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# Model of organic fertilizer utilization made from local agricultural waste as soil fertilizer in Riau Province

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## *ABSTRACT*

*In general, land in Riau Province has low fertility due to originated from sedimentary rock material and alluvial material that have a low natural fertility. Application of organic fertilizer is a way to improve soil fertility aside from chemical fertilizer. Sources of organic fertilizers in Riau are abundanly. However, it was utilized optimally. This study aimed to find the utilization model local organic materials as soil fertilizer in Riau Province. This research is divided into two stages. The first step was to identify the local organic materials in Kampar Regency, using the data that issued by Central Beureau of Statistic, as well as annual reports from relevant agencies. While, the second stage was to formulate strategy and model of utilization of local agricultural waste as sources of organic fertilizer in Kampar Regency. The result of the research shows that the source of local raw materials of organic fertilizers originating from food crops (rice, corn, peanuts, soybeans, and green beans), plantation area (oil palm), and livestock in Riau Province. Organic fertilizer development strategy: 1) Utilization of existing raw materials optimall, accurately and purposefully, supported by sustainable program, 2) Increased market access and promotion, 3) Provision of business capital with partnership system, 4) Integrated development of organic fertilizer development.*

***Keywords :*** *utilization model, organic fertilizer, raw materials, local, Riau*

## INTRODUCTION

Organosol and red-yellow-podzolic soil found widespread in Riau Province. In general, these soil originated from sedimentary rock material and alluvial material that have a low natural fertility. Harjoso (2002) said that Red-yellow-podzolic soil has sensitive to erosion, percolation, low infiltration, low soil pH, high of Al content, low organic content and low availability of nutrients. In addition, significant amount of rainfall during the year in Riau province leading to runoff from agricultural field. Sharpley et al. (2001) stated that nutrients in runoff may be caried in soluable fractions or absorbed onto sediment.

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In Riau Province, organosol soil is around 5,065,600 ha, and red-yellow-podzolic soil is around 2,746,600 ha. The organosol soil spread on the flat area, unlike red-yellow-podzolic spread on the hill region (Table 1).

Tabel 1. Kind of soils in Riau Province

| No. | Kind of soils | ha |
|---|---|---|
| I. | Flat area | |
| 1. | Organozol dan gley humus | 5,065,600 |
| 2. | Hidromorf kelabu | - |
| 3. | Red yellow podzolic | 2,156,000 |
| 4. | Red yellow podzolic | 68,000 |
| II. | Hill region | |
| 1. | Podzol | 209,600 |
| 2. | Red yellow podzolic | 218,200 |
| 3. | Red yellow podzolic (complex) | 94,800 |
| 4. | Red yellow podzolic latosol and litosol | - |

Source: Central Beureau of Statistic, 2009a

The use of organic fertilizers improve the rate of soil water intake, increase soil resistance to erosion, improve biodiversity, and reduce the use of inorganic fertilizers. Besides that, organic fertilizers will not leave residues in the crops so it is safe for the environment and human health. Moreover, organic fertilizer utilization improving soil structure and indirectly improving soil productivity.

The large requirement of organic fertilizer but its limited availability in the field become the main problem to increase soil organic matter. On the other hand, Riau has abundant sources of organic material coming from crops, plantations and livestock. Therefore, this study is valuable to identify potential local raw material such as agricultural waste to increase soil organic matter and contributing to improve soil fertility in Riau province.

The objective of this study is to identify potential local agricultural waste, formulate strategy to use local agricultural waste and find out model of the utilization of local agricultural waste as organic fertilizer in Riau Province.

## MATERIALS AND METHODS

### Type and research approach

The study of this researchis a descriptive study that makes a systematic, factual and accurate picture of characteristics and relationships between the phenomena that investigated. Descriptive method is fact finding with the right

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interpretation. According to Nazir (1999), descriptive research is a study to find facts with the right interpretation. This study is divided into two stages, the first stage is to identify local agriculltural waste in Kampar Regency, Riau Province. While the second stage is the formulation of local organic fertilizer development strategies in Kampar Regency.

**Study area**

Kampar was chosen as the study area, because Kampar Regency was considered suitable as it is close to Pekanbaru, the capital city of Riau. In addition, Kampar is accessible, and has complete sources of local agricultural waste and infrastructure to support organic fertilizer development.

**Types of data and sampling technique**

The data collected in this study consist of primary and secondary data. Primary data were collected by field observations and interviews of 100 farmers. The primary data were also derived from self-administered questionnaires prepared by the researcher. In addition, purposive sampling was employed. The information obtained from the interviews provided primary research data that supported the study. Primary data included respondent characteristics and field observation results. Secondary data were collected from agricultural institutions, including the Centre of Data and Agricultural Information Systems, Indonesian Ministry of Agriculture, Agricultural Agency of Riau Province and the Riau Central Bureau of Statistics, as well as form the annual reports of other agencies relevant to the focus of this study.

**Data analysis**

The data obtained were analyzed descriptively qualitative and quantitative to achieve the study objectives. The collected data is tabulated, then grouped by type. While the data analysis used to obtain the strategy of developing and utilizing organic fertilizer as a growing medium and soil fertilizers is a survey method using SWOT analysis, which combines Internal Factors (Strength/Strength and Weakness) and External Factors (Opportunity/Opportunity and Threat/Threat) (David, 2002).

## RESULTS AND DISCUSSION

### The potential of agricultural waste as a source of organic fertilizer in Riau Province

The productive agricultural area provides harvested yield and harvested by-product such as agricultural waste. According to OECD statistical term (2018), agricultural waste is waste produced as a result of various agricultural operations. It includes manure and other wastes from farms, poultry houses and

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slaughterhouses; harvest waste; fertilizer run-off from fields; pesticides that enter into water, air or soils; and salt and silt drained from fields.

The potential of agricultural resources for food crops cultivated by farmers in the Kampar Regency was quite large. Efforts to improve productivity through intensification and organic fertilizers usage intended for land improvement and recovery. Harvested area of food crops for rice, corn, peanuts, soybeans and mung beans in Kampar Regency covering an area of 15,437 ha, consisting of wet-land 6,005 ha and dry land 5,686 ha. The corn area of 2,444 ha, peanut covering 624 ha, soybean 389 ha, and mung beans 289 ha (Table 2). Based on study results in Kampar Regency, it is known that only 50% of farmers know about the benefits of food crop waste for soil fertilizers.

Table 2. Harvested yield and potencial of agricultural waste used as soil fertillizer in Kampar Regency

| Commodities | Harvested Area (ha) | Yield (ton) | Harvested by-product (ton) | Potencial of agricultural waste (ton) | Compost production (ton) |
|---|---|---|---|---|---|
| Paddy-wet land | 6,005 | 28,.607.54 | 30,025 | 15,013 | 7,506 |
| Paddy-dry land | 5.686 | 5,694.49 | 28,430 | 14,215 | 7,108 |
| Corn | 2,444 | 10,038.47 | 19,552 | 9,776 | 4,888 |
| Peanut | 624 | 1,316.29 | 2,496 | 1,248 | 624 |
| Soy bean | 389 | 602.61 | 778 | 389 | 194.5 |
| Mung bean | 289 | 443.77 | 578 | 289 | 145 |
| **Total** | **15,437** | | **81,859** | **40,930** | **20,465** |

Source: Central Beareau of Statistics, 2008a

For farmers who cultivate plantation crops, only 42.11% know the benefits of plantation waste, and 97.37% know about the benefits of livestock waste for soil fertilizers as compost. The total plantation area in Kampar District in 2008 which included rubber, coconut, oil palm, cocoa and areca nut reached 413,333 ha. Of the several commodities, palm oil contributed the largest to 311,137 ha (Central Beureau of Statistic, 2009). Production of oil palm plantations will produce oil palm by-product such as large quantity of empty fruit bunches. The rapidly increasing demand for organic fertilizer is one of the opportunities for the use of empty fruit bunches into compost. Empty fruit bunches through the decomposition process can be used as fertilizer that is enrichedof nutrients such as N, P, K, and Mg as needed by plants.

Rice harvested by product which is in the form of rice straw waste converts per hectare to 5 tons. Depreciation of fresh straw into compost reaches 50%. For maize, the yields of corn harvest in the form of stems, leaves and cob produce 8-10 ton/ha of dry corn waste (Subandi and Zubachtirodin, 2004; Yasa

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and Adijaya, 2004; Sariubang et al. 2000). For peanut plants can produce biomass of 4 ton/ha (Sumarno, 1986), soybean plants produce 2 ton/ha (Puslitbangtan, 2007), and mungbean at 2 ton/ha.

Table 3. Oil palm area, production, potency of oil palm empty bunches and compost in Kampar Regency

| Commodity | Immature plant area (ha) | Mature plant area (ha) | Production (ton) | Oil palm empty bunches (ton) | Compost production (ton) |
|---|---|---|---|---|---|
| Oil Palm | 41,838 | 119,033 | 467,747 | 93,549.4 | 74,839.52 |

Source: Central Beureau of Statistic, 2008a

Livestock in Kampar Regency consist of ruminants and poultry, namely cattle, buffaloes, goats, laying hens, broilers, domestic chickens, and ducks (Ditjennak, 2006) (Table 4).

Tabel 4. Population of livestock in Kampar Regency

| Kind of Livestock | Population (head) | Agricultural waste from livestock (ton) | Manure Production (ton) |
|---|---|---|---|
| Cattle | 14,914 | 12,383.67 | 6,191.83 |
| Buffaloes | 18,923 | 18,816.45 | 9,408.23 |
| Goats | 13,368 | 280,07 | 140,04 |
| Laying hen | 243.21 | 17,75 | 8,88 |
| Broilers | 12,076,057 | 3,526.21 | 1.763,10 |
| Domestic chicken | 418,447 | 183.28 | 91,64 |
| Ducks | 28,262 | 16,51 | 8,25 |
| **Total** | | **35,224.00** | **17,611,88** |

Source: Central Beureau of Statistic, 2008a

In agricultural system, the existence of livestock is able to increase subsistence collateral through diversification of types of businesses to produce food for farm families, transfer nutrients and energy between animals and plants through manure. According to Dwiyanto and Handiwirawan (2004) there are eight advantages obtained in the application of integrated farming systems between food crops and livestock namely: 1) diversification of the use of production resources, 2) reducing the occurrence of risks, 3) efficiency of labor use, 4) efficient use of production components, 5) reduce dependence on chemical energy, biological energy and input other resources from outside, 6) more sustainable and non-polluting ecological systems 7) increase output and 8) develop more stable farm households.

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**The development strategies for organic fertilizer utilization in Riau Province**

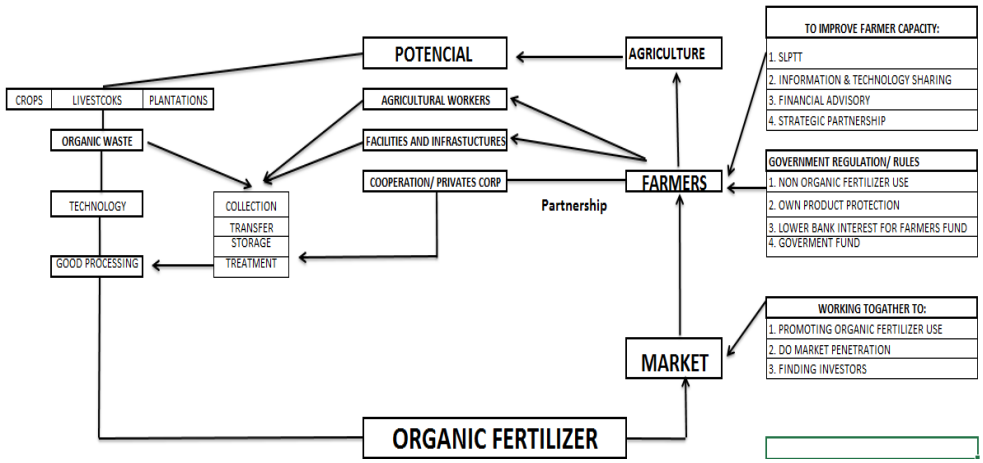
Several alternative strategies obtained from SWOT matrix can be made a sequence as ranking that shows the level of importance. This level of importance is seen from the score obtained through the total scores from each of internal and external factors. The highest score places an alternative strategy in the top rank until the lowest score that places the alternative strategy at the lowest rank. The results of the calculation of scores and ratings are as shown in Table 5.

Table 5. Several alternative strategies from SWOT matrix

| Alternative Strategies | Score | Ranking |
|---|---|---|
| 1. Utilization of existing raw materials optimally, precisely and directed, supported by sustainable programs | 2.54 | 1 |
| 2. Increased market access and promotion | 2.02 | 2 |
| 3. Provision of venture capital with a partnership system | 1.96 | 3 |
| 4. Integrated development of organic fertilizer development | 0.81 | 4 |

Source: research result

**The development model for organic fertilizer utilization in Riau Province**




## CONCLUSIONS

This study aimed to identify the potential of local agricultural waste, formulate strategy to use local agricultural waste and find out model of the utilization of local agricultural waste as organic fertilizer in Riau province. The results indicated Kampar Regency can produce compost from the remaining

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crop yields of 20,465 ton/year, from plantation crops by 74,839.52 ton/year, and from livestock waste by 17,611.88 ton/year. From the results of the IFE analysis, a strategic factor in the most important strength element in the development of the use of organic fertilizer is the availability of raw materials for organic fertilizers because it has the highest impact on the position of developing strategies for the use of organic fertilizers. Factors of limited business capital and limited facilities and infrastructure are the main weaknesses of the regional and community/farmers/breeders in Kampar District. Limited business capital and limited facilities and infrastructure in processing and utilizing organic fertilizer will make it difficult for the community/farmers/breeders to obtain better organic fertilizer results. Development strategy for organic fertilizers: 1) Utilization of existing raw materials optimally, appropriately and directed, supported by sustainable programs, 2) Increased market access and promotion, 3) Provision of venture capital with a partnership system, 4) Integrated development of organic fertilizer development.

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