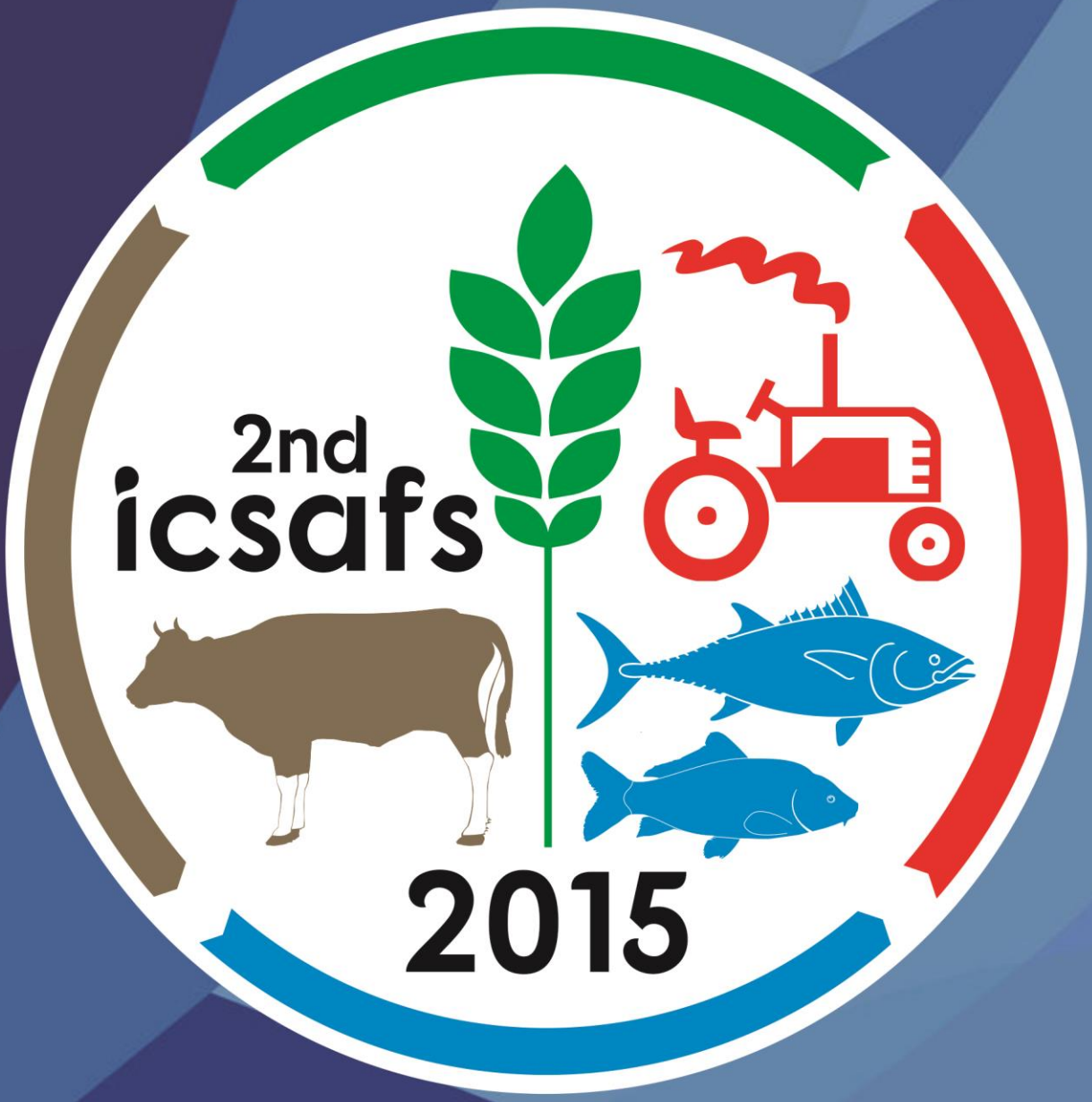
Book of Abstracts



2nd International Conference on Sustainable Agriculture and Food Security

A Comprehensive Approach

October 12 - 13, 2015

Universitas Padjadjaran, Jatinangor, West java, Indonesia

Greetings

Rector of Universitas Padjadjaran

Ladies and Gentlemen,

On behalf of Universitas Padjadjaran and on my own behalf, I welcome you to the 2nd International Conference on Sustainable Agriculture and Food Security: A Comprehensive Approach. I would also like to extent our greetings to all distinguished speakers, participants and guests from the various countries that are here with us in our campus in Jatinangor Sumedang, West Java. High appreciation is extended to the committee of this conference, who has organized seminar intensively, as consequence this conference could be taken place in time as we all intended.

It is our pleasure and honor to host this very important conference which has been jointly organized by four faculties within the Universitas Padjadjaran: the Faculty of Agricultural Industrial Engineering, Faculty of Agriculture, Faculty of Animal Husbandry, and Faculty of Fisheries and Marine Sciences. This conference is a part of several activities of the 59th anniversary commemoration of our university.

I realize that all of you are totally devoted to the sessions that will follow but I do hope that the audients will also take time to enjoy fascinating Indonesia with its tropical surroundings, friendly people and various cultural cuisines. This gathering also enables the building of a mutual partnership among countries and it provides invaluable opportunity for fruitful contacts and networking among participants from various countries.

Sustainable agriculture and food security are very important issues in the world; therefore Universitas Padjadjaran has also considered these issues to be very essential for agricultural development as well as for the country development in agriculture as a whole. Our university has been working to promote food security and sustainable agriculture system through education, training, research, community services, and professional practice. We also take an interdisciplinary approach to the environmental sustainability, health and socio-cultural aspects of food security.

As we know that global populations is rising rapidly, world agriculture faces critical challenge of producing and distributing sufficient food, feed, and fiber to meet increasing demand in conditions of changing climate and scarce natural resources. Innovative policy and new farming approaches based on a strong scientific base are needed to tackle the challenge of increasing agricultural production while also meeting environmental, economic, and social goals.

In this meeting, we expect that the key concept of sustainable agriculture in increasing agricultural productivity and efficiency, promoting the sustainable use of natural resources, without affecting the quality of soil and water, preserving ecosystems, protecting animal welfare, and generating income for farms which allows long term economic growth and enhancement of production capacity, along with being environmentally acceptable will be delivered. For achieving these goals, it requires increased investments for human resources development and agricultural infrastructures, sharing knowledge, innovation and technology. We believe that sustainable agriculture can contribute to food security, fighting poverty and improving quality of life.

Currently four dimensions of food security i.e. availability, physical access, economic access and utilization, are gained much more attentions by many countries in the world. Due to the fact that the rise in food prices in 2007-2008, followed by the financial and economic crisis in 2009, has keen awareness on poverty and hunger issues around the world. Indonesia addresses this concern domestically through improving rice, maize and soybean production, diversifying food sources, supporting local farms, improving agricultural infrastructures, technology innovations and many more efforts.

Today and tomorrow we will be witnessing, discussing and listening to progresses that have been made in the area of sustainable agriculture and food security from distinguished speakers and excellent participants. I wish the participants a very fruitful and productive meeting and I am looking forward to hearing the outcome and constructive conclusions of this meeting. Thank you very much.

Prof. Dr. med. Tri Hanggono Ahmad, dr.

Greetings

Chair of Committee

Dear Colleagues,

As world population increase rapidly, agriculture faces difficult task to meet increasing demand for food, feed, fiber and recently fuel. Without careful consideration and implementation this may lead to a dissastrous consequences. In light of these condition, sustainable agriculture production and food security are very important issues in the world.

Bearing this in mind, Padjadjaran University has been conducted The First International Conference onSustainable Agriculture and Food Security in 2011. During that event, distinguished speakers from dozens of countries had met here and formulated many ideas and finding on that subject.

To find out recent developments, today we are conducting the second conference with a special emphasis on integrated approach on the subject. In line with the topic of this conference, in addition to speakersfrom Indonesia, we have invited the following respected speakers from overseas:

a. Prof. Florin Stanica from Romania
b. Prof. Paul Barber and Dr. Ferry Jie from Australia
c. Prof. Marie-Helen Famelart from France
d. Prof. Hassan M. El-Shaer from Republic of Egypt
e. Prof. Giacomo Biagi from Italy
f. Dr. Milan P. Petrovic from Republic of Serbia
g. Dr. Subha Bassu from Malaysia

In addition to the paper from invited speakers, we have received more than 180 papers from 12 countries and 166 of them will be presented orally in two days. The rest of them are presented as posters displayed around this building.

This conference will be conducted from today until tomorrow. In addition to share ideas and findings in sustainable agriculture and food security, hopefully this conference will serve to nurture existing network between researchers and create new networks among related institutions which in turn will speed-up developments in these subjects.

On this ocassion I would like to express sincere appreciation to Rector of Padjadjaran University, Vice Rector for Collaboration, Deans of Faculty of Agriculture, Faculty of Animal Husbandry and Faculty of Fisheries and Marine Science and also to all sponsors for very nice cooperation that make this conference can be conducted today.

Thank you.

Ir. Mimin Muhaemin, M.Eng., Ph.D.

List of Abstracts

Invited Speakers

Participants

A. Biodiversity, Conservation and Sustainable Use

B. Plant, Fish and Animal Production

C. Sustainability of Water and Land Resource

D. Pests and Diseases Management

E. Socio-Economic of Agriculture

F. Post-Harvest and Food Technology

G. Innovation in Agricultural Education

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The abilities of Endophytic and Biofertilizer Bacteria and their Combinations to Suppress Bacterial Wilt Disease *(Ralstonia solanacearum)* in Chili

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Abstract
Bacterial wilt disease (*Ralstonia solanacearum)* is one of the important disease in Solanaceae including chili. Biological control is one of environmentally-friendly method for controlling plant diseases. Microbes that are potential as biological control agents include bacterial endophytes and bacteria that are usually used for biofertilizer. This paper discusses the result of the study that examined the abilities of endophytic and biofertilizer bacteria solely or in combination to suppress bacterial wilt disease (*R. solanacearum*). The endophytic bacteria isolates tested were *Lysinibacillus* sp. and *Bacillus subtilis*, while biofertilizer bacteria used were N-fixing bacteria (*Azotobacter chrococcum*) and P-solubilizing bacteria (*Pseudomonas cepacea*). The result showed that the endophytic bacteria, biofertilizer bacteria and their combination inhibited wilt disease incidence in chili by 44.8 - 82.8 %. The highest disease suppression (82.8 %) showed by endophytic bacteria, *B. subtilis.* The antagonist also increased chili growth significantly.
Keywords: *Ralstonia solanacearum*, Endophytic bacteria, Biofertilizer, Biological control Chili.

Conference Paper

Food Self-Sufficiency Through Land Area Expansion (CGE Analysis in Indonesia)

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Abstract

This study aimed to analyze the impact of land area expansion policy of paddy and corn crops towards food self-sufficiency in Indonesia. Analyses were performed by using CGE models based on the SAM data and Input Output Table of Indonesia in 2008. The result showed that the increase of land area of paddy and corn by 4-10%, the paddy production will rise 36,21-87,93%, while the corn production is relatively constant even going down to 0,55%. If the land of paddy and corn increased by 4-10%, it will decrease the export of almost all sectors in Indonesia, except the food and beverage industry whose increased 52-118,12%, as well as fertilizer and pesticide industries whose are relatively constant. On the other hand, the land area expansion of paddy and corn 4-10% will not affect the import of this commodity. Thus, it can be concluded that the land area expansion of paddy and corn crops have a positive impact on food self-sufficiency (rice and corn) in Indonesia.

Keywords: land area expansion; paddy and corn crops; food self-sufficiency; CGE models.

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OPEN ACCESS

1. Introduction

Food policy analysis has become the focus of the experts since a long time ago, especially after the worldwide food crisis in 1973-1974 and a fears of food crisis in 1979-1980 will continue to happen [1]. The main role of food policy analysis is to design a national food program that connects micro and macro environmental issues, aiming for faster food growth. Four basic goals of national food policy are: (1) the efficiency of growth in agricultural sector, (2) the increase in the distribution of income through expanding new job vacancy, (3) the adequacy of nutrition for the entire society, and (4) ensuring adequate food security when harvest time fails, natural disasters or food supply and unstable world prices [2].

World food crisis is a serious threat to society in the world, including Indonesia. Indonesia's dependency on imported food is one cause of this situation. But agriculture development in Indonesia by using self-supporting system (*swasembada*) is a condition for continuity of nation's existance in addressing the threat of global food shortages [3]. Fertile land conversion, land and water degradation, climate change and environmental degradation, has been becoming a major constraint in the development of food self-sufficiency oriented in the future [4].

Provision of food, particularly rice, in sufficient quantities and at reasonable prices remains a top priority of national development. Besides being a staple food for more than 95% of the people of Indonesia, paddy has also provided employment for around 20 million households in the rural areas. In the period of 2000-2006, the population of Indonesia has increased at a growth rate of 1.36% per year while rice consumption was 137 kg per capita. Assuming a declining population growth rate of 0.03% per year, the consumption of rice in 2015 and 2025 respectively projected at 34.12 million tonnes and 37.43 million tonnes. The total population in the second period were estimated respectively around 249 million and 273.2 million people [5]. If the assumption is not met, Indonesia should be able to provide food in larger quantities. If not, then the food dependency on imports will be greater.

To fulfil food demand especially rice in the country, the government can increase the production of food crops (rice) by using multiple scenarios, one of which is food self-sufficiency. Self-sufficiency in food (rice) can be achieved by expanding land based on the following facts [6]. National paddy production in 2012 totalled 69.05 million tons of dry unhusked paddies or experiencing an increase of 3.29 million tonnes (5%) compared to 2011. The increase of production occurred in Java as much a 2.12 million tons and 1.17 million tons outside Java. Increaseing in production occurs due to increasing of harvested area as much as 239.80 thousand hectares (1.82%) and the increase of productivity by 1.56 quintal/hectare (3.13%). Food (rice) self-sufficiency can be maintained until 2025 when the rate of land conversion can be inhibited to about 75,000 ha/year and the addition of wetland through new paddy fields around 100,000 ha/year [7].

Related to previous explanation, the effort to expand the area of cropland through the opening of new land recently has become very important to support the self-sufficiency of rice, given the need for food crop production that continues to increase while the conversion of land each year occur in area broad enough [8]. With the opening of new land then areas available for farming will increase, so that the production of rice and maize will increase and the availability of food for 95% of Indonesian society will also increase. The contribution of rice and corn sector's to gross domestic product will also be larger. If the domestic demand for rice and corn are met, then self-sufficiency can be achieved. In addition, food self-sufficiency scenario also would

reduce Indonesia's dependency on imported rice and corn which means it will also improve the trade balance and the exchange rate. This means that Indonesia will be able to finance the import of commodities that do not have a competitive advantage. Therefore, this study aimed to analyze the impact of land expansion policy especially for rice and corn to food self-sufficiency.

Preliminary research that has been done [9] using data from SAM 2005 has produced findings that marketing efficiency improvement has positive impact on sectoral economic performance. A research was conducted using CGE models to evaluate the impact of the efficiency improvement of marketing of agricultural products to food security and household welfare in Indonesia with the data base tables of SAM 2008 and Input Output table 2008. The findings are marketing efficiency improvement having positive impact on food security and household welfare [10].

Results of previous studies that have been described indicate that the results of policy evaluation using a model of general equilibrium analysis will be an essential ingredient for developing policies and for the development of science, considering that during this time, the majority of policy evaluation using partial equilibrium analysis model. Therefore, it is important to assess whether the new policy of printing wetland recommended by the government will support the achievement of food self-sufficiency and have positive impact on sectoral economic performance.

1.1. CGE (Computable General Equilibrium) Model

In economic system, changes in the balance of a market have impact on other economic sectors and activities through the input-output relationship. General equilibrium occurs when the supply and demand in each market in the system is in a state of equilibrium simultaneously. The disturbance causing imbalance in a partially market will be immediately followed by an adjustment in the relevant market and the subsequent adjustment process occurs in other markets (simultaneous adjustment) which brought the economy to the new balance. The mechanism of achieving a balance on all types of goods in all applicable markets for producers and consumers is called general equilibrium analysis [11].

The general balance will occur when the economy is in a state of perfect competition and there is no increasing return to scale [12]. The economy that has no competitive state will not have a point in general equilibrium. In its development, General equilibrium model formulated by Arrow and Debreu is known as CGE models.

CGE model is a comprehensive approach that encapsulates multimarket models and uses the balance of market as its analysis basic element [13]. A CGE model illustrates economic actors and behaviour which directs the various markets into a general balance. CGE model formulation includes the linkages between economic actors, i.e. the

company or industry, households, investors, governments, importers, exporters and between different commodity markets. The entire market will be in a state of balance and has a specific structure to achieve a balance when there are shocks in one market [14].

With comprehensive system of equations, CGE model has the advantage of revealing impact on production, consumption, trade, investment and overall spatial interaction of a policy or shock. This model has been applied to simulate the socio-economic impacts of a scenario. First, foreign shocks is such as changes of terms of trade (i.e. the increase of imported oil price or drop of main exported commodity prices in a country). Second, changing in economic policy is such as taxes and subsidies in the trade. Third, changing in social structure of domestic economy, such as changing in agricultural technology, the redistribution of assets and human capital formation [15, 16].

According Yeah et al. [17], CGE model is not only used in the model of international trade but also in the model of development planning, finance, environment, resource management, as well as changes in economic and market transitions [17]. The cornerstone of microeconomic theory used include elasticity parameters and input-output data, so that the CGE model is the experimental analysis tool for analyzing the economic changes, including the expansion of land area.

2. Methodology

CGE models are the best choice if the policy evaluation will have significant effects to the whole economy. Moreover, CGE models are the best option if the research question involves analyzing the static/dynamic, direct/indirect and short/long term effects caused by a shock. Thus, because of its nature, CGE analysis performs well when evaluating, among others, fiscal policy, trade policy, climate change shocks and shocks in international prices, especially agriculture policy that is: self sufficiency through land expansion.

CGE model developed in this study is how to introduce the expansion of the area of land into a model of the economy so that the policy affects the achievement of food self-sufficiency in Indonesia. To achieve these objectives static CGE model developed reported in Reference [15, 18, 19] was used assuming constant return to scale. This model is more appropriate to look at the effects of policy [20–22].

The data used was secondary data obtained on Statistics Social Accounting Matrix (SAM) Indonesia and Input Output (IO) of Indonesia in 2008, while some of the coefficients/other parameters such as the elasticity of Armington, elasticity factor of primary production, and the elasticity of substitution is obtained from various sources in previous studies. SAM is an open framework of comprehensive economic data that represent the economy of a country [23]. While Reference [24] states that SAM is

written in table form a square matrix with an agent name as the name row and column names. In addition, the model in this study was also constructed using MPSGE approach. By using GAM/PSGE, calibration can be performed simultaneously [13].

CGE model used in this study is a static CGE. Data of SAM 2008 and I-O table 2008 to be the basis for aggregating and disaggregating sectors to be 10 sectors (6 sectors of food crops and 4 other sectors) and 8 households. The first step taken was to arrange basic matrix (85x85), eliminate the negative elements in the SAM Indonesia, further validation (balancing) of SAM, SAM mapping, compiling data models and static CGE model are solved by GAMS/MPSGE, then do simulation. To refine the analysis, performed several simulations policies, namely: (a) expansion of paddy land and corn amounting to 4%, (b) expansion of paddy land and corn by 5%, and (c) expansion of paddy land and corn by 10%. Selection of simulation figure of 4% and 5% based on the rationalization that refers to the current conditions, self-sufficiency in rice and corn in Indonesia will be achieved if land for both agricultural commodities is expanded 4-5%. While the simulation figure of 10% was chosen to find out what happens when self-sufficiency in food (rice and corn) has been reached.

3. Results and Discussion

Land expansion of crops to achieve rice and corn self-sufficiency will have an impact on the economic performance of sectors that exist in Indonesia, not only limited to the economic performance of rice and corn sectors. The analysis showed that the land expansion of corn and rice, in general, has a positive impact on the achievement of food self-sufficiency that can be seen from the quantity indicators of domestic output, exports and imports, as presented below.

3.1. Impact on national production performance

Table 1 shows that the policy of paddy and corn land expansion by 4-10% has a positive impact on the performance of national production in the sectors of rice, beans, tubers, food and beverage industry, and other industries, except for sectors of national corn, other crops, and fertilizer and pesticide industry. If paddy and corn land is increased by 4%, rice production will rise 36.21%, while corn production will fall by 0.55% and production of other food crops do not increase constantly. Furthermore, paddy and corn land expansion by 5-10%, will increase rice production to 75 to 87.93%, while corn production is not increased and the production of other food crops will be down to 0.19%. The empirical evidence indicates that there is trade off between land for rice farming, corn, and other crops.

Table 1: The impact of land expansion for paddy and corn on the national production.

No.	Sector	Baseline (Trillion IDR)	Percentage Change in Production due to the Land Area Expansion of Paddy and Corn		
			4%	5%	10%
1	Paddy	116	36,21	75,00	87,93
2	Nuts	65	16,92	32,31	36,92
3	Corn	183	-0,55	0,00	0,00
4	Tubers	72	0,00	1,39	1,39
5	Other food crops	534	0,00	-0,19	-0,19
6	Other crop farming	1.734	-0,12	0,69	0,81
7	Food and beverage industry	5.805	46,77	138,43	154,40
8	Industrial fertilizers and pesticides	48	-4,17	-2,08	-2,08
9	Other industry	5.277	4,38	10,21	11,20
10	Trade, hotel and restaurant	2.560	-0,94	-0,59	-0,51
11	Service	6.480	-0,37	-0,32	-0,34

Source: Secondary Data Analysis, 2015

The increase of national rice production at 36.21 to 87.93% due to the expansion of the land area is expected to support the achievement of rice self-sufficiency program launched by the government of Indonesia in 2018. But it is important to understand that efforts to increase food production using the same land area as rice, corn, and some other food crops can not be done only through the expansion of planting areas, but effort to open new agricultural land or conducting land revitalization which is quite large in amount.

But the increase of national production of paddy, beans, tubers, and other agricultural crops are not supported by an increase of national production of industrial fertilizers and pesticides. If paddy and corn land is expanded by 4-10%, the industrial production of fertilizers and pesticides will drop from 2.08 to 4.17%. This condition happens due to the reducing use of chemical fertilizers and pesticides at farm level.

While increasing of performance of national production of food and beverage industry (46.77 to 154.40%) and other industrial sectors (from 4.38 to 11.20%) are suspected as the outcomes from the increasing production of paddy, nuts, tubers and other crops, which in turn will also increase the national production of food and beverage industry as downstream industry of fresh agricultural products, including land expansion of paddy and corn that has a positive impact on the performance of other sectors related to backward linkage and forward linkage with paddy and corn as corps.

3.2. Impact on export performance

The simulation results presented in Table 2 indicates that the policy of paddy and corn land expansion by 4-10% will reduce export performance of almost all sectors in Indonesia, except paddy sectors and fertilizers and pesticides industry that has constantly unchanged export quantity, as well as the food and beverage industry which has increasing in term of export quantity by 52.90 to 118.12%.

Based on existing data in SNSE Indonesia in 2008, Indonesia does not export rice because domestic production has not been able to fulfil ddomestic demand. In other words, Indonesia, at this time, still import rice. Rice exports will be carried out after rice self-sufficiency is achieved; i.e if dry harvested grain production has reached 84 million tons. Production is targeted to be achieved by 2019. Based on information from various sources, it is estimated that rice and corn self-sufficiency will be achieved if both agricultural commodities land is expanded to 4-5%. If self-sufficiency of rice and corn has been reached, Indonesia will be able to export rice. However, simulation results by land expansion of paddy and corn up to 10% did not indicate this phenomenon, because a constant quantity of rice export did not change from baseline of 0 trillion IDR. The causes are: first, the SNSE database in 2008, which is used in this analysis, did not contain rice exports; and secondly, over estimate of substitution elasticity between land, capital and labor as production factors.

While constant export quantity of fertilizer and pesticide industries sector does not change from baseline of 2 trillion IDR, presumably because the sector is still not able to fulfil domestic needs. Moreover, the national production of fertilizers and pesticides industries has declined from 2.08 to 4.17% from baseline of 48 trillion IDR when land expansion of paddy and corn by 4-10% happened, so that production of fertilizers and pesticides industries has been sold out in domestic market without the need to be exported.

If the land of corn and paddy are expanded by 4-10%, the export performance of food and beverage industries will increase from 52.90 to 118.12% from the baseline export value of 2,274 trillion IDR. The increasing of export performance of food and beverage industries allegedly happens because of the increasing of food and beverage production by 46.77 to 154.40% due to land expansion policy of corn and paddy as much as 4-10%, so most of production of food and beverage industries are not sold out in domestic market and must be exported overseas.

Declining exports will affect a country's trade balance. However, total decline of export performance from various sectors as presented in Table 2 as a result of paddy and corn land expansion by 4-10%, the value is still lower than the increasing in exports of food and beverage industry. In addition, other important component of the trade balance is also being imported. Declining of exports is followed by decreasing

Table 2: The impact of paddy and corn land expansion of to export.

No.	Sector	Baseline (Trillion IDR)	Percentage Change in Exports due to the Land Area Expansion of Paddy and Corn		
			4%	5%	10%
1	Paddy	0	0	0	0
2	Nuts	0,94347	-0,01	-0,01	-0,01
3	Corn	0,72558	-0,66	-1,33	-1,51
4	Tubers	0,20673	-0,45	-0,86	-0,97
5	Other food crops	0,86074	-1,98	-4,91	-5,68
6	Other crop farming	65	-16,92	-36,92	-41,54
7	Food and beverage industry	2.274	52,90	107,52	118,12
8	Industrial fertilizers and pesticides	2	0,00	0,00	0,00
9	Other industry	2.293	-12,04	-26,21	-28,74
10	Trade, hotel and restaurant	77	-11,69	-23,38	-25,97
11	Service	7	-71,43	-91,71	-93,01
Source: Secondary Data Analysis, 2015					

in imports where the declining of imports is greater than the declining of imports will produce trade balance remained positive.

3.3. Impact on import performance

Impact of corn and paddy land expansion to import of all sectors in Indonesia is presented in Table 3. Policy of paddy and corn land expansion by 4-10% has an effect on the increasing of quantity of imports in almost all sectors, except for imports of rice and corn sectors that is constantly unchanged. Import of rice sector were carried out constantly at baseline of 5 trillion IDR and imports of corn sector were constantly carried out at baseline of 4 trillion IDR, which is indicating national production of paddy and corn that have not been able to fulfil domestic demand.

Import performance of other sectors besides rice and corn showed a significant increase. In fact, the greater the percentage of land expansion, the higher imports of other sectors in the economy are. Sectors experienced highest increase in imports are other crops, food and beverage industries, and other agricultural crops. It should be underlined that the increase of imports would significantly affect the status of Indonesia's trade balance, deficit or surplus in the trade balance.

The higher import of sectors in economy is in line with the greater percentage of land expansion of paddy and corn, it is thought to occur because of the trade off between the production of paddy and corn with other crops and agricultural plants, as a result of the agricultural commodities cultivation on same land. While food and beverage

Table 3: Impact of paddy and corn land expansion to import.

No.	Sector	Baseline (Trillion IDR)	Percentage Change in Imports due to the Land Area Expansion of Paddy and Corn		
			4%	5%	10%
1	Paddy	5	0	0	0
2	Nuts	13	15,38	30,77	38,46
3	Corn	4	0,00	0,00	0,00
4	Tubers	0,8938	1,94	3,54	3,95
5	Other food crops	27	44,44	88,89	100,00
6	Other crop farming	38	31,58	52,63	55,26
7	Food and beverage industry	306	34,97	62,09	67,97
8	Industrial fertilizers and pesticides	70	15,71	30,00	34,29
9	Other industry	2.930	18,77	39,80	43,86
10	Trade, hotel and restaurant	183	10,93	18,58	20,22
11	Service	975	18,67	34,05	37,33

Source: Secondary Data Analysis, 2015

industries is experiencing increase in imports which is allegedly due to production other agricultural commodities used as declining raw materials.

Beside to fulfil domestic needs, the increasing imports of sectors in economy can also be caused due to low domestic competitiveness. It is characterized by domestic commodity prices that are relatively higher than similar imported commodity prices, or the quality of domestic commodities that are relatively lower than similar imported commodities quality. However, domestic commodity prices that are higher in long term can also encourage domestic producers to increase their output so that the quantity of imports will drop [25].

4. Conclusions and Recommendations

Land area expansion policies of paddy and corn have a positive impact on food self-sufficiency in Indonesia. If the land area of paddy and corn increased by 4-10%, it will increase the national production of almost all sectors in Indonesia, except for corn, other crops, also fertilizers and pesticides industries. Empirical evidence indicates that there is a trade-off between the land for paddy farming, corn, and other crops. If land of corn and paddy is increased by 4%, the rice production will rise to 36.21%, while corn production will constant and continuesly fall by 0.55% and so does, production of other food crops that will be fall to 0.19%.

If the land area of paddy and corn increased by 4-10%, it will decrease the export of almost all sectors in Indonesia, except the food and beverage industry which increased

52.90-118.12%, as well as fertilizer and pesticide industries and rice sectors whose are relatively constant. If the land area of paddy and corn increased by 4-10%, it will not affect the import of this commodity.

To reduce the negative impact of the trade-off from land expansion of paddy and corn, government policy intervention is required. These interventions are expected to increase national production of rice and corn to support rice and corn self-sufficiency program, but it also can increase the production of other food crops sector and other sectors involved in the economy. Examples of policies that can be taken are: (1) expansion of rice and corn planting area that is more focused on opening new agricultural land or revitalizedation abandoned land/marginal area; (2) In addition, land expansion needs to be optimized through intensification, increasing cropping intensity, innovation development of cultivation and post-harvest technology, improved watershed management, soil and water conservation, and protection against conversion of agricultural land, abandonment and degradation.

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