# OPTIMIZATION ANALYSIS OF DRY FARMING IN GUNUNG KIDUL DISTRICT, INDONESIA

*by* Nur Rahmawati

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# INTERNATIONAL CONFERENCE ON SUSTAINABLE INNOVATION (ICOSI)

# proceedings

Sustainable Innovation in Enhancing Global Competitiveness in Asian Countries

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**March 19 - 21, 2012**

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# PROCEEDINGS INTERNATIONAL CONFERENCE ON SUSTAINABLE INNOVATION

Sustainable Innovation in Enhancing
Global Competitiveness in Asian Countries

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# MESSAGE FROM THE RECTOR

In response to global changes brought by modern civilization, some countries might have experienced artificial changes from traditional to modern faces by embracing totally new characteristics of western developed countries, while leaving aside their cultural wisdom and other inner or local characters. This is not the one that this particular conference is meant for a sustainable development in all countries of the world, in particular those of Asia. The emergence of Asian countries is deeply influenced by their dynamics in embracing innovation in science and technology from the West without putting aside their heritage and legacy. Nevertheless, enhancing competitiveness of the Asian Countries remains unchallenged, demanding sustainable innovation, a key word, which plays a significant role in contributing to the creation of global harmony in the world. Asian countries are rapidly emerging as a power house of economic growth and political issues. The International Conference on Sustainable Innovation (ICoSI) for Asian Competitiveness is aimed at exploring the idea of how sustainability of innovation development is embedded within global knowledge, interaction, competition, governance and networking of the Asian countries, taking into account their own local and national considerations. ICoSI is an extended form of International Joint Seminar III, following IJS I and II which had been held in UMY and IIUM in November 2006 and December 2009 respectively.

We wish you a pleasant and productive time during the conference.

**Rector of Universitas Muhammadiyah Yogyakarta,**
*M. Dasron Hamid*

# FOREWORD

On behalf of the Scientific and Organising Committee, I am pleased to extend our warmest welcome to all of delegates to the International Conference on Sustainable Innovation (ICoSI) 2012 combined with 3rd International Joint Seminar. ICoSI 2012 is organized by Universitas Muhammadiyah Yogyakarta (UMY) in collaboration with International Islamic University Malaysia (IIUM) as co-host and Eindhoven University of Technology (TU/e), Netherlands as co-partner. This conference is also officially supported by Association of Universities of Asia and The Pacific (AUAP).

The conference of ICoSI 2012 will discuss the advances and understanding on how sustainable innovation and global competitiveness are embedded within global knowledge, production and governance networks in Asian countries, taking into account local and national considerations. ICoSI 2012 also provides a mean for academicians, researchers, governments and professionals to disseminate and exchange their ideas, reviews and research findings in the scientific environments in terms of innovation and its sustainability. The conference theme of "Sustainable Innovation in Enhancing Global Competitiveness in Asian Countries" reflects the sustainable innovation to face the challenge in global competition and can bring "transformation issues between tradition and modern" to the social and environmental equilibrium in the society. All together the conference will encompass two keynote speeches, 10 special lectures from invited speakers, and 53 papers, from 8 countries including Australia, Philippine, Indonesia, Switzerland, Malaysia, Netherlands, Taiwan R.O.C, United States of America, and participants from Indonesia, Cameroon, Philippines, R.O.C, making this conference a international one.

I would like to express our high appreciation and best gratitude to the Vice President of the Republic of Indonesia, Prof. Dr. Boediono who officiates the opening ceremony of the conference. I would also like to express to express my sincerest gratitude to keynote speakers, Mr. Jusuf Kalla (Former Vice President of the Republic of Indonesia) and Mr. Hatta Radjasa (Coordinating Minister of Economic), and all invited speakers in ICoSI 2012.

I would like to express my thanks to all authors for their outstanding contributions and in particular the members of the program board for their competent evaluation of the large number of submissions. Likewise I would also like to express my appreciation to the member of international advisory committee and reviewers for their support for this conference and member of scientific and organizing committee for their excellent job in organizing and managing this international event, as well as to the invited chairs for their careful preparation of the invited sessions.

I hope that his conference will generate a lot of discussions and share experiences on the sustainable innovation for recent times. I wish all participants a pleasant and memorable

deliberation and hope that you will greatly benefit from this conference and take home with you a truly intellectual and socially satisfying experience.

**Conference Chairman,**

*Sri Atmaja P. Rosyidi, Ph.D., P.Eng.*

# PREFACE

All praises be to the Almighty Allah Who has enabled us to organize the first International Conference on Sustainability and Innovation (ICoSI), 19 – 21 March 2012 at *Universitas Muhammadiyah Yogyakarta* (UMY), Indonesia.

We are pleased to inform you that although we have very limited time to prepare this conference, yet we still receive substantial amount of abstracts and full papers. It is perhaps due to the main theme of the conference, namely the *sustainability* and *innovations* which are very attractive never ending, not only for certain branches of knowledge, but almost by all disciplines.

It is indeed the broad topic that might be related to any discipline of knowledge in the human life. The topic has eventually attracted wide ranges of knowledge as indicated by many different titles submitted during the process of submission and review. We are also pleased to inform that papers submitted were coming from local, national or even international contributors.

Due to above condition, we have classified all the papers submitted into four main issues, these include (1) the health related sciences, (2) science and engineering, (3) social sciences and (4) Islamic studies. The health related sciences cover the studies on medicine, dentistry, pharmacy, nursery and nutrition. The science and engineering include the agriculture, environment, mechanical, civil, architecture and so on. While the social sciences cover the accounting, business, economics, law, political science, education and languages; The Islamic studies cover anything related to Islamic issues.

As every one might be aware, a scientific conference is a medium where the scholars present and disseminate their ideas and research findings, and participants will contribute through their criticism and feedbacks, so that the study can be improved and enhanced for the benefits of the society at large. We do hope highly that this objective can be achieved effectively.

Finally, allow me to extend my thanks and sincere appreciation to all parties who have participated in this important occasion. May Allah SWT reward you the best. Amin.

Yogyakarta, 19 March 2012

**Dr. Muhammad Akhyar Adnan**
*Editor in Chief*

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# OPTIMIZATION ANALYSIS OF DRY FARMING IN GUNUNGKIDUL DISTRICT, INDONESIA

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**Abstract**

*Existence the limitation of resources likes farm land, capital and manpower work had the problem in the farming activities. Its have been done in the dry farming activities in Gunungkidul District. Therefore, farmers need the good planning of farming pattern with combination of availability resources. The objectives of this research is to describe of the farming pattern practices in Gunungkidul district and to know the optimal inputs which are available to farming activity to be obtaining the maximum profit. The ethod used in this research is descriptive analysis with the technique analyze is Linear programming. This research conducted in Ngeposari Village, Semanu Sub-district, Gunungkidul. The observation from farming practices show that in the rainy season farmers planting some crops such as paddy (23%), soybean (73%) and intercrop between paddy and soybean (4%). In the dry season I, farmers usually planting of soybean (69%), peanut (27%) and intercrop corn and soybean 4%). While in the dry season II, 54% farmer planting corn, soybean 42% and intercrop between corn and soybean 4%. The organic fertilizer used in the farming practices that supply from one cow and one goat. Chemical pesticide and fertilizer still used in this farming system. The existing limitation sources in this research are farm land of 0,17 ha and family labor is 240 man day every season.The optimal solutions relative to practices were able to increase the total net revenue on the study area. The requirement of labor, straw, and organic fertilizer has influenced the optimal solution and has changed over the season's period. In the rainy season paddy is the main food, and in the dry season is soybean. For the dry season II, LP has chosen intercrop between corn and soybean. The optimal solution in the study area has given the maximum profit of Rp 4.648.745, 836,-. for one year. That maximum profit involves the total net revenue from crops activities and livestock activities. The results of the comparison concluded that the farming practices by farmers in the study area are not optimum yet.*

**Keyword:** *Limitation of resources, dry farming, optimization of resources.*

## 1. INTRODUCTION

### 1.1. Background

The issue of globalization will be important in the context of global competition, which it becomes a central part of business activities and a new way of thinking that is needed to understand global management and its implication. In addition of that change in the global competition, Indonesia's agriculture also has to adapt and has to develop the agriculture policies such as: (1) Food safety and nutritional value; (2) Niche market to earn high price to increase of farmer's income; (3) Environment friendly and safe place for farmers' work; (4) Sustainable natural resources; (5) Decreasing dependence to the chemical inputs and also decreasing production cost (Department of Agriculture, 2002).

In the context of decreasing production cost or increasing of farmers income, its still be urgent condition. Indonesia as agriculture country has many kind of natural resources that have specific treatment to optimize the production.

Gunungkidul District is one of the specific natural resources in Indonesia. The topography of Gunungkidul District is hilly and its dry land. The characteristics of this condition are dry land agriculture in yards, fields and rain fed rice fields. There are several problems often faced by farmers in the management farming such as: limited socio-economic conditions, physical environment, land, capital and labor.

These problems can impact to the farming activities in the applying of farming patterns. Based on that various problems, it's required good planning and mature on alternatives in the farming pattern selection to get the maximum income. Appropriate farming patterns can be used by farmers in the using of limited resources and get the maximum profits.

### 1.2. Objectives of the Study

The general objective of this study is to analyze the economic aspects of dry farming practices in Gunungkidul District. The specific objectives are:

1) To evaluate the cost and revenue of dry farming practices in Gunungkidul District.
2) To determine the optimal allocation resources used in the dry farming practices in Gunungkidul District.

### 1.3. Significant of the Study

1. Give farmers recommendation about the management farming of dry farming activities
2. The result of this study will be useful for government to make the policy of dry farming development.
3. Give Non Government Organization identification of OIPFS in Yogyakarta, Indonesia to be reference their agriculture development programme.

### 1.4. The Framework of Analysis

The framework analysis of this research showed on below:

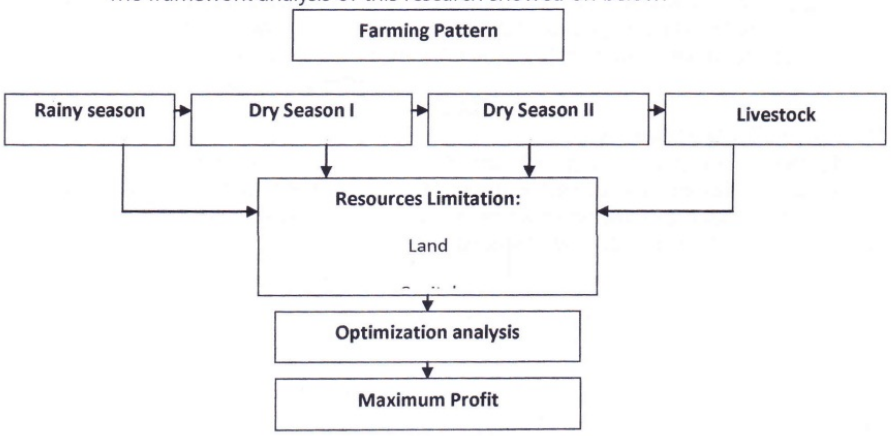


Figure 1. Framework of analysis

## 2. METHODOLOGY

This study uses both primary and secondary data. For the primary data, a farm survey was conducted during June–August 2009. Secondary data were collected from relevant agencies to complement the primary data. Purposive technique was used to get the sample of village. This study located in Ngeposari Village, Semanu Sub-district, Gunungkidul, Yogyakarta, Indonesia. Ngeposari village was chosen as the location of study because this area is the center of the food crops farming on dry land. Farmers incorporated in group farming of Bogo Kisma blocks south, Kalang Bangi Lor B, Village Ngeposari, District Semanu used as a sample (respondents). The chosen of Bogo Kismo group farming in south blocks caused this area closed to source of water.

This study uses Linear Programming (LP) analysis. According to Anderson (1985), there are three essential parts in a LP model: an objective function, a set of constraints and a set of non-negativity restrictions. To formulate the problem mathematically, it will be introduced the following notation:

$X_j$ = Level of the $j_{th}$ farm activity, such as the acreage of corn grown. Let n denote the number of possible activities; then j = 1 to n.

$C_j$ = Forecasted gross margin of a unit of the $j_{th}$ activity (e.g., dollars per acre).

$A_{ij}$ = Quantity of the $i_{th}$ resource (e.g., acres of land or days of labor) required to produce one unit of the $j_{th}$ activity. Let m denote the number of resources; then i = 1 to m.

$B_i$ = Amount of the $i_{th}$ resource available (e.g., acres of land or days of labor).

With that notation, the linear programming model can be written as follows:

$$\max Z = \sum_{j=1}^{n} c_j X_j \qquad (1)$$

such that $$\sum_{j=1}^{n} a_{ij} X_j \le b_i, \quad all\ i = 1 to\ m \qquad (2)$$

and $$X_j \ge 0, \quad all\ j = 1 to\ n \qquad (3)$$

The problem in words is to find the farm plan (defined by a set of activity levels Xj, j = 1 to n) that the largest possible total gross margin Z, but which does not violate any of the fixed resource constraints (2), or involve any negative activity levels (3).

## 3. RESULT

### 3.1. Pattern of Dry Land Farming

Farming pattern is a series of one or more farming activities (agriculture, livestock, and fisheries) are carried out by farmers. Farming patterns needed to determine the rotation of farming activities in each season. Based on the research, the farming pattern in study area can be described as bellow.

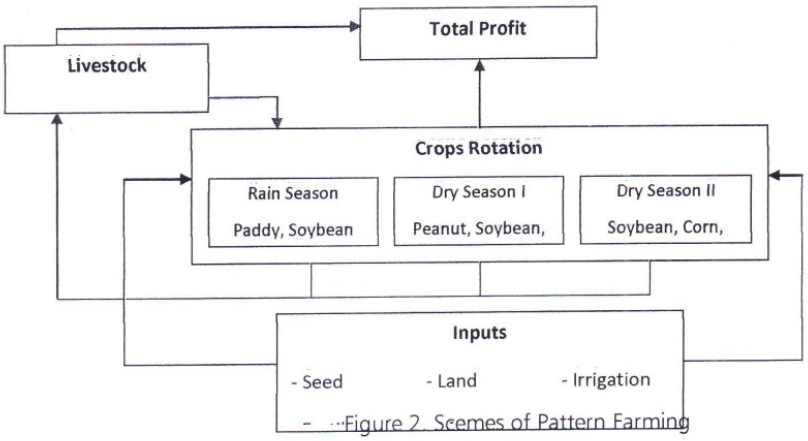


Figure 2. Scemes of Pattern Farming

Explanation :

_____ : Revenue

_____ : Waste of crops or straw

Figure 2 explain that the total profit supply by livestock and crops activities. There are two kinds of livestock, cow and goat. The livestock will supply the dung to be organic fertilizer to the crops activities and its will sell if the supply of dung is surplus. Crops activities will supply straw of paddy, soybean, peanut or corn to be feed of livestock. Above figure also show that in the crops activities need some inputs such as: seed, fertilizer, pesticide, land, machine, labor, irrigation, etc. There are kind of crops in the rain season such as paddy monoculture, soybean monoculture and paddy with soybean in intercrop farming system. Kind of crops in the dry season I are peanut and soybean with monoculture farming system or corn and soybean with intercrop farming system. Crops that plant in the dry season II are soybean and corn with monoculture and intercrop between corn and soybean.

### 3.2. Optimization Analysis

Optimization analysis in the farming system is to determine the optimal pattern of farming in various limited land, capital and labor. Optimization results can be used to find the solutions of good farming patterns that can provide maximum profit to farmers based on the availability of resources. The optimal solution also can be used to determine the optimal amount of resources needed in the farming activities.

Based on the results of the analysis, optimal solution can be obtained by farmers in the Ngeposari village for one year with the average land area 0.17 ha is Rp. 4,648,745.836, - which consists in the rainy season is Rp. 1,853,959.84, -, dry season I is Rp. 1,848,095.07, - as well as the dry season II is Rp. 946,690.848, -. The optimum inputs of the decision variables are shown in Table 1 below.

Table 1. The Value of the Variable (Activities) in the Dry land Farming System in Gunungkidul District, 2009.

| No. | Variable | Rain Season | Dry Season I | Dry Season II |
|---|---|---|---|---|
| 1. | Paddy | 0.1700 | 0.0000 | 0.0000 |
| 2. | Soybean | 0.0000 | 0.0000 | 0.0000 |
| 3. | Peanut | 0.0000 | 0.1700 | 0.0000 |
| 4. | Intercrop Paddy and soybean | 0.0000 | 0.0000 | 0.0000 |
| 5. | Intercrop Corn and soybean | 0.0000 | 0.0000 | 0.1700 |
| 6. | Intercrop seed and consumption | 0.0000 | 0.0000 | 0.0000 |
| 7. | Corn for feed of livestock (straw) | 0.0000 | 0.0000 | 0.0000 |
| 8. | Cow | 1.0000 | 1.0000 | 1.0000 |
| 9. | Goat | 1.0000 | 1.0000 | 1.0000 |
| 10. | Hire Labor | 0.0000 | 0.0000 | 0.0000 |
| 11. | Buy Straw | 0.0000 | 0.0000 | 119,40 |
| 12 | Sell Straw | 2.798,0 | 1.500,7 | 0.0000 |
| 13. | Buy Organic fertilizer | 0.0000 | 0.0000 | 0.0000 |
| 14. | Sell Organic fertilizer | 1.327,8 | 1.956,2 | 1.930,6 |
| 15. | Sell Paddy | 295,65 | 0.0000 | 0.0000 |
| 16. | Sell Soybean | 0.0000 | 0.0000 | 72,250 |
| 17. | Sell Peanut | 0.0000 | 161,50 | 0.0000 |
| 18. | Sell Corn | 0.0000 | 0.0000 | 199,75 |
| 19. | Sell Seed Corn | 0.0000 | 0.0000 | 0.0000 |
| 20. | Sell Corn for feed (straw) | 0.0000 | 0.0000 | 0.0000 |

Resource: Linier Programming Analysis

### 3.2.1. Rainy Season

In the rainy season, farmers can get the maximum profit if planting of paddy on 0.17 ha of land area. To support the crops activities, farmers must be have one cow and goat. The result of Linier Programming analysis also has suggestion to sell the paddy straw (2.798,0 kg) and organic fertilizer (1.327,8 kg). In the real condition, some times farmer didnt sell their paddy straw and organic fertilizer but they will safe for the next season. From the optimal input, farmers can produce about 295,65 kg of paddy from 0.17 ha.

The average price of paddy straw is Rp. 333.33, -/kg. So the revenue from the sale of paddy straw is Rp. 932,657.34, -.Other revenues that can be obtained from organic fertilizer, if the average price is Rp. 400, -/kg so the revenue from organic fertilizer is Rp 531,120. Primary data inform that the price of paddy is Rp. 2500, -/kg, so the revenue from paddy activities is Rp 739,125. Based on that calculation, so the maximum profit can be obtained in the rainy season is Rp. 1,853,959.84, -.

### 3.2.2. Dry Season I

The result of analysis show that in the dry season I, farmers have to planting peanut 0.17ha. Similar with rainy season, in the dry season farmers have to belongs one cow and goat to supply the organic fertilizer. Beside that, farmers have to sell straw about 1,500.7 kg. In the optimal conditian farmers have to sell organic fertilizer about 1,956.2 kg. As we know that the straw use in dry season I is from rainy season crops or paddy activities and the organic fertilizer is from production of rainy season.

Cost used for farming activities Peanut cultivation in the area of 0.17 ha of land is Rp. 182,958.93, -. While maintenance costs for one Cow is Rp. 136,605, - and one

Goat is Rp. 84,060, -. Revenue in the dry season I came from the sale of livestock feed (straw) as much as 1,500.72 kg multiple by Rp. 333.33, - equal to Rp 500,235. Revenue from organic fertilizer is Rp 782,484 and the total Peanut sale is Rp 969, 000. So the maximum profit can be obtained from selected farming activities in the dry season I was Rp. 1848095.07, -.

### 3.2.3. Dry Season II

Optimization analysis results showed that maximum profit in the dry season II can be obtained when farmers planting Corn and Soybean with intercrop farming system on 0.17 ha of land area. Costs used to carry of crop farming activities is Rp. 476,308.55, -. Just as the rainy season and dry season I beside to carrying out crops farming activities, farmers to encouraged one cow and one goat. Cost used respectively is cow Rp. 136,605, - and Goat is Rp. 84,060, -. The availability of feed (straw) as much as 1,828.6 kg, but the needed for fodder in the dry season II is 1,948 kg. Therefore, to meet the needed of livestock feed (straw) and to keep the maximum profit farmers have to buying feed (straw) of livestock as much as 119.4 kg. Based on the result, the revenue in the dry season II come from the sale of organic fertilizer as much as 1,930.66 kg at Rp. 400, -/kg or about Rp 772,264. Sales of corn as much as 199.75 kg with prices of Rp 2500, -/kg or about Rp 499,375. Soybean sales of 72.25 kg at Rp. 5700, -/kg or about Rp 411,825. So, the maximum profit can be obtained from selected farming activities in the dry season II is Rp. 946,690.848.

### 3.2.4. Slack and Sensitivity analysis (*Objective Coefficient Ranges and Right Hand Side Ranges)*

Farmer-owned of resources to farming activities is limited. However, the results of optimization analysis showed an excess of resources if the farmer to carry out farming activities based on the analysis of LP in the rainy season, dry season I and dry season II. The unused all of the resources are labor.

Family labor of farmer owned every season is as much as 240 man day. This workforce was already sufficient manpower to carry out the farming activities selected in the each season. The results of the optimization analysis indicate that the labor used to carry out farming activities selected in the rainy season as much as 51.694 man day, the dry season I as much as 47.931 man day and dry season II is 40.08 man day. Based on the the result of LP analysis that all of the resources have the value of *Right Hand Side Ranges.* Right hand side ranges is the rang of sensitivity value to determine the optimal value of the constraints changes that allowed getting the optimal answer.

Prices of production factors that analyzed in this study are the price that occurred at the time of this research carried out. Price is not absolute and may change at any time. The result of the analysis of linear programs in addition to showing the value of the optimal decision is also displaying a range of objective coefficients function. Similar with the Right Hand Side Ranges, the *Objective Coefficient Ranges* range is used to determine the optimal value (price) of the variable changes that allowed getting the optimal answer.

## 3.3. Comparison of the LP Result with the Farming Practices

### 3.3.1. Farm Land

Based on the LP result, we can conclude that the optimum solution is the farmers planting of ***paddy*** of 0.17 ha in the rainy Season, ***peanut*** 0.17 ha in the dry season I. In

the dry season II, farmers have to use 0.17 ha to plant the *inter crop between corn and soybean* 0. 17 ha.

The real condition of the farming practices has differences with the LP result. Farming practices in the rainy season, there are only **23%** farmers planting ***paddy***, soybean 73% and intercrop between paddy and soybean 4%. In the dry season I usually farmers planting soybean 69% and intercrop between corn and soybean about 4 %, while ***peanut*** only **27%**. In the dry season II, its about 54% farmers planting corn, soybean 42% and ***intercrop between corn and soybean*** only **4%**. Based on above explanation, we can conclude that the farming practices in the uses of farm land and in the choice of crops are not optimum yet.

### 3.3.2. Labor

The labor activity in the LP model have used in the crops activity, livestock's activity and production of compost activity. In the all seasons, there is same number of labor (240 man days) available for crops activity, livestock's activity and production of compost activity. The labor used in the crops activity is depended on the land activity. Based on the LP result that in the rainy season used 51,694 man days of labor, dry season I is 47,931 man days and dry season II is 40,08 man days.

In the real condition, many farmers plant soybean in rainy season. In dry season I usually farmer's plant soybean. In the dry season II, farmer's plant corn 54% and soybean 42%. Compare to the result of LP analysis, the real practices is have differences the kind of crops. Its will be effect to the number of labor used or the efficiency from labor resources.

### 3.3.3. Paddy Straw

In the farming system, the function of paddy straw is to supply the fed of cow. Result of LP analysis explain that the supply of straw come from the paddy activities in rainy season, peanut from dry season I and inter crop between corn and soybean from dry season II. The farming pattern show that the requirement of straw in the dry season I supplied by rainy season.

The total supply of straw in rainy season is 4,750 kg and it's only used about 1,952 kg for 1 cow. So, the farmers can sell about 2.798 kg. In the dry season I, farmers can sell of straw about 1.500 kg. While in dry season II, farmers have to buy about 119,4 kg. These condition depend on the supply of straw from crops.

In the farming practices, the straw requirement is difference with the LP result. It caused the differences of crops rotation in each season. Based on the above explanation, we can conclude that the straw activity has not optimum.

### 3.3.4. Organic Fertilizer

In the study area, Organic fertilizer will be supported by livestock's activities. The LP model had shown that the constraints of cow and goat respectively are one. These constraints have affected the production of organic fertilizer in the all seasons. Besides that, the uses of organic fertilizer depend on the kind of crops activity in each season.

Based on the analysis describe that the production of organic fertilizer is 1,870 kg in rainy season, 1,956 kg in dry season I and 1,930 kg in dry season II. In the real condition, farmers in study area only use organic fertilizer in rainy season. So, farmers can sell about 1,327 kg in rainy season, 1,956 kg in dry season I and 1,930 in dry season II. This result also indicates that in the all of season farmer's excess the supply of organic fertilizer and it must be sold or transferred to the next season. The LP result shows that there is a zero value for buying organic fertilizer activity and it indicates that the production of organic fertilizer is enough.

In the farming practices, the differences of crops in the rainy season have effect to the amount of organic fertilizer that used. Compared to the LP result, the uses of organic fertilizer is not optimum yet.

### 3.3.5. Farmers Income

The farmer's income in this study comes from on farm activity such as crops and livestock. The result of LP analysis summarizes that in the optimum solution of LP, farmers can get the maximum profit about Rp. 4,648,745.836, - which consists in the rainy season is Rp. 1,853,959.84, -, dry season I is Rp. 1,848,095.07, - as well as the dry season II is Rp. 946,690.848, -. This income consists of the revenues from crops, and organic fertilizer minus by some costs.

From the farming practices of the farmers in the study area, the average income in rainy season is Rp 1,058,000, in dry season I is Rp 768,000 and in dry season II is 692,500. So, the total income in the real practices is Rp 2,518,500.

This income came from crops were planted in the real practices such as Soybean in the rainy season and dry season I, corn in the dry season II. This showed that the real income was low when compared to the LP results. The conclusion is the farming practices were not at the optimum level

## 4. CONCLUSION

The optimal solutions relative to practices were able to increase the total net revenue on the study area. The requirement of labor, straw, and organic fertilizer has influenced the optimal solution and has changed over the season's period. In the rainy season paddy is the main food, and in the dry season is soybean. For the dry season II, LP has chosen intercrop between corn and soybean.

The optimal solution in the study area has given the maximum profit of Rp 4.648.745, 836,-. for one year. That maximum profit involves the total net revenue from crops activities and livestock activities. The results of the comparison concluded that the farming practices by farmers in the study area are not optimum yet.

## 5. POLICY IMPLICATION

### 5.1. Increasing the Availability of Resources

The LP analysis resulted in objectives that would optimally increase the resources available in the study area. The increase of resources available hopefully could increase the total net revenue of the farmers. Based on the LP results of dual prices, lands was the resource available to increase the total net revenue. In the farming system, land has a crucial role in the scale of production. The increase of land availability would increase crop production. Unfortunately, due to the pressure of a high population and marginal land condition the opportunity to increase the farmland is very limited.

### 5.2. Introducing New Technology in the Farming System

#### 5.2.1. Livestock Activity and Organic Fertilizer

With respect to the situation that existed, the farmers in Gunungkidul seemed to have good potentials for increasing their income from livestock activity. The farmers had to change the target of livestock activity from saving to supplying organic fertilizer and also for the production of meat, milk or organic fertilizer for business. The change of targets should be supported by new technology to produce cow feed, livestock production and to improve business management.

#### 5.2.2. Crops Activity and Cow Fed

Paddy, besides producing rice, also produces the paddy straw that has great potential in supporting the national requirements of cow feed. In addition, the bran of

the paddy can be used as one of the components to produce feed concentration. According to Agriculture Department of Gunungkidul District, the farmers in the study area always had problems in fulfilling the grass requirement. Based on the above description, the Gunungkidul farmers can be seen to need new innovation and technology that can help farmers to improve the nutrition of paddy straw and use the other crop waste such as those from maize, peanuts, and soybeans to fulfill the cow feed requirement

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