farming. Consequently, farmers conducted six integration patterns of crops and beef cattle in the dried area. The evaluation was necessarily performed to know which farming pattern was the integrated farming pattern and cattle that can result in a maximal income for farmers.

Research Method: The research was conducted in two Villages, such as Sidodadi and Sangtumbolang, District of Sangkub, Regency of Bolaang Mongondow Utara, which is the largest dried area in the Regency of Bolaang Mongondow Utara; and, farmers performed the integrated farming of crops and cattle. 80 farmers were selected by purposive sampling to obtain the required information for this research. Then, data analysis employed a linear programming model with the assisting tools of LINDO software.

Findings: Of six activities in the integrated farming, 3 activities of annual cultivation resulting in maximal income of Rp 57,186,127.44 were corn-corn-corn + (and cattle), onion-onion-onion + (and cattle), corn-soybean-the uncultivated field + (and cattle). The cultivation pattern of corn-corn-corn + (and cattle) was proposedly applied in the area of 0,638 hectares; for the cultivation pattern of onion-onion-onion + (and cattle), it was suggested to be applied in the area of 0,439 hectares; and, the cultivation patter of corn-soybean-the uncultivated is + (and cattle) was applied in the area of 0,296 hectares.

Research Limitations: The research was limited to the integrated pattern of corn and horticulture and beef cattle in the dried field.

Originality/value: The research has provided new information on the development standard of the integrated farming of crops and cattle in the dried area as a solution to lower agriculture productivity resulting in lower income for farmers.

Keywords: *Income, Integrated farming, Optimization of resources*

INTRODUCTION

According to economic vulnerability, Indonesia is in a highly vulnerable status. The agriculture sector has contributed to mitigating the negative impacts of each crisis (Septiadi and Nursan, 2020). It includes some of, the economic crises due to the Covid-19 Pandemic. The interesting fact to prove this condition is that the agriculture sector has become a vital sector in formulating Indonesian gross domestic products (Septiadi and Joka, 2019). The contribution to the national

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economy is sufficiently high. In 2019, the contribution of the agriculture sector to Gross Domestic Products (GDB) was 13.14 percent (Central Bureau of Statistics, 2018). This value has positioned the agriculture sector as the second largest contributing sector after the industrial sector. It means that the agriculture sector has a high urgency extent to be developed in accelerating regional development (Khairiyakh *et al.,* 2015; Khurniyah *et al.*, 2019). Also, the agriculture sector, particularly the sub-sector of food crops, has provided a significant contribution to societal food and nutrition resilience (Arham *et al.*, 2020). Hence, this finding demonstrates that the agriculture sector of food crops becomes a strategic sub-sector in maintaining national food security.

However, some issues become inhibiting factors in the agriculture sector, such as lower productivity levels and external obstructions comprising the unpredictable market and climate conditions by farmers (Bustos *et al.,* 2016). A lower productivity level in agriculture has directly impacted the lower income of farmers. The implication of this issue is the decreasing welfare of farmers. Consequently, well-planning and strategic measures are necessarily required in an attempt to improve the production of the agriculture sector.

In the context of Indonesia, the Regency of Bolaang Mongondow Utara is one of the Regencies having the widest administrative territory and agriculture area of all Regencies/ Cities in the Province of North Sulawesi. Then, the Regency of Bolaang Mongondow Utara is a strategic region in the developing agriculture sector. Nonetheless, the Regency of Bolaang Mongondow Utara has a widely dried area that has not been well-utilized by farmers. Typically, farmers more frequently utilize rice fields for their farming than cultivating the dried area. The dried field, evidently, has better potency to develop farming in the Regency of Bolaang Mongondow Utara. Hence, the utilization of the dried field must become a priority by considering the trend of agricultural land conversion (rice field) into residence or other (non-agriculture) use. The activity of agricultural land conversion causes fewer agricultural areas as farming sites, so the utilization of the dried land is necessarily performed as the development area of the agriculture sector in the Regency of Bolaang Mongondow Utara.

Besides the use of the agriculture sector, the dried field is also suitable for the sub-sector of agriculture. The sub-sector of agriculture is highly important to develop since it is the main living of society in the dried field, besides the producer of foods and meat (Lubis *et al.,* 2020). Also, the dried field is suitable for green crops for cattle feeds. The waste of agriculture harvests can be utilized as alternative cattle feed, such as cows, so none of the agriculture waste is disposed of (Sampat *et al.,* 2018). The superiority of this sub-sector of agriculture has a strategic position in the integrated agriculture system (Lubis*, et al.,* 2020). Similarly, it is supported by Mir *et al.* (2022) and Munandar *et al.* (2015) arguing that the main results of cattle are not only meat and milk but also a waste of cattle can be side-products, such as solid and liquid feces that can be processed into the source of organic and biogas fertilizer. It, then, shows that the agriculture process by integrating plant cultivation and cattle husbandry can reduce the production cost in agriculture activities.

Integrated farming is farming integrating a sub-sector of agriculture and other sub-sectors, such as husbandry. The concept of cattle integration in farming cultivates a few cattle, without reducing plant activity and productivity. Furthermore, the existence of cattle must improve both its food crops and cattle production. It is in line with Ezeaku *et al.* (2015) stating that cattle activity combined with agriculture fields can be mutually adjustable with food crops. This means that the existence of cattle is not a competitor of crops in the same field. Farming is the main component, and cattle is the second component. The integration of food crops and cattle is aimed to result in mutualism synergism and, eventually, assist in reducing production costs (Mukhlis *et al.*, 2018).

Some examples of efficiency are reducing fertilizer purchase due to materials of fertilizer are derived from the feces of cattle that can be processed into organic fertilizer. Then, it is given to food crops as fertilizer. The utilization of cattle waste as production input for food crops shows that the concept of integrated farming has a holistic view of the utilization of the production input. This system minimizes the use of external input from the agriculture sector, boosts the existing resources in the agriculture sector, and prioritizes environmentally friendly sustainable agriculture processes (Phong *et al.,* 2007; Lindawati *et al.*, 2018). It is by Victor *et al.* (2018), describe that the integration of food crops and cattle improves business diversification of cattle's feces, increases the value-added of food crops and their derivative products, has sustainable production potency and is environmentally friendly. Moreover, integrated farming becomes the alternative solution to constraints due to restrictions on production factors, higher input costs, and environmental pollution (Ugwumba, 2010). Therefore, the production model of this integrated farming can be implemented in creating the optimal production model to achieve maximal income. Some results of the research regarding the integrated farming pattern show a positive impact on income level and farmers' welfare (Victor *et al.*, 2018; Miccoli *et al.,* 2016; Mukhlis *et al.*, 2019; Manjunatha *et al.,* 2014; Dash *et al.*, 2015; Ponnusamy and Devi, 2017). This finding depicts that the integration pattern of food crops and cattle provides the best impact on improving agricultural production and farmers' welfare. In the same vein, this is in line with Islam *et al.* (2020) postulating that the integration of various crops and cattle industries in certain farming is an attempt to improve the total income of farmers. However, various types of research have not provided information on the optimization of the existing resources in the integration of food crops and cattle and maximal income from the integration pattern of food crops and cattle in the dried field.

Farmers in the Regency of Bolaang Mongondow Utara raise cattle in pens located on their land and provide feed from crop waste they own and forage grass planted as animal feed. Cattle's manure is used as energy in the form of biogas for households and fertilizer for food crops such as corn, onions, tomatoes, soybeans and rice. Breeders still use labor from within their family to manage their farming business

Based on the results of field observation, there were 6 types of integration patterns of food crops and cattle employed by farmers in the Regency of Bolaang Mongondow Utara. Of the six types of integration modes, the best integration model of food crops and cattle that can result in maximal income and the use of optimal production factors has not been known yet. Later, the researcher is interested in deeply observing the efficient utilization of the existing resources in the integration model of food crops and cattle in the Regency of Bolaang Mongondow Utara

According to the description above, the purpose of this research is to analyze the maximal income derived from the integration model of food crops and cattle in the Regency of Bolaang Mongondow Utara.

MATERIALS AND METHODS

The Site, Sample, and Data Collecting Technique

The research was conducted in the Regency of Bolaang Mongondow Utara. It was in the District of Sangkub, determined by purposive sampling. This area was selected considering that the area has the widest dried field in the Regency of Bolaang Mongondow Utara. Administratively, the Regency of Bolaang Mongondow Utara is also the widest area in the Province of North Sulawesi.

The population used in the research was all farmers performing the integrated farming of food crops and cattle in the District of Sangkub, the Regency of Bolaang Mongondow Utara. From villages existing in the District of Sangkub, two villages were selected as sampling

villages, such as Sidodadi and Sangtumbolang, by purposive sampling. It considered that those villages had wider dried fields than other villages and many farmers had performed the integrated farming of food crops and cattle. In every village, 40 respondents that had performed the integrated farming were respectively selected by purposive sampling, so the total of samples was 80 farmers.

The data collecting technique in this research was conducted in January-February 2022. The sources of data used in the research were primary data, derived from an in-depth interview with respondents using the designated list of questions. The research was analyzed by a quantitative approach with an analysis of production optimization based on a linear programming model, and formulated as follows:

Construct Variables of Objective Function

Construct variables of objective function where net income resulted from deduction of production values or gross income with a total income of farming in a year activity as formulated below:

$$Pbi = Pki - Tpi \qquad\qquad 1$$

$$Qi = Pq.Qi - Hx.Xi - Fci \qquad\qquad 2$$

Where:

Pbi = net-farm income for respective activity (Ci) (IDR/year)

Pki = gross-farm income for respective activity (IDR/year)

Tpi = Total farm expenses (IDR/year)

Qi = Total production (unit/year)

Xi = Production input (unit/year)

Pq = Output price per unit (IDR/unit)

Hx = Input price per unit (IDR/unit)

Fci = Fixed cost (IDR/year)

Construct Variables of Constrains Function

n analyzing the optimal use of the agriculture resources, construct variables of constraints factor (bi) were as follows:

a. The available area every planting season in conducting the farming activity and managed cattle by farmers (symbolized by b1).

b. The available total workers (TK) in the first (1) planting season (MT1) (symbolized by b2).

c. The available total workers (TK) in the second (2) planting season (symbolized by b3).

d. The available total workers (TK) in the third (3) planting season (symbolized by b4).

e. The available total seeds in every planting season as determined based on the average use per hectare in every planting season multiplied by the available area (symbolized by b5 - b10).

f. The available cattle industry in every planting season (symbolized by b11).

g. The available total fertilizers of Urea, NPK, KCL, TSP, and organic in every planting season. The total was determined based on the average use per hectare in the planting season with the available area in the dried field (symbolized by b12 - b15).

h. The available total feeds in every planting season (symbolized by b16).

Data Analysis

Data were analyzed by a quantitative approach using a linear programming (LP) model using LINDO software. The management of purposes function in the LP model was a means of maximizing income with the formulated equation as follows (Minh *et al.*, 2007):

$$Z \text{ maximal} = C1X1 + C2X2 + C3X3 + ... + C_{21}X_{21} \quad 3$$

Where:

Z = Maximal income (The optimized value)

C_1-C_{21} = Parameter turned as optimization criteria, such as net income in each activity (the 1st-21st net income activity)

X_1-X_{21} = Variable of decision-making or the desired activity (the 1st-21st)

The coefficient of the objective function is the value that represents the contribution per unit to Z for each xj and is denoted by cj. Therefore, the problem of linear programming can be solved by maximizing or minimizing the linear function of the decision variables which is called the objective function.

RESULTS AND DISCUSSION

The Integrated Farming in the District of Sangkub, the Regency of Bolaang Mongondow Utara

In performing the integrated farming of food crops and cattle, farmers in the research site employed the available and affordable resources. There were some alternatives to the integrated farming pattern performed by farmers. Typically, some activities performed by farmers are the following activities of food crops and cattle, as follows:

1. corn-corn-corn + (and cattle),
2. onion-onion-onion + (and cattle),
3. corn-onion-the uncultivated field + (and cattle),
4. corn-tomato-the uncultivated field + (and cattle),

5. corn-soybean-the uncultivated field + (and cattle),
6. soybean-the uncultivated field-the uncultivated field + (and cattle).

To select the best alternative among alternatives, the Linear Programming (LP) model was used. Meanwhile, to know the optimization of agriculture resources via the integration of food crops and cattle that could maximize farmers' income in the dried field, the analysis of the Linear Programming (LP) used the simplex method. The Linear Programming (LP) model was able to combine and explore various possibilities of agriculture production in improving agriculture income by using the optimal resources. To simplify the analysis, the following formulation of purposes and constraints function from the optimization program of agriculture resources is presented.

Purpose Function:

The purpose function derived from the analysis results of the linear programming, using the simplex method to maximize farmers' income, is as follows:

$$\text{Max. Z} = 34{,}441{,}167X1 + 36{,}027{,}812X_2 + 6{,}746{,}417X_3 + 7{,}439{,}543X4 + 13{,}521{,}000X5 + 4{,}758{,}250X6$$

Where:

X1-X6 = Variable of decision-making or the 1st-6th activity, such as:

X1 = corn-corn-corn + (and cattle),

X_2 = onion-onion-onion + (and cattle),

X_3 = corn-onion-the uncultivated field + (and cattle),

X_4 = corn-tomato-the uncultivated field + (and cattle),

X_5 = corn-soybean-the uncultivated field + (and cattle),

X_6 = soybean-the uncultivated field-the uncultivated field + (and cattle).

Note: The uncultivated field = a season when a field is uncivilized in one planting season

The optimization analysis of agriculture resources via the integration of food crops and cattle comprised primal and dual issues. The total input activities in the purpose function were 6 (six) activities (the integrated farming pattern). The activity coefficient of the purpose function was the income of each activity, which was the net income obtained in each planting pattern. The activity unit of planting pattern in the purpose function was hectare, and the optimal solution of total units from various farming patterns was searched.

From 6 (six) activities, the coefficient value of the highest activity was the activity of X_2 (onion-onion-onion + (and cattle), and the following was the activity of X_1 (corn-corn-corn + (and cattle) and X_5 (corn-soybean-the uncultivated field + (and cattle). The coefficient value of the lowest activity was the activity of X_6 (the uncultivated field-the uncultivated field + (and cattle). The coefficient value of the highest activity did not show the suggested activity to be developed due to it was related to the availability of the existing agricultural resources.

Constrains Function:

The constraint function included the input-output coefficient and the available resources (value on the right side). Resources including constraints were area, capital, production infrastructures (seeds and fertilizer), workers, and feeding. Meanwhile, the input-output coefficient and value on the right side of agriculture resources can be seen in the matrix model of Line Programming. Followingly, the coefficient value of the purpose function and input-output coefficient of resources was arranged in the adjustment model of Linear Programming and it was more simply written in the form of the input-output matrix of Linear Programming. The analysis results of the optimization of agriculture resources by the integration of food crops and cattle in the dried field located in both villages of Sidodadi and Sangtumbolang in the District of Sangkub were explained sequentially, including the primal and dual issues and the utilization of the optimal agriculture resources in various planting patterns.

Primal Solving in the Optimization Analysis of the Integrated Farming

Based on the analysis results of the Linear Programming in the primal solving, the information was obtained that from 6 activities of the integrated farming pattern, 3 activities of the planting pattern resulted in the maximal income from the existing agriculture resources. The results were supported by the research conducted by Wati *et al.,* (2018) stating that the Cattle-Rice Integration System (SIPT) in the Regency of Serdang Bedagai has a significant impact on maximizing farmers' income. The findings show the difference in output between income per hectare for farmers applying the cattle-rice integration system and the income of farmers not applying the cattle-rice integration system.

The analysis results with the Linear Programming (LP) model were that three activities of the planting model were the suggested planting model since it could maximize farmers' income in the dried field located in both villages of Sidodadi and Sangtumbolang in the District of Sangkub by IDR. 52,436,235.41/year. This finding was in line with the previous research stating that the implementation of the integrated farming system is optimally performed, where farmers receive maximal income in the optimal situation (Sahoo *et al.,* 2020; Indrayani and Hellyward, 2015)

The optimization analysis of agriculture resources in various integrated farming activities under the primal analysis is presented in Table 01.

Table 01: **Analysis results of the primal issues solving.**

Number	Activity	Value (Ha)	Reduced Cost (IDR)
1	X_1	0.638	0.000
2	X_2	0.439	0.000
3	X_3	0.000	7,124,212.87
4	X_4	0.000	1,347,705.71
5	X_5	0.296	0.000
6	X_6	0.000	18,235,574

Where:

X1 = Farming activity of corn-corn-corn + (and cattle),

X2 = Farming activity of onion-onion-onion + (and cattle),

X3 = corn-chili-the uncultivated field + (and cattle),

X4 = corn-tomato-the uncultivated field + (and cattle),

X5 = corn-soybean-the uncultivated field + (and cattle),

X6 = soybean-the uncultivated field-the uncultivated field + (and cattle).

Based on Table 01, the selected planting activity in the optimal solution under the primal solving was the planting model of X1, X2, and X5. It was marked with activity having a reduced cost value by zero. The analysis of the reduced cost displays information stating that the number of activities excluded in the optimal planning (maximal income), could affect the value of the purpose function as much as the value of the reduced cost (Phillip *et al.,* 2019; Parulian *et al*., 2019).

In Table 01, the value of the reduced cost for activity including in the base of (X1, X2, and X5) was zero. It means that the scale of activity development from three activities had provided maximal income, and it was non-profitable if there was an additional development scale. In short, the addition of one unit of activity would result in the negative value of the reduced cost, so there was a decline in the optimal program as much as its reduced cost value. Also, it indicates that the concept of the integrated farming of food crops and cattle had risk potency. It was in line with previous research by Corrêa *et al*. (2018), stating that some underlying risks in the integrated farming system are production, business, financial, and damage (Corrêa *et al*., 2018) Based on Table 01, the largest value of the reduced cost was the farming activity of soybean-the uncultivated-the uncultivated + and cattle (X_6). It

was due to the existing uncultivated area system for two planting seasons, so this farming system was ineffective in achieving optimal production. It means that if the integrated farming system of soybean-the uncultivated area-the uncultivated area + and cattle (X_6) was forcefully applied, the purpose function (maximal income) would decrease by IDR. 18,235,574. The results were in accordance with the research performed by Djafri *et al.* (2016), explaining that the reduced cost with the positive value in the planting activity of peas. Adding the production area of peas by one m^2 from the optimal area will reduce profitability by IDR 25,781.

According to the analysis of the primal solving in Table 01, the amount of the suggested activity pattern, such as the planting model of corn-corn-corn + (and cattle (X1)), had a value of 0.638 It means that the planting model of corn-corn-corn + (and cattle (X1)) was expectedly applied in the area of 0.638 hectares. In this area breeders can accommodate 0.975 animal units of cattle. This postulates that the value concept in the description of Table 01 correlated to the optimal land utilization in every activity variable of the integrated planting pattern. The following example was the planting model of onion-onion-onion + (and cattle (X2)) had a value of 0.439. It defines that the planting model of onion-

onion-onion + (and cattle (X2)) was proposed and applied in an area of 0.439 hectares. In this area breeders can raise as many as 0.782 animal units of cattle. For the planting model of corn-soybean-the uncultivated area + (and cattle), the value was 0.296, describing that this planting model was recommended to be applied in an area of 0.296 hectares. This area can be raised as many as 0.584 animal units by breeders. Therefore the optimal number of cattle that can be raised in the three areas of the recommended farming pattern is 2.341 animal units

Meanwhile, other activities having a value equal to zero provided information that such activities were not selected in achieving the optimal solution (maximal income) and it was recommended for non-further development.

Dual Solving in the Optimization Analysis of the Integrated Farming

Besides the primal problem-solving referring to the optimal solution of the planting pattern, the significant information obtained from the analysis results of the optimization was the evaluation of the utilization of agriculture resources depicted in the dual problem-solving. The dual problem-solving provided information on the used resources (constraint), the residual resources, and the dual values of resources as presented in Table 02.

Based on the analysis result of the optimization of agriculture resources in various planting models for the dual solving (Table 02), the used-up resources in the optimal solution could be seen from the slack value by zero. It happened in workers at MT 1 (C2), capital (C21), and fertilizer use (C19). The available resources were equal to the utilization value of the optimal solution, so none of the rest of the resource utilization was available. Thus, resources had been used optimally without residual. It proves that the slack value was equal to zero. While the utilization of other resources was available, where such resources were not completely used

in the optimal solution, such as corn seeds at MT 1 (C5) having the rest of 41.20 kg, corn seeds at MT 2 (C6) having the rest of 42.34 kg, and so forth. It was for other resources having not been used optimally and efficiently.

This situation was shown by the slack value greater than zero. The dual value was shadow price, stated in the theory of marginal value production that every addition of the resource utilization by one unit of activity will add the value of the optimal solution as much as its dual value. From the results of the dual problem-solving (Table 02), resources having a positive dual value (greater than zero) were a worker at MT 1 (C2) by 12,410,082, Urea fertilizer (C19) by 38,316.202, and capital (C21) by 0.751. Further, the dual value of area (C2) by 12,410.082 states that every addition of areal resources (other resources were fixed) would improve the optimal solution (income) by IDR. 12,410.082. Also, for resources of fertilizer (C19) and capital (C21), it means that the addition of such resources by one unit (other resources were fixed) would improve the optimal solution (income) by IDR 39,414.103 and IDR 0.751

Resources having marginal value production (shadow price) were equal to zero. If there was an addition of utilization in the optimal solution, it would not provide result improvement (income) due to the available resources were not completely used. Therefore, the addition of resources having marginal value product (shadow price) and equal to zero would be wasteful and cause losses for farmers due to costs arising from resources purchasing.

Based on the analysis results, the elimination of the limited resources situation was necessarily considered. It could be performed by substituting the rest of the resources for the use of agricultural resources, such as the optimal solution. Therefore, the separated analysis was performed where the solving of optimization issues with the Linear Programming (LP) model was known as the sensitivity analysis or the sensitivity of the plan or the stability of the plan.

Table 02: **Analysis results of the dual issues solving.**

Resources	Slack (excess of resources)	Shadow price (Marginal product value)
C1 (Area)	489.05M^2	0.000
C2 (TK MT 1)	0.00kg	IDR.12,410.082
C3 (TK MT2)	12.59 Man days	0.000
C4 (TK MT3)	22.28 Man days	0.000
C5 (Corn seeds of MT 1)	41.20kg	0.000
C6 (Corn seeds of MT 2)	42.34kg	0.000
C7 (Corn seeds of MT 3)	42.35kg	0.000
C8 (Onion seeds of MT 1)	836.66 kg	0.000
C9 (Onion seeds of MT 2)	840.13kg	0.000
C10 (Onion seeds of MT 3)	840.13kg	0.000
C11 (Chili seeds of MT 2)	101.00kg	0.000
C12 (Tomato seeds of MT 2)	5020.00kg	0.000
C13 (Soybean seeds of MT 1)	102.00kg	0.000
C14 (Soybean seeds of MT 2)	47.48kg	0.000
C15 (Cattle purchasing)	IDR2,372,649.32	0.000
C16 (KCL)	122.86kg	o.ooo
C17 (SP36)	85.07kg	0.000
C18 (NPK)	137.84kg	0.000
C19 (Urea)	0.00kg	IDR.39,414.103
C20 (Cattle feeds)	96.68	0.000
C21 (Capital)	IDR.0.00	IDR. 0.751

Where:

TK = Worker ; MT$_{1-3}$ = the 1st until 3rd planting season

Note of constraints factor:

C1 = constraint of area; C2 = constraint of worker in MT 1; C3 = constraint of worker in MT 2; C4 = constraint of worker in MT 3; C5 = constraint of corn seeds in MT 1; C6 = constraint of corn seeds in MT 2; C7 = constraint of corn seeds in MT 3; C8 = constraint of onion seeds in MT 1; C9 = constraint of onion seeds in MT 2; C10 = constraint of onion seeds in MT 3 ; C11 = constraint of chili seeds in MT 2 ; C12 = constraint of tomato seeds in MT 2; C13 = constraint of soybean seeds in MT 1; C14 = constraint of soybean seeds in MT 2 ; C15 = constraint of cattle purchasing; C16 = constraint of KCL; C17 = constraint of SP36 ; C18 = constraint of NPK ; C19 = constraint of Urea ; C20 = constraint of cattle feeds; and, C21 = constraint of capital

CONCLUSION

Based on the results of the optimization analysis in the resources utilization via the integration of crops and cattle in various cultivation patterns in the dried field located in the District of Sangkub, mainly two Villages of Sidodadi and Samgtumbolang, the information showed that from 6 activities of cultivation pattern, three activities of cultivation pattern resulting in the total of maximal incomes derived from the existing agriculture resources, such as the cultivation pattern of corn-corn-corn + cattle (X1); onion-onion-onion + cattle (X2); and, corn-soybean-the uncultivated field + cattle (X5). The optimal amount of land resources for the three farming activity patterns is 1.710 hectares with a total of 2.341 animal units of cattle that can be raised by farmers. It indicates that three activities of the cultivation pattern were the proposed cultivation pattern since it could maximize farmers' income in the dried field, such as IDR. 52,436,235.41/ year.

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