# THE INCREASING OF AGRICULTURAL LAND PRODUCTIVITY THROUGH AGRICULTURE BIOINDUSTRY BASED OF CROP-LIVESTOCK INTEGRATION TO FACE GLOBAL COMPETITION ASEAN ECONOMIC COMMUNITY

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***ABSTRACT***

*Single commodity concept (monoculture) is a high risk agriculture because there can be no substitute from another if the main crop fail to be harvested. Agricultural bioindustry is a concept of agriculture that integrates the factors of production in an agricultural area for a profitable advantage in industrial scale and ecologically insight (zero waste concept). This Agriculture concept, based on bio-industry of crop-livestock integration, is able to give mutual support between commodities in the areas. In addition, the utilization of a commodity (or part of commodity) for another commodity input in this concept will support zero waste agriculture. For example, this will optimize plant waste utilization in the form of plant biomass as green fodder and processed feed for livestock. Plant biomass can be also processed as bio-products industry in the form of briquettes that can be used as a heating pinfold at night time and can be also marketed to natural fuel (biofuel). The research was conducted in Meunasah Dayah Gampong Bananas, Sakti Subdistrict, Pidie District in 2015. The purpose of this study was to assess the model of bio-industry based on crop-livestock integration in farmer cooperators land. The methodology used a desk study. The results showed that the productivity of the land in the area of the experiment increased based on benefit-cost ratio indicator. The bioindustry agriculture b/c ratio value was > 1. This bioindustry agriculture b/c ratio value was > conventional farming systems. This showed that agriculture bioindustry based on crop-livestock integration better than monoculture and can be developed in the surrounding locations.*

*Keywords : Agriculture Bioindustry, Crop- Livestock Integration, Soybean, Goat.*

## I. INTRODUCTION

ASEAN Economic Community (AEC) is pattern integrate ASEAN economies by establishing a system of free trade or free trade between member countries of ASEAN. Indonesia and other ASEAN members have agree on a treaty the ASEAN Economic Community. AEC used in Indonesia but is basically the same as the AEC AEC or Asean Economic Community. In the face of AEC, especially the agricultural sector in the country Indonesia should prepare to compete in presenting excellent products which are standards in free trade. To produce superior products that are standards needed agricultural system which to improve the productivity of agricultural land, so that the resulting product able survive and

sustainable. One way to increase the productivity of agricultural land developed by the Agricultural Research Agency is the concept of bioindustry. Bioindustry are economic activity that process raw materials, semi-finished goods and finished goods into goods with a higher value for their use (Ministry of Agriculture, 2014). Bioindustry agriculture is agriculture that connects the factors of production in the agricultural area and take advantage of the relationship between the factors causing relations and utilization of all the components of production become intertwined and profitable industrial scale and sound ecological (zero waste). Agricultural land using farming principle on a single commodity (monoculture), included in the farm that has a high degree of risk because in the event of crop failure there can be no substitute from another. Agriculture concept based bioindustry crop-livestock integration capable of mutual support between commodities in the land and the agricultural areas. Besides agriculture-based bioindustry crop-livestock integration uses the concept of zero waste for waste utilization commodities become inputs for other commodities.

Concept-based bioindustry crop-livestock integration not only increase the added value of agricultural waste generated, but also increase the amount and quality of organic fertilizer derived from livestock so as to improve soil fertility (Maryono, 2010). In the system of integration of crop - livestock, soybean plants from plant biomass up in processed form, namely pulp used as an alternative to the processed feed goats. Stover plants are still green can be used as forage for livestock. Another benefit of the stover plants is processed using the tool pyrolisator plants produce liquid smoke, biochar and industrial products (briquettes). Goats integration relationship with soybean plants are the benefits of urine as a biopesticide and benefits of goat manure is used as compost through a process of fermentation. The purpose of this study was to test the model adaptation based bioindustry crop-livestock integration. With the holding of this research it is expected that there is a recommendation to the concept of technology-based bioindustry crop-livestock integration in Aceh Province.

## II. METODHOLOGY

The experiment was conducted with two (2 ) phases , namely desk study and test in the field. The study was conducted in Meunasah Dayah, Sakti subdistrict, Pidie regency. Locations were selected intentionally (purposive sampling) based on the potential location and farmer cooperators. The study was conducted from February to December 2015. The methodology were used a desk study and test in the field. Desk study is needed to make causal loops bioindustry soybean -based integration - goats on dry land . Early research desk study conducted in BPTP Aceh, primary data obtained through a survey to several potential locations and potential cooperator farmers as much as 10 respondents prospective farmer cooperators. The following Figure 1, the flow chart of research.

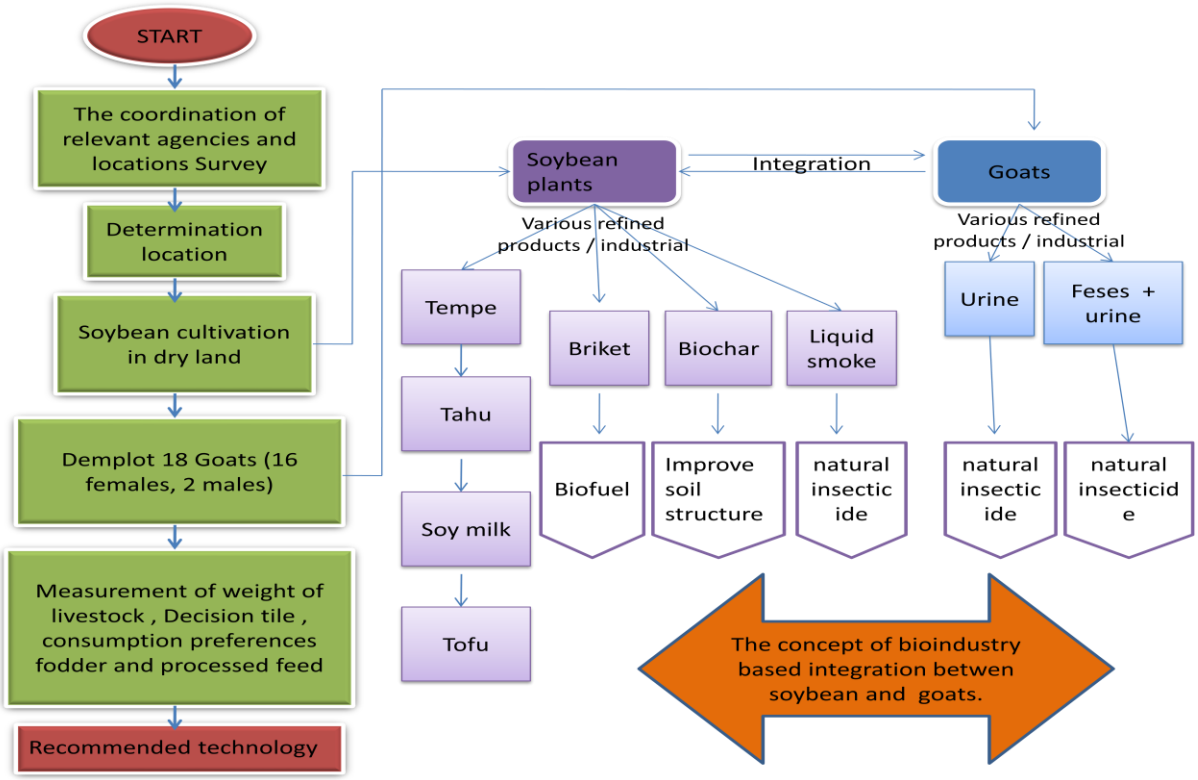


Figure 1. Flow diagram of the integration of research -based bioindustry soybean plants and goats .

The next test of the model bioindustry in the field get a specific technology on a case study on dry land. Analysis of the data are used to see matches the model created by desk study and application of models in the field. To calculate farmer income before and after applying the analytical used B/C ratio (benefit/cost) .

## III. RESULTS AND DISCUSSION

The results of the study desk are model-based bioindustry causal loops for integration of soybean plants and goats on dry land. The concept of causal loops is a model widely used in problem solving with a systems approach that considers the dynamic complexity of the system or to support a dynamic system approach. Model-based bioindustry causal loops integration soybean plants and goats on dry land have two factors that will be achieved is an increase in soybean production and the increased weight of goats on dry land. Each factor was emphasized on the concept of zero waste integrated from each (causally). Malabay (2008) said that the model causal loops highlighted the causal relationship between the components of the system were illustrated in a diagram in the form of a curved line that led the arrow that connects the system components with one another. Arrowheads bore the symbol "+" indicating that if the components that influence or as cause changes or increases, the affected component is changed or increased. T sign symbol "-" indicates a result opposite to sense when the components that affect increases, the affected component decreased.

Variables into consideration of each factor are the environment and the social and economic value. Several environment variables into consideration are the cultivation of a good soybean crop as recommended IAARD i.e. varieties, quality seed, a spacing (population/plant), and pest and disease control in an integrated manner. Furthermore, the addition of the variable harvested area and acreage soybean crop and water availability in drylands. The availability of water is the main thing being the point of leverage for increased production of soybean crops in dry land.

Variables that the main concern of the social economic condition are a soybean prices very volatile and tend to fall as the harvest even though no benchmark prices from the government, but there was still an effect on the state of farmgate prices. Governments were supposed to intervene in the total price through Bulog to buy all soybean farmers in quality and sold soybeans to the private sector through Bulog (one way in and out). The variable price becomes the main thing for the improvement and development of soybean planting well as guarantee prices will improve harvest area, while soybean prices fall then harvest area in the next planting season will drop significantly (real). The following Figure 2, schema based bioindustry causal loops integration soybean plants and goats.

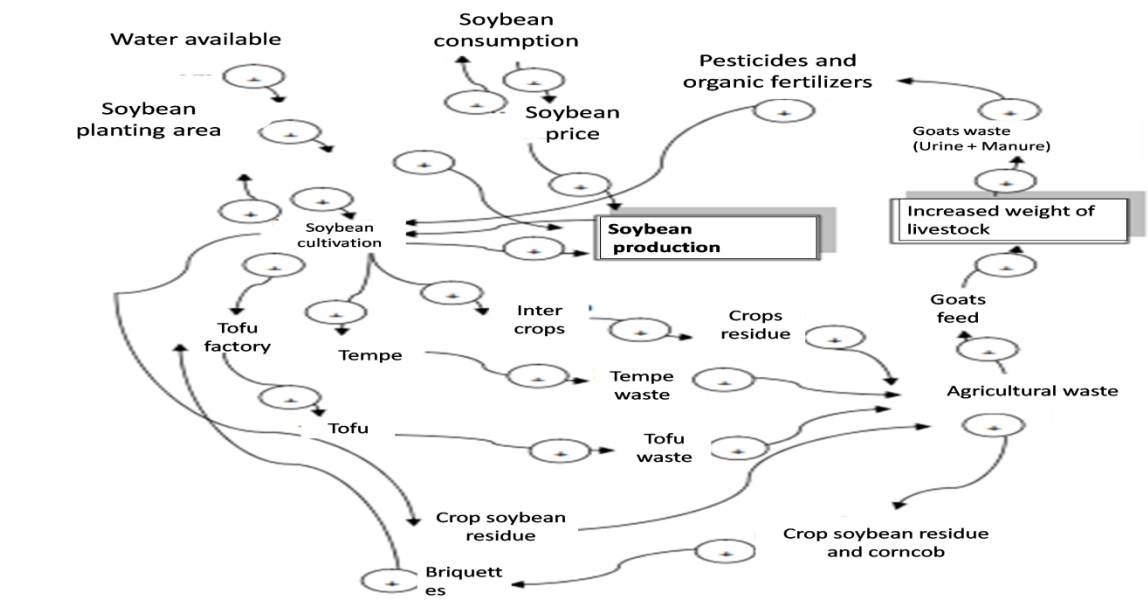


Figure 2. The concept of causal loops bioindustry
soybean -based integration and goats.

The concept of causal loops bioindustry desk study based on variables that can be still controlled operational research model test in the field. The concept was planned as a desk study development diagram together with related agencies namely the Department of Agriculture , Irrigation Department and local Agricultural Extension Agency.

Bioindustry model test research in the study site survey and selected intentionally (purposive random sampling). Location of the study include the type of dryland (rainfed), the source of water is rain water. Soil research site include types of dusty clay (the clay content 48.84 %, 38.66 % of dust, sand 12.50 %). Organic C content of 0.99 %, 0.12 % total N, P205 5.84 mg/100 g, K20 18.08 mg/100 g ( 25 % HCl extract for P205 and K20).

General overview of the potential location of the research is the area of dry land with an area of 35 hectares ownership group , the study site using an area of one (1) hectare of land around farmers' groups. There are goats are reared as a shepherd and put into a cage at night. Habits of local farmers in the cultivation of crops that rotation between rice and pulses (soybean or corn plant). Besides the potential in Pidie district tropical climate with two seasons, dry and rainy. Temperatures average around 24 - 30°C. In 2005, the number of rainy days were 115 days, with an average rainfall of 232.67 mm, the highest in December (614 mm) and the lowest in June (52 mm). The climatic conditions affect the state of the ground water and the potential of agriculture-related water potential .

Input technology included in the concepts bioindustry based integration of crops and livestock, i.e. : type enclosure management stage, technology pengandangan goats stage model, processing fodder using activators trichoderma, technology use tofu as feed concentrate.

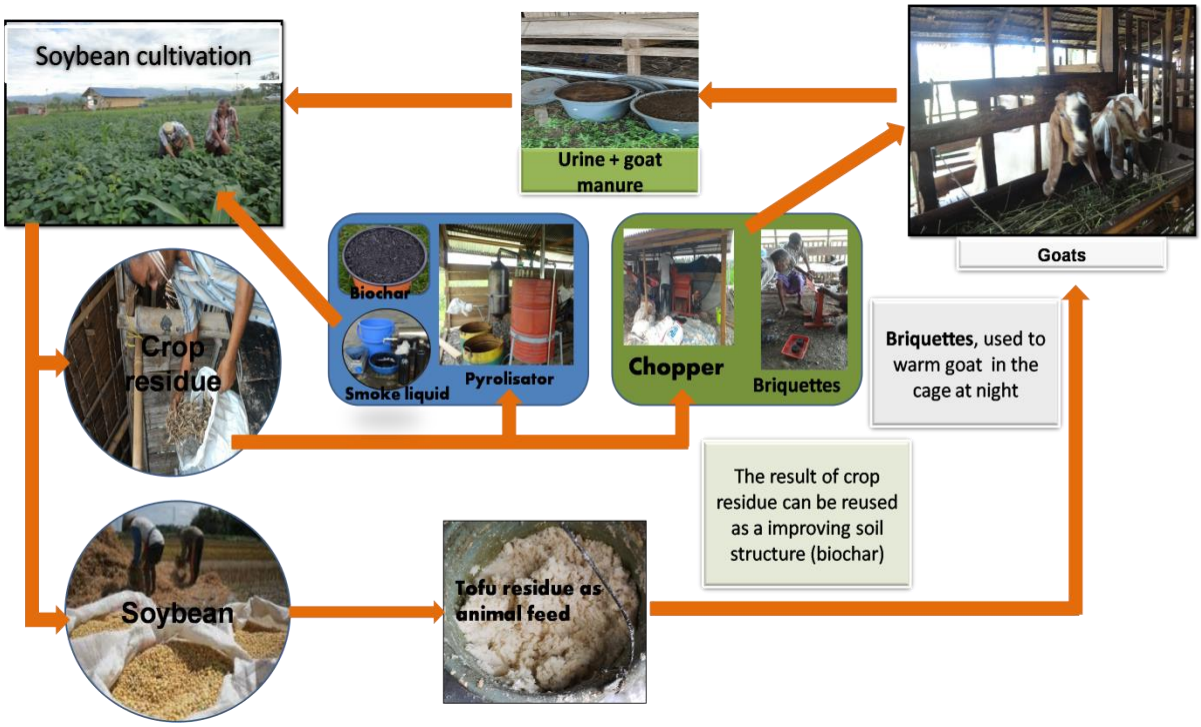


Figure 3. Implementation concept based bioindustry integration of crop-livestock Gampong meunasah Dayah, Sakti subdistrict, Pidie regency.

Table 2. Data components and saprodi value before and after applying crop-livestock bioindustry.

| Treatment / Production Facility | Price (Rp/kg) | Technology before applying bioindustry concepts. | | Technology after applying bioindustry concepts. | |
|---|---|---|---|---|---|
| | | Volume (kg) | Total (Rp) | Volume (kg) | Total (Rp) |
| - Seed | 14.000 | 50 | 700.000 | 35 | 490.000 |
| - Inorganic fertilizers | 3.500 | 100 | 350.000 | 75 | 262.500 |

| | | | | | |
|---|---|---|---|---|---|
| - (NPKp) | | | | | |
| - Insecticide | 150.000 | 2 | 300.000 | 2 | 300.000 |
| - organic fertilizers | - | - | - | There is no purchase | 0 |
| - Fungicide | 120.000 | 1 | 120.000 | 1 | 120.000 |
| **Labor (**person days**)** | | | | | |
| - Preparation of Land | 50.000 | 10 | 500.000 | - | - |
| - Cultivation | 50.000 | 15 | 750.000 | 17 | 850.000 |
| - Weeding | 50.000 | 30 | 1.500.000 | 15 | 1.500.000 |
| - Fertilization | 50.000 | 4 | 200.000 | 19 | 200.000 |
| - Spraying | 10.000 | 4 | 40.000 | 4 | 40.000 |
| - Harvesting | 50.000 | 15 | 750.000 | 15 | 750.000 |
| - Defoliation 10% of yield (kg) | 7.000 | 192 | 1.344.000 | 239 | 1.673.000 |
| - freight | 50.000 | 4 | 200.000 | 5 | 250.000 |
| Total Cost of Production | | | *6.666.500* | | *6.523.000* |
| Yield (kg/ha) | | | 1.920 | | 2.390 |
| Price (Rp/kg) | | | 5.500 | | 5.500 |
| Income bruto (Rp/ha) | | | **10.560.000** | | **13.145.000** |
| Income netto (Rp) | | | **3.893.500** | | **6.622.000** |
| B/C ratio | | | **0,58** | | **1,02** |

Mantau (2015) reported that data analysis using cost benefit analysis (benefit-cost analysis). Approach to pricing in the cost factors using real-time pricing approach (financially) for a one year period of the business (2 planting). Results of benefit cost analysis for plant bioindustry are 1.02 meaning bioindustry models that have integrated crop-livestock applied by cooperator farmers could be increase yields and feasible to be implemented by the farmer cooperators and non-cooperators other. Model bioindustry plants that have been integrated with livestock that utilize animal waste (urine and feces) as a liquid organic fertilizer and insecticide (urine goats). While the farming activities undertaken by non cooperator farmers have rated a high risk if implemented as it is very dependent on the price, if the price at harvest below the price estimated (Rp. 5,500), then the farmer will lose money (the B / C ratio below < 1).

Blakely and Bade (1991), stated goats can be consume more dry matter compared to his size (5-7% of body weight), whereas in cattle only 2-3% of their body weight. Besides goats could be digest efficiently feed containing a high crude fiber compared to cows or sheep (Blakely and Bade, 1991). In the model of bioindustry cattle, goats are kept together by a group of farmer cooperators stabled there are 18 heads, consisting of two males and 16 females aged an average of 1 (one) year. The amount of forage provided in the form of grass and leguminose of 10% of the weight of livestock and given additional concentrate 10% of the amount of forage. Final weight gain of goats reared intensively for three months range from 37 % -41.5 %.

## IV. CONCLUSIONS

The consepts based bioindustry integration betwen crop-livestock (soybean and goats) to be one way to increase the productivity of agricukture land through synergistic relationships through the use of plant waste into animal feed and processing of livestock

waste into fertilizer for plants. It is necessary to replication the model/consepts based bioindustry crop-livestock integration in other districts. The integration of various commodities can be depend potential of the area. Final weight gain of goats reared intensively for three months range from 37%-41.5%. Results of benefit cost analysis for bioindustry consepts are 1.02 meaning bioindustry consepts on integrated crops-livestock that which applied by the other farmers.

Bioindustry model/concepts based on crop-livestock integration can be one way to improving the agriculture land and suistainable, directly to organic farming with low external input suistainable agriculture (LEISA).

## THANK-YOU

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