# FINAL REPORT

# FIRST PHASE
# STUDY ON POTENTIAL MARKET OF COPPER AND ZINC FERTILIZER AND GYPSUM SOIL ENHANCER IN INDONESIA

**Prepared by**
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**for**
**PT MERDEKA COPPER GOLD, Tbk**

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# PREFACE TO THE FINAL REPORT

It is our pleasure to provide on schedule this Final Report of the First Phase Study on Potential Market of Copper and Zinc Fertilizer and Gypsum Soil Enhancer in Indonesia, an applied research cooperation between PT Merdeka Copper Gold, Tbk and Biotech Center, IPB University under Consulting Agreement No. 008/MCG/CLT/X/2021. In this Final Report, we have added an Executive Summary and the spatial distribution of Indonesian agricultural centers are given as separate maps scaled to provincial level with regency and district boundaries. These centers represent the potential target market areas of Cu and Zn fertilizers and gypsum soil enhancer that will be produced soon by PT Merdeka Copper Gold, Tbk. Therefore, these areas will be of priority to be considered for conducting demonstration plots or field trials of the fertilizer products within the Second Phase of the study, particularly at districts with the largest area in the chosen regencies.

As the main objective of the first phase study, which is to estimate the potential market size, it can be summarized that the total Indonesian potential market for Cu and Zn fertilizer and gypsum soil enhancer in the first quarter of 2022, calculated as pure Cu, pure Zn, and gypsum, are 18,002; 25,655; and 156,295 ton per year, respectively. When converted into Cu-Sulfate or Cu-EDTA and Zn-Sulfate or Zn-EDTA, the Cu and Zn fertilizer types most preferred by the potential user, the estimated amount of the potential market becomes 69,238 Cu-Sulfate or 120,013 Cu-EDTA and 71,263 Zn-Sulfate or 256,548 ton Zn-EDTA per year. It is necessary to point out that the process of market sizing was carried out in a conservative way, meaning that the estimated potential market size obtained was based on the lowest scenario. Therefore, there are still considerable opportunities to increase it even up to the size of the total addressable market.

Sulfate and EDTA are inorganic and organic anions required to produce the fertilizer substance, which then can be manufactured as solid, liquid, or solid fertilizer to be dissolved in water by the user and applied as liquid fertilizer. Cu- and Zn-sulfate as well as Cu- and Zn-EDTA are also the two commonly distributed fertilizer formulas in the existing Indonesian market. Sulfate formula is preferred by users cultivating crops in mineral soils especially for paddy rice, horticultural crops, and oil palm, while EDTA formula is preferred especially for oil palm plantation cultivated in peat soils. Intensive paddy rice, potato, onion, chili peppers and plantation oil palm are the five most cultivated crop commodities in Indonesia that necessitate the application of Cu and Zn fertilizer for their optimal growth and productivity.

We, Biotech Center IPB University, hope that this Final Report satisfactorily meets the needs and expectations of PT Merdeka Copper Gold, Tbk concerning information on the present potential market of Cu and Zn fertilizer and gypsum soil enhancer in Indonesia. It is our belief that this information is crucial in the near future to the preparation of good planning and best strategies to the ecologically friendly and profitable utilization of Cu-sulfate, Zn-sulfate, and gypsum materials produced from the mining processes undertaken by PT Merdeka Copper Gold, Tbk.

Bogor, 30-03-2022
Biotech Center IPB University

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# EXECUTIVE SUMMARY

Fertilizer recommendations and fertilizer subsidies provided by the Government of Indonesia are basically only for N, P, and K macronutrient fertilizers. High P and K nutrient levels are presently found in almost all the intensive rice cultivation area in Java, Bali, Lombok, Sumatera, and Kalimantan. It causes nutrient imbalances in soil and depresses the availability of micronutrients, especially copper (Cu) and zinc (Zn). One way to overcome this problem is to rebalance the use of synthetic fertilizers, especially for rice and other strategic crop commodities, by applying micronutrients fertilizer, especially Cu and Zn, as well as organic and inorganic soil enhancers such as manure, calcite, dolomite, gypsum etc. Gypsum ($CaSO_4.nH_2O$) contains approximately 23% Calcium (Ca). So, apart from being a soil enhancer, it also provides Ca as plant essential macronutrient. Application of gypsum improves absorption of water and nutrients by plant roots and reduce soil toxicity caused by aluminum (Al) and excessive iron (Fe). Recently, biofertilizers have also been used to increase rice production.

PT Merdeka Copper Gold, Tbk is a world-class mining company in Indonesia that also produces Cu and Zn and gypsum as by-products of its mine ore primary processing. From these by-products, it can still be extracted through secondary refinery processing a significant amount of Cu-sulfate, Zn-sulfate, and gypsum, which are important products to be utilized as sources or raw materials to produce Cu and Zn fertilizers and gypsum soil enhancer. In this regard, this first phase study is carried out to analyze the potential market of Cu and Zn fertilizer and gypsum soil enhancer in Indonesia, while the second phase will focus on the product formulation and development as single or compound fertilizers or additive for macronutrient fertilizers as well as soil enhancer and their trials to increase the productions of food, horticulture, and plantation crops as well as the Indonesian farmers' welfare.

The overall goal of the first phase study can be broken down into specific objectives as follows: (1) identification of potential agricultural centers that most likely require Cu and Zn fertilizer or gypsum soil enhancer or both, (2) identification of potential user preference on type(s) of Cu and Zn fertilizer or gypsum soil enhancer or both, (3) to find out potential competitors of Cu and Zn fertilizers and gypsum soil enhancer providers in the existing market, and (4) estimation of potential market or current and future consumption of Cu and Zn fertilizer and gypsum soil enhancer in Indonesia.

The first objective was attained by applying GIS approach and digital soil mapping technique on agricultural center area that were considered requiring Cu and Zn fertilizer as well as gypsum soil enhancer for cultivating the 8 main economic crops in Indonesia. The area consisted of intensive paddy soils, high-pH paddy soils, seawater intrusion affected paddy soils, tidal affected paddy soils, soils for horticulture development of potatoes, red onions, and chili peppers, and peat as well as mineral soils for oil palm plantation development. The second one was attained by evaluating the results of in-depth interview guided by questionnaires. To provide *Consumer Education*, information concerning the roles, functions, dosage, and application methods of Cu and Zn fertilizer and gypsum soil enhancer were included in the questionnaires. The third objective was attained by making use the available secondary data and expert judgement. The fourth one was attained by identifying recommended dosage of Cu and Zn fertilizer and gypsum soil enhancer based on the available secondary data, results of in-depth interview and field verification, and by applying the "total addressable market (TAM)~actual demand (AD)~ potential demand (PD)~potential competitor market share (PCMS)" approach, in which the Potential Market is a function of TAM, AD, PD, and PCMS. TAM is the total identified areas requiring the fertilizers and soil enhancer multiplied by recommended dosage, AD is TAM after deduction by reducing factors, PD is AD multiplied by growth rate, and PD subtracted by PCMS becomes the Potential Market size.

The results of the first phase study are described as follows. The main intensive paddy soils were distributed in 7 provinces, namely Central Java, East Java, West Java, South Sulawesi, Banten, South Sumatera, and Lampung, in

which around 1,223,813 Ha of the area were potentially deficient in and therefore requiring Cu and Zn fertilizer. The main high-pH paddy soils were distributed in 4 provinces, namely Central Java, East Java, East Nusa Tenggara, and Special Region of Yogyakarta with area of around 136,625 Ha were potentially requiring Cu and Zn fertilizer as well as gypsum application. Paddy soils affected by seawater intrusion were mainly distributed in 3 provinces, namely West Java, Central Java, and East Java and of around 98,716 Ha of the area were also potentially requiring Cu and Zn fertilizer as well as gypsum application. Tidal affected paddy soils were mainly distributed in the islands of Sumatera and Kalimantan in which around 669,145 Ha of the area were potentially requiring Cu and Zn fertilizer. The horticulture development area was mainly distributed in 8 provinces, namely West Java, Central Java, East Java, West Sumatra, North Sumatera, Jambi, West Nusa Tenggara, and South Sulawesi where around 277,880 Ha of which were potentially deficient in Cu and Zn. The islands of Sumatera and Kalimantan were also central area for the development of oil palm plantation in which 17,474,712 Ha were potentially deficient in Cu and Zn.

The application of micronutrient fertilizers on small-scale farming generally conducted by very few farmers under *trial-and-error* approach. The farmers' group who was most familiar with micronutrient fertilizer application was horticulture farmers. Oil palm plantation corporate users have a better knowledge on the micronutrient fertilizers. However, not all corporations have applied micronutrient fertilizers for their crops. The preferred types of Cu and Zn fertilizer given by the potential users were Cu-sulfate, Cu-EDTA, Zn-sulfate, and Zn-EDTA and gypsum as pure $CaSO_4$ as possible. The demand of Cu and Zn fertilizer and gypsum was *seasonal* in nature and followed *users' segmentation* and *purchasing power*. There was a tendency of *different dosage preference* in the *acquisition mode of different types* of fertilizers. Response and feedback from the respondents reflected their *willingness to accept* Cu and Zn fertilizer and gypsum soil enhancer and this supported the idea of market development to potential customer and at the same time confirmed the need for customer education for a better market penetration.

The addition of micronutrients was generally done through the application of macronutrients that contain micro-nutrients. The production of micronutrient fertilizers in Indonesia has been conducted by several companies, namely PT Pupuk Sriwijaya, PT Sentana Adidaya Pratama, PT Nusa Palapa Gemilang, and PT Meroke Tetap Jaya, among a few others. There is only one gypsum producer, namely PT Petro Jordan Abadi. These companies are currently the potential competitors as producer of Cu and Zn fertilizer and gypsum soil enhancer.

The total Indonesian potential market for Cu and Zn fertilizers and gypsum soil enhancer in the first quarter of 2022, calculated as pure Cu, pure Zn, and gypsum was respectively 18,002; 25,655; and 156,295 ton per year. When converted into Cu-Sulfate or Cu-EDTA and Zn-Sulfate or Zn-EDTA, the most preferred Cu and Zn fertilizer types by the potential user, the estimated amount becomes 69,238 Cu-Sulfate or 120,013 Cu-EDTA and 71,263 Zn-Sulfate or 256,548 Zn-EDTA in ton per year. The process of market sizing was conducted in a conservative way. Therefore, there are still considerable opportunities to increase it even up to the total addressable market size.

As of the existence of the currently high potential market for Cu and Zn fertilizers and gypsum soil enhancer, PT Merdeka Copper Gold, Tbk is highly recommended to take this strategic opportunity of utilizing raw material for producing both micronutrient fertilizers and gypsum soil enhancer as part of its mine processing by-products management in an ecologically friendly and profitable manner. Therefore, it is suggested to immediately conduct the second phase of the study particularly to formulate, develop, and produce at a pilot scale the most preferred types of Cu and Zn fertilizers and gypsum products to test their effectiveness in increasing yields and thus income and farmers' welfare of the most economically important crops, through green house and field trials in selected agricultural centers in Indonesia considered to perform significant positive responses, to be used as attractive demonstration plots for the purpose of product promotion. Then, based on the results of the trials, improvements to produce products with a better quality should be done concerning their physical type and chemical blending composition, purity of the nutrient content, pricing and strategic commercialization. It is also highly recommended to conduct customer education for a broader market penetration as the goal. It is about the primary time to do so.

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# I. INTRODUCTION

## 1.1. Background

Synthetic fertilizers have been used and proven to be able to improve agricultural production in Indonesia. Its use has increased rapidly since the implementation of agricultural intensification programs through the BIMAS (*Bimbingan Massal* or Mass Guidance) and INMAS (*Intensifikasi Massal* or Mass Intensification) programs which began in Java ricefields in the late 1960s. Up to now, through these programs, the nutritional requirements of plants – especially food crops – have only been fulfilled by the application of macronutrient fertilizers, mainly nitrogen (N), phosphorus (P), and potassium or kalium (K). However, fertilizer recommendations issued as well as fertilizer subsidies provided by the government are basically only for N, P, and K macronutrient fertilizers and are too general or not site specific. It has been so – provided without considering differences in soil characteristics, soil nutrient status, and agroclimatic conditions of different cropping areas in Indonesia – until the Minister of Agriculture Regulation No.01/Kpts/SR.130/1/2006 concerning local specific fertilization of N, P and K for paddy rice was enacted since 3 January 2006.

Continuous macronutrients fertilization causes nutrients excess or accumulation in soils, especially for P and K. High P and K nutrient levels were presently found in almost all the intensive rice cultivation areas in Java, Bali, Lombok, Sumatera, and Kalimantan. The high level of P and K causes nutrient imbalances in soil. This condition depresses the availability of micronutrients, especially copper (Cu) and zinc (Zn), which further impacts negatively to the soil and crop productivity over time, especially when the crop cultivation uses seeds or transplants of high-yielding varieties. In addition, continuous intermittent waterlogging of ricefields for years also causes iron (Fe), in the form of $Fe^{2+}$ or ferrous cations, to be released from soil colloids to soil solution and covers the plant roots that subsequently interferes with the other essential macro- and micro-nutrients absorption. This disturbance of nutrient uptake by excessive $Fe^{2+}$ decreases paddy rice production significantly and can only be overcome or balanced by the addition of other micronutrients, mainly Zn.

Continuous use of macronutrients fertilizers without being balanced with the addition of micronutrients as well as the decrease in soil organic matter content are the main causes of rice production stagnation in Indonesia. The rice production within the last 20 years (2001–2020) only grew at 0.73 percent per year (Santosa 2021). Meanwhile, the population growth rate reached 1.3–1.4 percent per year in the same period. Moreover, in the current government period (2015 – 2020), rice production was decreasing by – 0.13 percent per year. Disparity between the increase in rice production and the population growth has caused imports of wheat as a staple food for the Indonesian population to increase rapidly from 3.75 million tons (2001) to 10.52 million tons (2020). In addition to wheat, in which 100 percent of its demand must be supplied by imports, importations of rice are also relatively high, with an average of 0.93 million tons per year for the last 20 years (2001–2020) (Santosa 2021).

If the above-mentioned conditions are not addressed carefully, Indonesia's dependence on food imports will become increasingly high, which threatens political and national stability when the world food prices spike sharply. One way to overcome this problem is to rebalance the use of synthetic fertilizers, especially for rice and other economically important crops, by adding micronutrients fertilizer, especially Cu and Zn, as well as the application of organic and inorganic soil enhancers such as manure, calcite, dolomite, gypsum etc. Recently, biofertilizers have also been used to increase rice production in Indonesia.

Micronutrients-containing fertilizers, especially Cu and Zn, are still less known and rarely used by the food crop farmers in Indonesia. On the contrary, horticulture and oil palm plantation farmers are already familiar with it, although their use is still limited.

Sources of micronutrient fertilizer are varied considerably in their physical state, chemical reactivity, price, solubility, nutrients content and availability to plants. Some of the commonly used Cu and Zn sources are listed in ***Table 1.***

***Table 1. Sources of Cu and Zn fertilizers***

| Source | Solubility in $H_2O$ | Percent Element |
|---|---|---|
| ***Copper*** | | |
| $CuSO_4.5H_2O$ | Soluble | 26 |
| Cu-EDTA | Soluble | 15 |
| CuO | Insoluble | 50-75 |
| ***Zinc*** | | |
| $ZnSO_4.H_2O$ | Soluble | 36 |
| $ZnSO_4$ - $NH_3$ complex | Soluble | 10-15 |
| Zn-EDTA | Soluble | 6-14 |
| Zn oxysulfate | Variable | 18-50 |
| ZnO | Insoluble | 60-78 |

Source: Mordvedt (2021)

In addition to micronutrient fertilizers, application of soil ameliorants, soil amendments, or soil enhancers are also important to improve agricultural production sustainably. One of the important soil enhancers is gypsum ($CaSO_4.nH_2O$). Apart from being a soil enhancer, gypsum also provides crop essential cationic macronutrient, namely Calcium (Ca). Gypsum contains approximately 23% Ca. Application of gypsum as soil enhancer plays a beneficial role for plant in absorption of rain waters and thus improving soil structure of specifically acid dry lands in such a way that crop roots can absorb water and nutrients better. Therefore, adding gypsum into steep-sloping dry lands can also increase soil resistance to erosion and reduce soil toxicity caused by aluminum (Al) and excessive Fe. While its effect in increasing soil pH is not as significant as those of liming materials such as calcite ($CaCO_3$) and dolomite ($Ca.Mg.CO_3$), numerous studies, however, have shown that the addition of gypsum can significantly increase crop growth and yield.

PT Merdeka Copper Gold Tbk is a world-class mining company in Indonesia that produces Au (gold), Ag (silver), Cu, Zn, and other related metals. In addition to these primary minerals, PT Merdeka Copper Gold Tbk also produces Cu and Zn and gypsum as by-products of the mine ore primary processing. From these by-products, it can still be extracted through secondary refinery processing a significant amount of Cu-sulfate, Zn-sulfate, and gypsum. These

products are important raw materials or sources to produce Cu and Zn fertilizers and gypsum soil enhancer.

In this regard, it is necessary to conduct a study to analyze the potential market of Cu and Zn fertilizers and gypsum soil enhancers, their products formulation, development, and field trials to increase the productions of food, horticulture, and plantation crops, as well as forest plantation trees and the successfulness of revegetation in ex-mine land reclamation areas in Indonesia.

The study will be carried out in two phases. The main objective of the first phase study is to analyze the potential market of Cu and Zn micronutrient fertilizers and gypsum soil enhancer. By the completion of this Final Report, the first phase study has been carried out on schedule.

The second phase study is aimed to formulate and develop Cu and Zn fertilizer products based on the results of the first phase study, either as single or compound fertilizers or additive of macronutrient fertilizers and soil ameliorants, and gypsum soil enhancer product. The second phase study also includes field trials of the products to evaluate their effectiveness and efficiencies in increasing growth and yields of various economically important crops in Indonesia, including food, horticulture, and plantation crops. The second phase study will be carried out for 18 effective months and begins after the completion of the first phase study.

The first phase study was conducted by a team of senior experts consisting of natural resource economists, soil chemistry, fertility and fertilizer expert, agriculture cultivation and GIS expert, agricultural economist, and experts consisting of bioeconomist, soil chemistry and fertility expert, and soil fertility and fertilizer expert supported by expert assistants, administrative staffs and farmer groups who are members of the Indonesian Seed Bank and Farmer Technology Association (*Asosiasi Bank Benih dan Teknologi Tani Indonesia* or AB2TI).

### 1.2. Goals

The first phase study was related to Cu-sulfate, Zn-sulfate, and gypsum products being produced by PT Merdeka Copper Gold, Tbk and carried out to achieve the general goal of identifying the potential users (markets) of Cu and Zn micronutrient fertilizers as well as gypsum soil enhancer in Indonesia, while the formulation, development, and trials of Cu and Zn fertilizer and gypsum soil enhancer to be produced by PT Merdeka Copper Gold, Tbk to evaluate their performance or effectiveness in increasing growth and yield of various economically important crops among various users in Indonesia will be carried out in the second phase.

### 1.3. Objectives

The overall goal of the study can be broken down into specific objectives as follows.

First Phase

1) Identify potential agricultural centers based on soil and agroclimatic conditions in which the soils are most likely requiring Cu and Zn fertilizer, gypsum soil enhancer or both,

2) Identify potential users or actors at corporate and smallholder or community scales who in their agriculture activities need Cu and Zn fertilizers, gypsum soil enhancer or both,
3) Identify the preferences of agricultural actors on the kind(s) or type(s) of Cu and Zn fertilizer, gypsum soil enhancer or both that are needed in their farming areas,
4) Find out potential competitors of Cu and Zn fertilizer and gypsum soil enhancer provider in the existing market, and
5) Estimate the potential market or current and future consumption of Cu and Zn fertilizer in Indonesian fertilizer industries.

Second Phase

1) Formulate compositions and develop techniques for manufacturing several types of Cu and Zn fertilizers and gypsum soil enhancer based on the results of the first phase study concerning the preference of the potential users,
2) Conduct trials on the effectiveness of Cu and Zn fertilizers and gypsum soil enhancer that will be produced by PT Merdeka Copper Gold, Tbk to increase yield of food, horticulture, and plantation crops at greenhouse and field stage through a collaboration with farmers network of AB2TI based on the results of the first phase study concerning the potential cropping areas that require Cu and Zn fertilizers and gypsum soil enhancer application,
3) Identify the key items that impact the efficiencies and effectiveness of application of the PT Merdeka Copper Gold, Tbk's Cu and Zn fertilizers and gypsum soil enhancer products (grain size, chemistry in terms of percent elements and impurities, price, etc),
4) Identify any advantages and disadvantages with these different materials, particularly whether the results of assay or elemental analysis of raw materials and the products comply with the SNI (Standar Nasional Indonesia, the *Indonesian National Standard*) criteria of a single micronutrient fertilizer, compound micronutrient fertilizer, and solid soil amendment, especially whether Cu and Zn-oxides may add value as micro-nutrients and the maximum arsenic and any other contaminants or impurities content that are acceptable,
5) Assess the possible use of rock mineral fertilizer in Indonesia, and provide some guidance as to the required chemistry, particularly assess the potential usages of some PT Merdeka Copper Gold, Tbk's potential products (Si/Al rich materials) as a rock mineral fertilizer or their use as part of a blended rock mineral fertilizer.

The second phase study will be proposed in detail and conducted after the completion of the first phase study.

# II. LITERATURE STUDY

## 2.1. Fertilizer Provision Policy in Indonesia

Since the 1970s, Indonesia has used agricultural input subsidies, especially on fertilizer, to stimulate agricultural production, largely in pursuit of the goal of rice self-sufficiency (Warr and Yusuf 2014). The need for fertilizers, especially macronutrient fertilizers, is met from own production and imports (***Table 2***). It can be seen that China is the largest source of imported fertilizers, followed by Canada.

***Table 2. Import of fertilizer from various countries, 2015-2020***

| Origin Country | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| | | | x 1000 ton | | | |
| China | 2,065.6 | 2,206.3 | 2,408.3 | 2,339.2 | 1,914.5 | 1,654.1 |
| Canada | 1,400.1 | 1,220.6 | 1,266.1 | 1,269.4 | 963.3 | 1,203.8 |
| Russia | 667.8 | 673.5 | 962.3 | 1,044.1 | 818.7 | 743.3 |
| Malaysia | 356.3 | 288.3 | 328.6 | 344.0 | 99.2 | 103.7 |
| Belarusia | 652.3 | 517.6 | 660.9 | 738.8 | 640.2 | 568.9 |
| Egypt | 644.3 | 624.8 | 729.1 | 794.9 | 681.3 | 753.7 |
| Norwegian | 151.3 | 101.2 | 22.6 | 20.8 | 46.0 | 51.3 |
| Australia | 333.5 | 299.3 | 332.9 | 286.7 | 185.5 | 188.3 |
| Germany | 147.3 | 107.9 | 249.3 | 156.0 | 111.8 | 162.7 |
| Jordan | 107.1 | 131.9 | 257.9 | 281.3 | 1.0 | 0.0 |
| South Korea | 48.5 | 28.7 | 52.0 | 12.6 | 34.5 | 29.4 |
| Japan | 6.9 | 1.1 | 0.9 | 0.5 | - | - |
| Thailand | 0.5 | 5.0 | 1.4 | 1.7 | - | - |
| Philippines | 0.5 | 0.9 | 0.8 | 3.4 | - | - |
| Vietnam | 83.5 | 37.5 | 75.7 | 112.3 | 66.5 | 116.1 |
| Others | 229.7 | 266.0 | 578.7 | 677.4 | 572.0 | 673.4 |
| Total | 6,895.2 | 6,510.6 | 7 927.5 | 8,083.1 | 6,134.5 | 6,248.7 |

In general, there are two types of fertilizers circulating in Indonesia, namely subsidized fertilizers, and unsubsidized fertilizers. In order to suppress deviations in the distribution of subsidized fertilizers, the government needs to supervise their distribution. In this context, social capital plays a very important role in the proper implementation of the distribution of subsidized fertilizers (Rustinsyah 2015). The IMF once asked that this fertilizer subsidy be removed if Indonesia wanted to get help from the IMF to overcome the monetary crisis in the late 1990s (Rada *et al*. 2011).

The policy on fertilizers is limited to macronutrient fertilizers, particularly N, P, and K. Subsidized fertilizers are limited to Urea, SP-36 (Super Phosphate 36% $P_2O_5$), ZA (Zwavelfuur Ammonium or Ammonium Sulfate), NPK (compound fertilizer) and organic fertilizer. The policy concerns subsidies provided by the government to increase food production, especially rice,

corn, soybeans, and sugarcane. The policy is contained in Ministerial Regulation 49 of 2020 which regulates the allocation and the highest retail price. Subsidized fertilizers are included in goods under government supervision. As for non-subsidized fertilizers, including micro-nutrient fertilizers, the production, distribution, and use of it are left entirely to the market mechanism.

So far, there has been no discourse on subsidizing micronutrient fertilizers. It can be expected that the government will not allocate a budget to subsidize the price of micronutrient fertilizers. On the one hand, this provides an opportunity for fertilizer producers or prospective producers of micronutrient fertilizers to compete with market prices without distortion. On the other hand, however, the application of micronutrient fertilizers is developing slowly.

### 2.2. Role and Function of Cu and Zn Micronutrient on Crop Growth and Production

Micronutrients are elements that are essential for plant growth but are required in much smaller amounts than those of the primary nutrients N, P, and K. The micronutrients are boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), and chloride (Cl). For this study, discussions on supplying micronutrient fertilizers are confined to Cu and Zn micronutrients. This literature is obtained from Mortvedt (2021).

Deficiencies of micronutrients have been increasing in some crops. Some reasons are higher crop yields which increase plant nutrient demands, use of high NPK fertilizers containing lower quantities of micronutrient impurities, and decreased use of farmyard manure on many agricultural soils.

*Cu and Zn Micronutrient Nutrition*. A brief discussion of micronutrient functions and nutrient deficiency symptoms in plants and soil conditions affecting micronutrient availability serves to help understand their importance in crop production and to recognize symptoms of possible deficiencies is described as follows.

*Copper (Cu)* – Copper is necessary for carbohydrate and nitrogen metabolism, so inadequate Cu results in stunting of plants. Copper is also required for lignin synthesis which is needed for cell wall strength and prevention of wilting. Deficiency symptoms of Cu are dieback of stems and twigs, yellowing of leaves, stunted growth, and pale green leaves that wither easily. Copper deficiencies are mainly reported on organic soils (peat soils, Histosols), and on sandy soils which are low in organic matter. Copper uptake decreases as soil pH increases. Increased P and Fe availability in soils decreases Cu uptake by plants.

*Zinc (Zn)* – Zinc is an essential component of various enzyme systems for energy production, protein synthesis, and growth regulation. Zinc-deficient plants also exhibit delayed maturity. Zinc is not mobile in plants, so Zn deficiency symptoms occur mainly in new growth. Poor mobility in plants suggests the need for a constant supply of available Zn for optimum growth. The most visible Zn-deficiency symptoms are short internodes or rosetting and a decrease in leaf size. Chlorosis of rice is a characteristic of Zn-deficiency symptoms. Delayed maturity is also a symptom of Zn-deficient plants. Zinc deficiencies are mainly found on sandy soils low in organic matter and on organic soils (Histosols). Zinc deficiencies occur more in areas with low temperature and are related to reduced root growth and activity as well as lower microbial activity that decreases Zn release from soil organic matter. Zinc uptake by plants decreases

with increased soil pH. Uptake of Zn is also adversely affected by high levels of available P and Fe in soils.

*Cu and Zn Fertilizer Sources* – The three main classes of micronutrient sources are inorganic products, synthetic chelates, and natural organic complexes.

*Inorganic sources* include oxides and carbonates, and metallic salts such as sulfates, chlorides, and nitrates. The sulfates are the most common of the metallic salts and are sold in crystalline or granular form. An ammoniated $ZnSO_4$ solution is also used in polyphosphate starter fertilizers. Oxides of Mn and Zn are also commonly used and are sold as fine powders and in granular form. Because oxides such as ZnO are water insoluble, their immediate effectiveness for crops is rather low in granular form. Oxysulfates are oxides, usually industrial by-products, which have been partially acidulated with sulfuric acid, and generally are sold in granular form. The percentage of water-soluble Zn in oxysulfates is directly related to the degree of acidulation by sulfuric acid. Research results have shown that about 35 to 50 percent of the total Zn in granular Zn-oxysulfate should be in water-soluble form to be immediately effective for crops. Inorganic sources usually are the least costly sources per unit of micronutrient, but they may not always be the most effective for crops.

*Synthetic chelates* are formed by combining a chelating agent with a metal through coordinate bonding. Stability of the metal-chelate bond affects availability to plants of the micronutrient metals Cu and Zn. An effective chelate is one in which the rate of substitution of the chelated micronutrient for other cations in the soil is quite low, thus maintaining the applied micro-nutrient in chelated form. Relative effectiveness for crops per unit of micronutrient as soil-applied chelates may be from 2 to 5 times greater than that of inorganic sources, while chelates costs per unit of micronutrient may be 5 to 100 times higher. Several types of chelates are sold, so relative effectiveness values depend on the sources of chelates and inorganic products being compared.

*Natural organic complexes* are made by reacting metallic salts with some organic by-products of the wood pulp industry or related industries. Several types of these complexes are the lignosulfonates, polyflavonoids and phenols. The types of chemical bonding of the metals to the organic components are not well understood. Some bonds may be coordinate as in the chelates, but other types of chemical bonds also may be present. While natural organic complexes are less costly per unit of micronutrient, they usually are less effective than synthetic chelates. They also are more readily decomposed by microorganisms in soil. These sources are more suitable for foliar sprays and mixing with fluid fertilizers.

*Application with Mixed Fertilizers*. The most common method of micronutrient application for crops is soil application. Recommended application rates usually are less than 11.2 kg/Ha (on an elemental basis), so uniform application of micronutrient sources separately in the field is difficult. Therefore, both granular and fluid NPK fertilizers are commonly used as carriers of micronutrients. Including micronutrients with mixed fertilizers is a convenient method of application and allows more uniform distribution with conventional application equipment. Costs are also reduced by eliminating a separate application.

Four methods of applying micronutrients with mixed fertilizers are incorporation during manufacture, bulk blending with granular fertilizers, coating onto granular fertilizers and mixing with fluid fertilizers.

Incorporation during manufacture results in uniform distribution of micronutrients throughout granular NPK fertilizers. Because the micronutrient source is in contact with the mixed fertilizer components under conditions of high temperature and moisture, the rate of chemical reactions which may reduce the plant availability of some micronutrients is increased. For example, acid decomposition of ZnEDTA or any synthetic chelate may occur if they are mixed with phosphoric acid before ammoniation during manufacture, which results in reduced plant availability of the micronutrient. Immediate plant availability of applied Zn in granular ammoniated phosphates also decreases with the level of water-soluble Zn in these products.

Bulk blending of micronutrients with granular NPK fertilizers is a common practice. The main advantage is that fertilizer grades can be produced which will provide the recommended micronutrient rates for a given field at the usual fertilizer application rates. The main disadvantage is that segregation of nutrients can occur during the blending operation and with subsequent handling. Segregation results in no uniform application, which is critical with micronutrients since their application rates are quite low. Segregation can be minimized by properly matching particle sizes of micronutrient sources with those of the NPK components of the blend. Mechanical devices to minimize coning and segregation of the materials during handling and storage are available. Blending of various sized fertilizer particles results in no uniform application because of segregation in the applicator during transport and spreading operations.

Coating powdered micronutrients onto granular NPK fertilizers decreases the possibility of segregation, which is the main disadvantage of bulk blending micronutrients with mixed fertilizers. Fertilizer solutions are preferred as binding agents because the fertilizer grade is not decreased so much as with use of water, oils, and waxes. Some binding materials are unsatisfactory because they do not maintain the micronutrient coatings during bagging, storage, and handling. This results in segregation of the micronutrient sources from the granular NPK components. Agronomic effectiveness of micronutrients coated onto soluble granular NPK fertilizers should be similar to that with incorporation during manufacture. This method of micronutrient application is not commonly used because of the extra costs associated with coating.

Mixing micronutrients with fluid fertilizers has become a popular method of application. Clear liquids are commonly used as starter fertilizers for row crops and some micronutrients, especially Zn sources, are easily applied with these fluids. Solubility of some micronutrient sources is higher in polyphosphate fertilizers than in orthophosphate clear liquids. Micronutrients also may be applied with nitrogen solutions, but solubility of many sources is rather low. Compatibility tests should be made before tank mixing operations of micronutrients with fluid fertilizers are attempted; otherwise, problems could occur when incompatible sources are mixed. Suspension fertilizers are also used as micronutrient carriers. Oxides can also be applied with suspensions since complete solution is not required.

*Foliar Sprays.* Foliar sprays are widely used to apply micronutrients, especially Fe and Mn, for many crops. Soluble inorganic salts generally are as effective as synthetic chelates in foliar

sprays, so the inorganic salts usually are chosen because of lower costs. Suspected micronutrient deficiencies may be diagnosed with foliar spray trials with one or more micronutrients. Correction of deficiency symptoms usually occurs within the first several days and then the entire field could be sprayed with the appropriate micronutrient source. Inclusion of sticker-spreader agents in the spray is suggested to improve adherence of the micronutrient source to the foliage. Caution should be used because of leaf burn due to high salt concentrations or inclusion of certain compounds in foliar sprays.

Advantages of foliar sprays are: (1) application rates are much lower than for soil application; (2) a uniform application is easily obtained; and (3) response to the applied nutrient is almost immediate so deficiencies can be corrected during the growing season. Disadvantages of foliar sprays are: (1) leaf burn may result if salt concentrations of the spray are too high; (2) nutrient demand often is high when the plants are small and leaf surface is insufficient for foliar absorption; (3) maximum yields may not be possible if spraying is delayed until deficiency symptoms appear; and (4) there is little residual effect from foliar sprays. Application costs will be higher if more than one spray is needed unless they can be combined with pesticide spray applications.

*Micronutrient Application Rates.* Recommended Cu rates range from *3.36 to 11.2 kg/Ha* as $CuSO_4$ or finely ground CuO. Residual effects of applied copper are very marked, with responses being noted up to 8 years after application. Because of these residual effects, soil tests are essential to monitor possible Cu accumulations to toxic levels in soils where Cu fertilizers are being applied. Plant analyses can also be used to monitor Cu levels in plant tissues. Copper applications should be decreased or discontinued when available levels increase beyond the deficiency range. Recommended rates of Zn generally range from *1.12 to 11.2 kg/Ha*. Band or broadcast applications are used, but foliar applications are also effective. Band applications of Zn sources with starter fertilizers is a common practice for row crops. Foliar sprays of a *0.5% $ZnSO_4$* solution applied at a rate of *190 to 285 L/Ha* are also will supply sufficient Zn, but several applications may be necessary. As with Cu, residual effects of applied Zn are substantial, with responses found at least 5 years after application. Because of these residual effects, soil test levels of available Zn generally increase after several applications.

## 2.3. Role and Function of Gypsum on Soil Characteristics and Crop Productivity

According to Wallace and Wallace (2021), regular use of gypsum is essential to the sustainability of most irrigated soils. It has been used for over 200 years. Gypsum is calcium sulfate. The most common form of it is the dihydrate ($CaSO_4.2H_2O$), which means that each molecule of Ca sulfate has two water molecules associated with it. Another form, called gypsum anhydrite, has no water. Much of the gypsum used in agriculture is mined and then pulverized to desirable particle sizes. The smaller sizes go into solution more rapidly than do large sizes. Gypsum is also a by-product of various manufacturing operations.

Roles and functions of gypsum as soil enhancer are as follows.

- *Improves Soil Structure.* Gypsum provides calcium which is needed to flocculate clays in acid and alkaline soil. It is the process in which many individual small clay particles are bound together to give much fewer but larger particles. Such flocculation is needed to give favorable soil structure for root growth and air and water movement.

- *Helps Reclaim Sodic Soils*. Gypsum is used in the reclamation of sodic soils. Where the exchangeable sodium percentage (ESP) of sodic soils is too high, it must be decreased for soil improvement and better crop growth. The most economical way is to add gypsum which supplies calcium. The calcium replaces the sodium held on the clay-binding sites. The sodium can then be leached from the soil as sodium sulfate to an appropriate sink. The sulfate is the residue from the gypsum. Without gypsum, the soil would not be leachable. Sometimes an ESP of 3 is too high, but sometimes up to 10 or more can be tolerated. The range is partly the result of concentration of soluble salts.
- *Prevents Crusting of Soil and Aids Seed Emergence*. Gypsum can decrease and prevent the crust formation on soil surfaces that result from rain drops on unstable soil. It can even prevent crusting that results when acid soils are limed, the gypsum is coapplied with the lime. The gypsum is either surface applied or put on in the irrigation system. Prevention of crust formation means more seed emergence, more rapid seed emergence, and easily a few days sooner to harvest and market. Seed emergence has been increased often by 50 to 100 percent. The prevention of crusting in dispersive soils is a flocculation reaction.
- *Improves Low-Solute Irrigation Water*. Gypsum is used to increase the solute concentration of low-solute water used for irrigation. Irrigation water from rivers that no longer have sources of leachable salts wither penetrates poorly into soil or causes soil particles to degrade that results in low water penetration. Rainwater can behave the same way and result in soil compaction. The problem can be corrected with surface-applied gypsum or application to the irrigation water.
- *Improves Compacted Soil*. Gypsum can help break up compacted soil. The compaction in many but not all soils can be decreased with gypsum, especially when combined with deep tillage to break up the compaction. Combination with organic amendments also helps, especially in preventing return of the compaction.
- *Stops Water Runoff and Erosion*. Gypsum improves water infiltration rates into soils. It is protection against excess water runoff that are accompanied with erosion.
- *Decreases pH of Sodic Soils*. Gypsum immediately decreases the pH of sodic soils or near sodic soils from values often over 9 but usually over 8 to values of 7.5 to 7.8. These values are in the range of acceptability for growth of most crops. Probably more than one mechanism is involved. $Ca^{2+}$ reacts with bicarbonate to precipitate $CaCO_3$ and release protons which lessens the hydrolysis of clay to form hydroxides. These reactions can decrease the incidence of lime-and bicarbonate-induced iron deficiency.
- *Increases the pH of Acid Soils*. One mechanism in which gypsum can increase soil pH enough in some acid soils to sufficiently decrease the level of soluble aluminum to grow crops satisfactorily is replacement of hydroxyl ions from some clay lattices by sulfate ions.
- *Improves Swelling Clays*. Gypsum can decrease the swelling and cracking associated with high levels of exchangeable sodium on the montmorillonite-type clays. As sodium is replaced by calcium on these clays, they swell less and therefore do not easily clog the pore spaces through which air, water, and roots move.
- *Prevents Waterlogging of Soil*. Gypsum improves the ability of soil to drain and not become waterlogged due to a combination of high sodium, swelling clay, and excess water. Improvements of infiltration rate with use of gypsum add to the ability of soils to have adequate drainage.
- *Increases the Stability of Soil Organic Matter*. Gypsum is a source of calcium which is a major mechanism that binds soil organic matter to clay in soil which gives stability to soil

aggregates. The value of organic matter applied to soil is increased when it is applied with gypsum.

- *Makes Excess Magnesium Non-Toxic*. In soils having unfavorable calcium:magnesium ratios, such as serpentine soils, gypsum can create a more favorable ratio.
- *Corrects Subsoil Acidity*. Gypsum can improve some acid soils even beyond what lime can do for them. The effects of toxic soluble aluminum can be decreased, including in the subsoil where lime will not penetrate. It is then possible to have deeper rooting with resulting benefits to the crops. The mechanism is more than replacement of acidic hydrogen ions which can be leached from the soil to give higher pH. Hydrogen ions do not migrate rapidly in soils containing clay. It is suggested that the sulfate from gypsum forms a complex ($AlSO_4^+$) with aluminum which renders the aluminum non-toxic. Also suggested is that the sulfate ions react with iron hydroxide to release hydroxyl ions which give a lime effect to increase soil pH.
- *Can Enhance the Values of Liming*. Addition to soil together with lime increased crop yields. The combination also decreased leaching losses of potassium and magnesium.
- *Improves Water-Use Efficiency*. Gypsum increases water-use efficiency of crops. In areas and times of drought, this is extremely important. Improved water infiltration rates and better water storage in the soil all lead to deeper rooting and better water-use efficiency. From 25 to 100 percent more water is available in gypsum-treated soils than in nontreated soils.
- *Creates Favorable Soil EC*. Gypsum, being readily soluble, results in a proper buffered solute concentration (EC) in soil to maintain soil in a flocculated state. It is better environmentally and costwise to maintain the needed EC with gypsum than with excess application of fertilizers. Regular annual applications of gypsum are needed for this purpose. Many highly weathered soils throughout the world have surface crusting because of low electrolyte content. This can be corrected with gypsum.
- *Helps Plants Absorb Plant Nutrients*. Calcium, which is supplied in gypsum, is essential to the biochemical mechanisms by which most plant nutrients are absorbed by roots. Without adequate calcium, uptake mechanisms would fail.
- *Decreases Heavy-Metal Toxicity*. Calcium also acts as a regulator of the balance of particularly the micronutrients, such as iron, zinc, manganese, and copper, in plants. It also regulates non-essential trace elements. Calcium prevents excess uptake of many of them; and once they are in the plant, calcium keeps them from having adverse effects when their levels get high. Calcium in liberal quantities helps to maintain a healthy balance of nutrients and non nutrients within plants.
- *Increases Value of Organics*. Gypsum adds to the value of organic amendments. Blends of gypsum and organics increase the value of the other as soil amendments, especially for improvement of soil structure. High levels of soil organic matter are always associated with liberal amounts of calcium which is part of gypsum. Calcium decreases burn out of soil organic matter when soils are cultivated by bridging the organic matter to clay.
- *Source of Sulfur*. Gypsum is a source of fertilizer sulfur. Due to the trend to production of high-analysis fertilizers and due to the need of removing sulfur dioxide emissions in industrial operations to give cleaner air, more and more sulfur deficiencies are present in agriculture.
- *Decreases Bulk Density of Soil*. Gypsum-treated soil has a lower bulk density compared with untreated soil. Organics can even decrease it more when both are used. The softer soil is easier to till, and crops like it better.

- *Decreases Loss of Fertilizer Nitrogen to the Air*. Calcium from gypsum can help decrease volatilization loss of ammonium nitrogen from applications of ammonia, ammonium nitrate, urea, ammonium sulfate, or any of the ammonium phosphates. Calcium can decrease the effective pH by precipitation carbonates and also by forming a complex calcium salt with ammonium hydroxide which prevents ammonia loss to the atmosphere. Calcium improves the uptake of nitrogen by plant roots especially when the plants are young.
- *Increases Water Retention in Soil*. Gypsum when applied to sodic soil decreased levels of exchangeable sodium resulted in a large increase in water retention at a given tension compared with controls. Dry matter and seed yield were increased as a result.
- *Can Increase Crop Yields*. Gypsum for various combinations of the above effects can substantially increase crop yields from 10 to 50 percent.

Response to gypsum amelioration as soil enhancer will be significant when (a) soil pH is over about 8.2 and maybe even if it is less, soil ESP is over 3 and definitely if it is over 9, water puddles on the soil, soil particles slake or disperse when added to water, subsoil pH is lower than 5, there is waterlogging in the soil, there is a crust on the soil after rain or irrigation, there is excessive cracking of the soil after rain or irrigation, the soil contains clay that is dusty when dry, irrigation water contains substantial amounts of bicarbonate, intense rain falls on soil that is not acidic and where all solutes may be leached from the soil surface, and no-till is used.

## 2.4. Socio-Economic Benefits of Micronutrient Fertilizer and Soil Enhancer on Indonesian Agriculture with Special Reference to Farmer's Welfare

This section traces out the significance of micronutrient fertilizer to socio-economic aspect through literature study. It is important to note that any development strategy applied in agriculture should not only be designated in the context of increasing the output, but also of the welfare of farmers. Accordingly, there should be a clear specific review indicating the association between the supplementation of Cu and Zn in crop cultivation and its socio-economic aspects.

In dealing with this question, reports specifically covering the impact of application of micronutrients in farming to human interest were studied. Socio-economic benefit in simple way might be defined as all gains for human interest that be born out of using micronutrient fertilizers. A close interest relating to the application of micronutrient is nutrient sufficiency and balance. In economic term, direct and important indicator of the benefit is better income of the farmers.

In order to comprehend the association between the benefit and micronutrient application, it is important to understand the pathways of influence born out of applying Cu, Zn, and gypsum materials in agriculture. **Figure 1** illustrates schematic overview of micronutrient pathway from soil to humans and the factors that influence micronutrient bioavailability to the next level (Mayer *et al.* 2011 *in* Valencia *et al.* 2017).

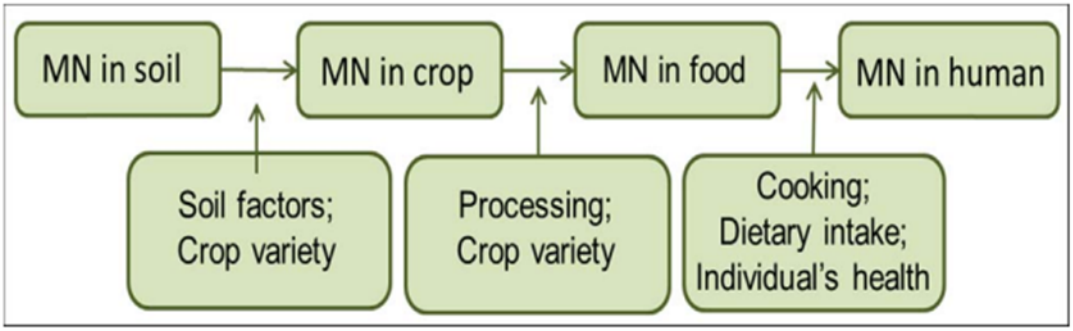


***Figure 1. Influence pathway of micronutrients (abbreviated as MN) from soil to human (Mayer et al. 2011 in Valencia et al. 2017).***

This diagram helps to trace out the socio-economic benefits of having micronutrients (including Cu and Zn) applied in a farming system. Basic fact on which we associate socio-economic aspects with supplementing micronutrients to the crops is that deficiencies in the soil are also closely associated with deficiencies in humans. According to sources cited by Valencia (2017), it means that a micronutrient deficiency in food crops, due to its deficiency in soil, could translate to micronutrient deficiency in humans. And contrary, sufficient nutrition content in crop is better status of human health. If the sufficient stand comes from the application of micronutrients, this may be claimed to be a social benefit of applying micronutrients.

Fortified nutrient is one of enhancement coming from the application of micronutrient to the crop. **Figure 2** shows other aspect of increased plant performance from the application of micronutrient. Better quality of crop harvested may take a form of biomass enhancement, yield enhancement, and higher yield. Reports show that micronutrients enhance crop nutritional quality, crop yield, biomass production, and resiliency to drought, pest, and diseases.

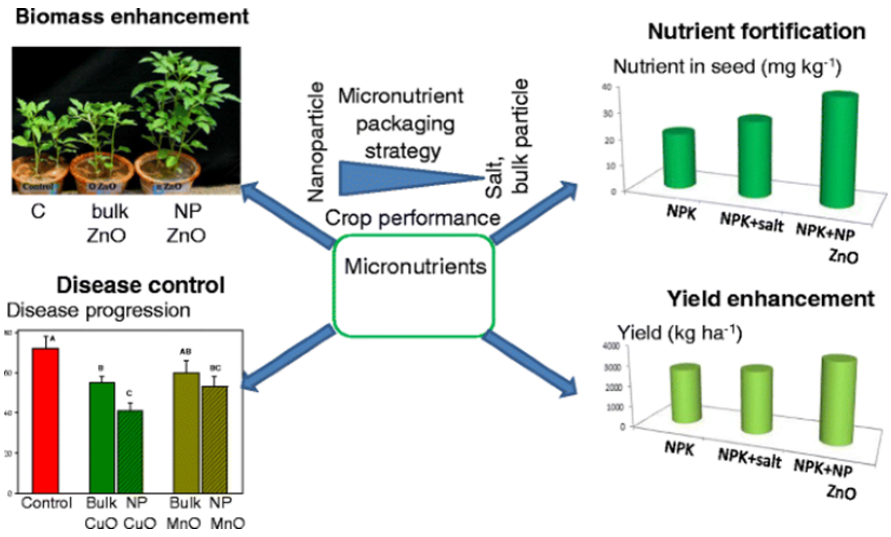


***Figure 2. Enhancement of crop performance due to micronutrient fertilizers application. Source: Dimkpa and Bindraban (2016)***

As indicated by **Figure 2,** social benefit to human being comes from consuming nutritious plants, which is enhanced by the application of micronutrient fertilizer. Micronutrient fertilization of crops (called agronomic fortification), in addition to increasing crop yield for human consumption, may address crop nutritional quality and attendant micronutrient dietary concerns in human health (Cakmak 2009 *in* Dimkpa 2016).

In specific socio-economic aspect, the program of the Government of India in collaboration with PwC reported three benefits brought about by micronutrient.

*1) Economic role: Reducing cost of macronutrient fertilizers and doubling income***.**
The report stated that non/less-availability of micronutrients in soil leads to the stunting of growth in plants, decreased yields, and increased susceptibility to diseases. By adopting agronomic bio-fortification as a strategy, there is an increase micronutrient content and bioavailability for human nutrition in the edible parts of crops. The results have been improvements of crop's nutritional quality, micronutrients, enhanced seed vitality leading to good seed germination, and better seedling growth.

It is emphasized that optimal application requires a balanced fertilizers use to ensure that nutrients are available in optimum amounts in the soil. It is for this balance the micronutrients play the key role to achieve cost reduction and doubling the farmer's income. Evident for this came from three case studies as parts of the program mentioned in the report.

Further, the study by Servin *et al.* (2015) reported about the profitability of application of micronutrients as follows. The profitability of the adoption of micronutrients in fertilizer regimes is shown by the following calculation. The calculation is based on a case observation. In the study, egg plants were foliar fertilized with an equal dose of bulk CuO ($18.5/bottle) and nano CuO ($44/bottle), and with a control treatment of no Cu amendment. During a two-season (2013 and 2014) experimental period, yield increases over the control of 17 and 31% and of 45 and 58%, respectively, were obtained from the bulk and nano CuO treatments. At the density of 3,500 plants per acre used in the study, 17,500 fruits per acre would be produced, assuming a single plant produces 5 fruits. The authors made other assumptions regarding the cost ($1/lb.) and weight (1 lb. = 0.453592 kg) of a fruit. With these assumptions, the control plants would generate $17,500 in monetary terms. For the treatments, an averaged % increase in yield from using the bulk and nano CuO for the two seasons would translate to $21,700 and $26,337, respectively. These values indicate that a $26 ($44–$18.5) extra investment in nano Cu fertilizer could generate a profit of $4,637 over conventional Cu fertilizer.

It is worth noting that economic benefit, especially in the form of better income of having micronutrient to be supplemented can performs adequately under certain condition. This condition is unfortunately can only come into being mostly with the help of government intervention. This intervention in required to offset the unfavorable market condition, especially farm gate market, the space where mostly agricultural produce is transacted. How far and what type of government intervention should take place is subject of the next discussion.

*2) Fighting Nutrition Deficiencies*
Nutrition deficiency called "hidden hunger" is a physical health status resulting from un-balanced diets based on starchy staple crops, vitamin, and nutrient deficiencies and is found

to be prevalent in among the population of *Sub Saharan Africa*. The results of hidden hunger are mental impairment, poor health, low productivity and in worst cases, even death. Children are especially vulnerable to micronutrient deficiencies. The deficiency of Zn in childhood leads to poor growth and stunting. Micronutrient deficiencies are also reported in adults. Such deficiencies in children and adults alike can be correlated to deficiencies in the soil. It is reported that almost 25% of the population in India suffer from Zn deficiency and more than 80% pregnant women suffer from iron deficiency anemia (IDA). The use of micronutrients in crops through fortification and other popular methods can help restore the nutrient imbalance in plants and human alike.

*3) Achieving food security*

Common definition of food security is a situation or socio-economic condition of a nation when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. As mentioned, food security will be a challenge for global agriculture including Indonesia. The FAO estimated that by 2050, agricultural production will have to increase by almost 50% to meet the needs of the growing population. So did the Sustainable Development Goals mention to focuses on ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture.

This benefit comes from the fact that food availability is dependent on soil, while nutritious and quality crops can only be grown if soils are healthy, which are prerequisites to food security. Healthy soil requires an adoption of balanced use of fertilizers where micronutrients must be the part of it. It is by that adoption that the quantitative and qualitative enhancement of food productivity can be achieved. Thus, the application of micronutrient will be a way of achieving food security. Physiological evidences have been found in the root and shoot uptake pathways for micronutrients. Metallic reductases, divalent metal transporters, and xylem transport facilitators are present in both shoot and root tissues to direct cation accumulation into the plant, irrespective of application point.

According to the report, these studies have played an important role in stimulating recent interest in this area, by collecting substantial data on firms and technologies involved in these programs and enlisting outside consultants and academic economists to analyze the impacts of its programs on innovation and resulting economic benefits. In general, in term of social aspect the application of micronutrient will bring enhancement of health status of human being; while in economic term, under certain condition, the application may bring benefit of high return on investment, and feasible benefit cost ratio.

# III. STUDY APPROACH AND METHODOLOGY

## 3.1. Stages of the Study

The first phase study on potential market of Cu and Zn micronutrient fertilizers and gypsum soil enhancer was carried out in several series of activities to achieve the overall goal and specific objectives. The series of study activities were as follows:

1) Identification of potential agricultural areas that most likely require Cu and Zn fertilizers, gypsum soil enhancer or both based on soil, crop and agroclimatic characteristics using Geographical Information System (GIS) approach and digital soil mapping technique for 10 strategic crops' cultivation areas consisting of (1) intensive paddy rice, (2) paddy rice on soils with high pH, (3) paddy rice on soils affected by sea water intrusion, (4) paddy rice on peat soils affected by tide, development farming areas for (5) chilli peppers, (6) potato, and (7) red onion, (8) oil palm plantation on peat and mineral soils managed by company and smallholder farmers, (9) forest plantation, and 10) revegetation for ex-mine reclamation. The GIS approach and digital soil mapping technique applied to obtain spatial data compilation is described in detail in Chapter 3.3.
2) Identification of potential agricultural actors who in their agricultural activities require Cu and Zn fertilizers, gypsum soil enhancer or both based on the results of in-depth interviews guided by a list of question (questionnaires) with respondents purposively chosen to represent the study areas. Prior to in-depth interview, the questionnaires were sent to the target subject groups. For a purpose of conducting *Consumer Education* at the same time, the questionnaires were provided with information concerning the roles and functions of Cu and Zn micronutrient and gypsum on crop growth as well as rates and methods of application of Cu and Zn fertilizer and gypsum soil enhancer.
3) Identification of crop cultivation pattern in term of crop population (planting space), cropping index (cropping season per year), recommended application dose of Cu and Zn fertilizer and gypsum and other local specific conditions in the study areas based on the results of in-depth interviews, available secondary data, and expert judgement.
4) Identification of existing kinds or types of materials used to increase soil Cu and Zn micronutrients availability in the study areas based on the results of in-depth interviews, available secondary data, and expert judgement.
5) Analysis of potential users of Cu and Zn fertilizers, gypsum or both in the study areas based on the results of in-depth interviews, available secondary data and expert judgement.
6) Analysis of volume and distribution of potential market for Cu and Zn fertilizers and gypsum in Indonesia broken down by the study areas showing current and future or potential consumption by applying "total addressable market ~ actual demand ~ potential demand ~ competitor share" approach that is described in detail in Chapter 3.4.

7) Estimation of current and future consumption or product volume of Cu and Zn fertilizer in Indonesian fertilizer industries based on the available secondary data and expert judgement.

### 3.2. Data Collection

The series of study stage activities described in Chapter 3.1 were preceded by secondary data collection, including statistical data and several thematic map sources for developing the maps as described in point 1 of Chapter 3.1. Overall data collection activities considered aspects of locus/region representing the areas that most likely require Cu and Zn fertilizer and gypsum at district level, required data to collect, data collection methods, and subject or respondent targets, as follows:

**(1) Regional Data Retrieval**

a) Sumatera for field areas of paddy rice, chili peppers, red onion, oil palm, forest plantation, and revegetation for ex-mine reclamation.
b) Java for field areas of paddy rice and horticulture cultivation.
c) Kalimantan for field areas of paddy rice, oil palm, forest plantation, and revegetation for ex-mine reclamation.
d) Sulawesi for field areas of paddy rice, horticulture, and revegetation for ex-mine reclamation.
e) West Nusa Tenggara and East Nusa Tenggara for field areas of paddy rice and horticulture cultivation.

**(2) Data Collected**

a) Conditions and factors that cause soil fertility degradation in the study areas.
b) Soil Cu and Zn deficiency and soil pH related problems in the study areas.
c) Impacts of soil Cu and Zn deficiency and low or high soil pH related problems on crop production in the study areas.
d) Supporting data: area and pattern of cultivation, cultivation actors, types of micronutrient fertilizers and soil enhancer that have been circulating in the existing market and their producers, volumes produced and marketed, and other supporting statistical data.
e) State budget allocated to address micronutrient related problems, especially fertilizer subsidy.

**(3) Methods of Data Collection**

a) Desk study to obtain supporting data for study preparation, preliminary situation analysis of the study areas and targeting of subjects for in-depth interviews.
b) In-depth interviews carried out by online call to collect data and information from actors in the study areas.
c) Field verification done in several locations/regions deemed necessary to improve accuracy and reliability of the estimated potential market by obtaining confirmation and clarification from the actors at field situation, as well as field observation of the study areas.

**(4) Target Subject**

a) **Target subjects of the study**

Target subjects of the study consisted of actors of cultivators at smallholder and corporate level, actors of micronutrient fertilizer and soil enhancer trading system, and local governments institutions.

b) **Target subject groups for in-depth interview:**

Target subject groups for in-depth interview were determined based on the identified study areas that most likely to have soil characteristics highly correlated with Cu and Zn deficiency, as well as with the requirement of gypsum soil enhancer (***Table 3***). In general, the study areas included very intensive ricefields and horticulture farming areas, which for decades has been fertilized with macro nutrients only, poorly drained soils (Hydromorphic soils), calcareous soils (Vertisols), light-textured soils, and tide or salt affected mineral soils mainly for rice paddy cultivation, peat and peaty soils (Histosols) and mineral soils cultivated for oil palm plantation, forest plantation, and revegetation for ex-mine reclamation. Given the Indonesia's wet climate, salt affected-soils are generally found in areas affected by sea-tides. Thus, this area is distributed adjacent to the peat soils.

***Table 3. Soil characteristics most likely to be highly correlated with Cu and Zn deficiency and requirement of gypsum soil enhancer***

| Soil Characteristics | Cu deficiency most likely occur if | Zn deficiency most likely occur if | Gypsum required if |
|---|---|---|---|
| Organic Matter Content | **Low**<br>Very intensive ricefields and horticultures<br>**High**<br>Peat and peaty soils (Histosols) | **Low**<br>Very intensive ricefields and horticultures<br>**High**<br>Peat and peaty soils (Histosols) | **Low**<br>Acid dry lands with light or heavy soil texture |
| Textural Class | Soils with light (sandy or coarse) texture | Soils with light (sandy or coarse) texture | Light and heavy textured-soils, mainly Vertisols |
| pH | High (>7,5).<br>Calcareous soils (Vertisols) | High (>8,5)<br>Vertisols with high P fertilizer application | Too Low or High.<br>Acid dry land soils (Ultisols) and Vertisols |
| Drainage | | Limited.<br>Hydromorphic soils, especially ricefields | |
| Others | Ricefields and horticulture areas that have been cultivated for more than 40 years without any fertilization of micronutrients | Ricefields and horticulture areas that have been cultivated for more than 40 years without any fertilization of micronutrients.<br>Degraded soils.<br>Soils of ex-mine sites. | Salt affected and tide-affected mineral soils or soils with high salinity |

Based on ***Table 3***, the study areas have been focused on very intensive ricefields and horticulture areas, high-pH ricefields, seawater intrusion affected ricefields, tidal affected ricefields, peata and mineral soils for oil palm plantation, forest plantation, and degraded ex-mine soils under reclamation-revegetation. The study areas were limited to lands that

have been cultivated and focused on provinces with the largest areas of the 10 specific land-uses that are most likely requiring Cu and Zn fertilizer and gypsum, as follows:

- Very intensive farming areas: Java, South Sumatera, Lampung, and South Sulawesi for ricefields and horticulture centers that have been cultivated for decades and used only macronutrient fertilizers.
- Peat soils areas: Sumatera and Kalimantan for oil palm plantation, forest plantation, and paddy rice cultivation.
- Mineral soils affected by tides: Sumatera, Kalimantan, and Java for paddy rice cultivation.
- Soils with very high pH: Java, West Nusa Tenggara, and East Nusa Tenggara for paddy rice cultivation.
- Ex-mine degraded soils: Sumatera, Kalimantan, and Sulawesi for ex-mine revegetation.

The detailed distribution of the study areas for the implementation of in-depth interview is given in ***Table 4***.

***Table 4. Distribution of the study area for the implementation of in-depth interview***

| Region | Very intensive paddy rice & horticulture areas | Peat soils | Mineral Soils | Mineral soils with tidal effect | Soils with very high pH | Ex-mine degraded soils |
|---|---|---|---|---|---|---|
| Sumatera | Rice 2 sites (South Sumatera: East Ogan Komering Ulu, Musi Rawas) | Oil Palm 2 sites (Riau: Pelalawan, Rokan Hilir)<br><br>Forest Plantation 4 sites (Riau, Jambi, South Sumatera: Palembang, Ogan Komering Ilir) | Oil Palm 2 site (West Sumatera: Dharmasraya; North Sumatera: Simalungun) | Rice 4 sites (South Sumatera: Banyuasin; Lampung: Mesuji, Mesuji, Lampung Timur) | | 2 sites (Bangka & Belitung: Bangka, Belitung) |
| Java | Rice 8 sites (West Java: Karawang, Indramayu; Central Java: Pati, Rembang; East Java: Nganjuk, Lamongan, Malang, Pasuruan) | | | Rice 3 sites (West Java: Indramayu; Central Java: Brebes; East Java: Gresik) | Rice 1 sites (East Java: Ngawi) | |

***Table 4. Continued***

| Region | Very intensive paddy rice & horticulture areas | Peat soils | Mineral Soils | Mineral soils with tidal effect | Soils with Very high pH | Ex-mine degraded soils |
|---|---|---|---|---|---|---|
| Java | Horticulture 5 sites (West Java: Cianjur; Bandung Barat: Central Java: Semarang; East Java: Batu, Malang) | | | | | |
| Kalimantan | | Oil Palm 3 sites (West Kalimantan: Kubu Raya; Central Kalimantan: Pulang Pisau; South Kalimantan: Tapin, Barito Kuala) | Oil Palm 1 site (Central Kalimantan: Sintang) | Rice 2 sites (Central Kalimantan: Kapuas; Kapuas) | | 5 sites (South Kalimantan: Tabalong; East Kalimantan: Kutai Timur, Kukar, Kukar, Kukar) |
| Sulawesi | Rice 2 sites (South Sulawesi: Soppeng) | | | | | 2 sites (North Sulawesi: Minahasa Utara; South Sulawesi: Luwu Timur) |
| West Nusa Tenggara & East Nusa Tenggara | | | | | Rice 3 sites (NTT: Manggarai, Manggarai, Manggarai) | |

**c) Target subject groups for field verification**

Field verification was purposed to get additional data from the fields of the same or different respondents that have been interviewed and official data from the government institution (Agriculture Offices at district and provincial level). The results of field verification were used to improve the reliability of the estimated potential market.

### 3.3. Method of Spatial Data Compilation

The compilation of spatial data was done by delineating polygons of distribution of soils in the study areas considered deficient in Cu and Zn micronutrients and/or required gypsum amelioration for more productive cultivation of different crops in their corresponding agricultural centers. With the development of digital technology, the use of Geographic Information System (GIS) techniques could speed up the process and produced accurate spatial data. In this process, several types of secondary data were referred to, both in the forms of vector (map) and raster (satellite image) data, which are consisting of the following:

1. Topography Maps, scale 1:50,000, year 2013 from the Geospatial Information Agency (BIG).
2. Soil Resources Semi-detailed Maps at districts level, scale 1:50,000, year 2016-2017 from the Center for Agricultural Land Resources Research and Development (BBSDLP).
3. Peat Soil Maps, scale 1:250,000, year 2014 from the BBSDLP.
4. Maps of Rice fields Standard Area, scale 1:10,000, year 2018 from the Ministry of Agrarian and Spatial Arrangement/National Soil Agency (ATR/BPN).
5. Maps of National Paddy, Corn, Soybean, and Sweet Potato Agricultural Area, scale 1:250,000, year 2014 from the Ministry of Agriculture (Kementerian Pertanian).
6. Spot 6 Satellite Images and Bing Map, year 2020 (latest coverage) from the National Institute of Aeronautics and Space (LAPAN).
7. Map of Irrigation Area, year 2012 from the Ministry of Public Works and Public Housing (PUPR).
8. Map of Administrative Region of Indonesia, year 2010 from Statistics Indonesia (BPS).

Intensive paddy soils deficient in Cu and Zn were delineated from irrigated paddy soils of alluvium parent material origin that were cultivated continuously for lowland rice development. The spatial distribution of paddy soils was referred to the maps of Rice fields Standard Area, scale 1:10,000 (ATR/BPN 2018), irrigation areas was referred to the maps of Irrigation Area (PUPR 2012), and soil parent material was referred to the semi-detailed maps of Soil Resource at district levels, scale 1:50,000 (BBSDLP 2016-2017). Spatial distribution of the intensive paddy soils was delineated in rice production centers in the provinces of Lampung, South Sumatra, South Sulawesi, West Java, Central Java, East Java, and Banten.

Horticultural development areas for potatoes, red onions, and chili peppers that require addition of Cu and Zn fertilizers were delineated from the Spot 6 Image and Bing Map of the latest coverage (LAPAN 2020) by referring to the existing tabular data. Spatial distribution of the horticulture cropping areas was delineated in horticulture production centers in the provinces of West Java, Central Java, East Java, West Sumatra, North Sumatra, South Sulawesi, and West Nusa Tenggara.

High-pH lowland rice fields deficient in and require Cu and Zn micronutrients application were delineated from paddy soils of Vertisols soil types or those that have a slightly alkaline soil reaction (pH >7.5). Spatial distribution of the high-pH paddy soils was delineated in the provinces of Central Java, East Java, Special Region of Yogyakarta, and East Nusa Tenggara.

Delineation of the spatial distribution of tide-affected paddy soils deficient in and require Cu and Zn micronutrients application was referred to paddy soils developed from marine and

marine fluviatic sediments affected by tidal or seawater intrusion. Spatial distribution of the tide-affected paddy soils was delineated in the provinces of Aceh, Jambi, Bangka Belitung Archipelago, Lampung, Riau, South Sumatra, North Sumatra, West Kalimantan, East Kalimantan, Central Kalimantan, and North Kalimantan.

Delineation of the spatial distribution of oil palm plantations was conducted by interpreting Spot 6 Image and Bing Map of the latest coverage (LAPAN 2020). The delineation was differentiated into oil palm plantations in peat and mineral soils. The delineation was carried out in the central areas of oil palm plantations, namely the islands of Sumatra and Kalimantan.

### 3.4. Analysis and Synthesis of Potential Market

All collected data and information have been analyzed and synthesized to answer the main objectives of the first phase study. For the estimation of potential market of Cu and Zn fertilizers and gypsum soil enhancer, a "total addressable market ~ actual demand ~ potential demand ~ competitor share" approach was applied and described as follows:

**Potential Market = *f* (TAM, AD, PD, PCMS)**

The potential market is a function of total addressable market (TAM), actual demand (AD), potential demand (PD), and potential competitors' market share (PCMS).

The TAM is a ceiling number or the highest estimate of potential buyers of the particular product(s), in the case of this study are Cu and Zn fertilizers and gypsum. It is essentially a total population of users in need of any product of interest. In the case of this study, the users are those buying tonnage of Cu and Zn fertilizers and/or gypsum. This tonnage is in turn determined by the total farming area in Indonesia indicated to be deficient in Cu and Zn and/or requiring gypsum application. This area has been estimated by the conducted digital mapping of soils of the study area described in sub chapter 3.3. To become tonnage the hectare units of the study area is converted into metric ton unit using dosage information. Thus, TAM is the population of demand of Cu and Zn fertilizer and gypsum to be produced by PT Merdeka Copper Gold, Tbk in the near future.

The AD is a number of users achievable that reside in particular area showing the size of or how far is users are willing to buy the products. AD is therefore representing the population of users who are currently applying micronutrient fertilizer and/or gypsum soil enhancer. This number is acting as a reducing factor in the estimation of potential market for PT Merdeka Copper Gold, Tbk. The AD is the TAM after deduction by reducing factors. Reducing factors are socio economic factors (risk preference, purchasing power, attitude toward innovation, etc.) that encourage users to actualize buying and using Cu and Zn fertilizers and/or gypsum at present condition from the existing market. Reducing factors is deduced from the results of in-depth interviews showing cancellation from buying the products that will be produced by PT Merdeka Copper Gold, Tbk, which requires judgement to convert qualitative into quantitative information.

For having a sharp or more accurate estimate of potential market, it is needed to estimate the PD that is representing an increase of AD of current estimation year. The PD, say for the next

5 years, is AD multiplied by growth factor. The growth factor in this study was deduced from a trend index of Indonesian importation of Cu and Zn fertilizer and/or gypsum raw materials.

Since PT Merdeka Copper Gold, Tbk is not a sole industrialist player in the fertilizer industry, it is needed to deduct the potential market by market size served by the other industrialists, the competitors. So potential competitor's market share (PCMS) is an estimate or projection of potential market that in time of estimation served by potential competitors. That is why the PCMS is deducted from the PD. Then, the potential market for Cu and Zn fertilizer and gypsum that will be produced soon PT Merdeka Copper Gold, Tbk is PD – PCMS (**Figure 3**).

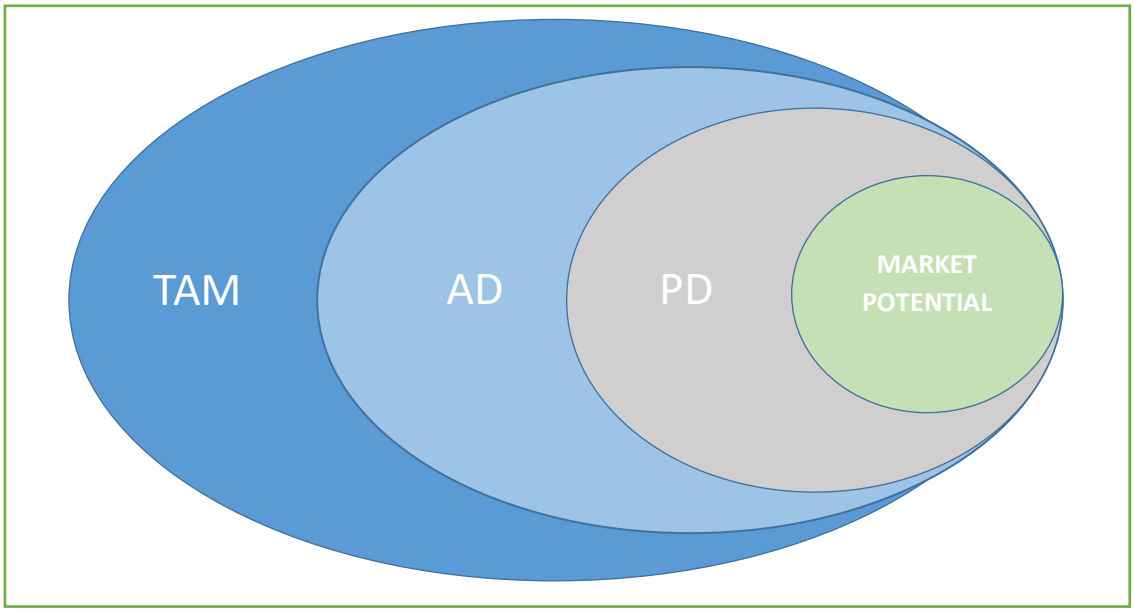


***Figure 3. Illustration of the "total addressable market ~ actual demand ~ potential demand ~ competitor share" approach to estimate potential market of Cu and Zn fertilizer and gypsum enhancer.***

# IV. STUDY IMPLEMENTATION

## 4.1. Activity and Timeline

Activities of the first phase study, timetable plan and its completion are given in ***Table 5***. Until submission of this Final Report, all the study activities have been completed on schedule.

## 4.2. Organizer

The first phase study on potential market of Cu and Zn fertilizers and gypsum soil enhancer in Indonesia was carried out by the Biotech Center of IPB University with the following expert team:

| | | |
|---|---|---|
| Person in Charge | : | Prof Dr Ir Dwi Andreas Santosa, MS |
| Team Leader | : | Prof Dr Ir Sudarsono Soedomo, MSc<br>(Senior Natural Resource Economist) |

Team Members:

(1) Senior Soil Chemistry, Fertility and Fertilizer Expert: Dr Ir Untung Sudadi, MSc
(2) Senior Agriculture Cultivation and GIS Expert: Dr Ir Chendy Tafa Krisnanto, MSi
(3) Senior Agricultural Economist: Dr Ir Suharno, MSc
(4) Bioeconomist: Muhammad Ramadhan Audirizki, ST, MSc
(5) Soil Chemistry and Fertility Expert: Hadi Wisa Nugraha, SP, MSi
(6) Project Officer: Ir Soni Wibi Yulianto
(7) Expert Assistants: 5 persons
(8) Administration Staff: 2 persons

***Table 5. Timetable and completion of activity of the first phase study***

| | Scope & Description of Activity | Month I | | | | Month II | | | | Month III | | | | Month IV | | | | Month V | | | | Month VI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | Preliminary Study: | | | | | | | | | | | | | | | | | | | | | | | | |
| | a Administrative preparation | o | | | | | | | | | | | | | | | | | | | | | | | |
| | b Desk study for scope & methodology determination | | o | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Preparation for In-depth Interview: | | | | | | | | | | | | | | | | | | | | | | | | |
| | a Questionnaire preparation and interviewees determination | | | | o | | | | | | | | | | | | | | | | | | | | |
| | b In-depth interview plan formulation | | | | | o | | | | | | | | | | | | | | | | | | | |
| | c In-depth interview plan finalization | | | | | | o | | | | | | | | | | | | | | | | | | |
| 3 | In-depth interview implementation: | | | | | | | | | | | | | | | | | | | | | | | | |
| | a On-line in-depth interview | | | | | | | o | o | o | o | o | o | | | | | | | | | | | | |
| | b Analysis dan Synthesis: | | | | | | | | | | | | | | | | | | | | | | | | |
| | Data & information analysis | | | | | | | o | o | o | o | o | | | | | | | | | | | | | |
| | Data & information synthesis | | | | | | | o | o | o | o | o | | | | | | | | | | | | | |
| | c Writing of in-depth interview results | | | | | | | | | | | | o | o | | | | | | | | | | | |
| 4 | Interim Report Writing: | | | | | | | | | | | | | | | | | | | | | | | | |
| | a. Preparation | | | | | | | | | | | | o | o | | | | | | | | | | | |
| | b. Submission | | | | | | | | | | | | o | o | | | | | | | | | | | |

***Table 5. (Continued)***

| | Scope & Description of Activity | | Month I | | | | Month II | | | | Month III | | | | Month IV | | | | Month V | | | | Month VI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 5 | Field Verification | | | | | | | | | | | | | | | | | | | | | | | | | |
| | a | Preparation | | | | | | | | | | | | | | | O | | | | | | | | | |
| | b | Implementation | | | | | | | | | | | | | | | | O | O | | | | | | | |
| | c | Progress Report Writing | | | | | | | | | | | | | | | | | | V | | | | | | |
| 6 | Final Report Writing: | | | | | | | | | | | | | | | | | | | | | | | | | |
| | a | Final report draft preparation | | | | | | | | | | | | | | | | | | | O | O | O | O | | |
| | b | Final report draft presentation | | | | | | | | | | | | | | | | | | | | | | | V | |
| | c. | Final report draft revision | | | | | | | | | | | | | | | | | | | | | | | O | O |
| | d | Final report completion and submission | | | | | | | | | | | | | | | | | | | | | | | | O |

**O** = activity

**O** = activity implemented

**V** = presentation

**O** = field verification

# V. RESULTS OF THE STUDY

Based on the analysis and synthesis of secondary data and information gathered in the desk study stage and of primary ones from the in-depth interview and field verification stage, the overall results of the first phase study are described in the following sub-chapters. The accuracy of estimation of the potential market has been improved by incorporating the refined total addressable market (TAM) in term of area that is mainly based on the results of digital soil mapping using satellite images of the recent coverage of the study area. These soil mappings resulted in maps of the potential agricultural centers that require Cu and Zn fertilizer and gypsum soil enhancer in Indonesia in terms of detail area and spatial distribution, while the accuracy of the reducing factors have also been improved by making use of the results of field verification. Description of the study results is ordered or made in line with and therefore represented the answers of the study objectives.

## 5.1. Potential Agricultural Centers Requiring Cu and Zn Fertilizer and Gypsum Soil Enhancer

Agricultural soils generally contain copper (Cu) of around 1-50 mg/kg and zinc (Zn) of around 10-300 mg/kg. Copper and zinc are essential nutrients that play vital roles and functions for plant growth. Deficiency of Cu and/or Zn can occur in soils that are cultivated continuously without application of Cu and Zn fertilizer, for instance ricefields and horticulture soils. In addition, high-pH soils, peat and alluvial soils in tidal swamp areas are also poor in Cu and Zn content. Cultivation of oil palm requires addition of Cu and Zn fertilizer as well, while high-pH paddy soils and ricefields affected by seawater intrusion also need improvement to decrease soil pH and increase calcium (Ca) content using gypsum.

Based on the standard area of ricefields, the total area of paddy soils in Indonesia is around 7.46 million Ha (ATR/BPN 2019), consisting of irrigated paddy soils of around 2.90 million Ha or 38.85%, tidal swamp paddy soils of around 1.52 million Ha or 20.41%, and rainfed paddy soils of around 3.04 million Ha or 40.74% (BPS 2016). Irrigated paddy soils that are used intensively without any application of organic fertilizer or straw will be deficient in Cu and Zn. In addition, intensive cultivated ricefields have often been flooded or waterlogged for a long period of time and this cultivation practice causes soil reaction to become neutral or soil pH approaches to 7.0. This condition decreases Cu and Zn availability to plants. The main intensive cultivated ricefields were distributed in 7 provinces, namely Central Java, East Java, West Java, South Sulawesi, Banten, South Sumatera, and Lampung, in which around 1,223,815 Ha of the area were estimated to be potentially requiring Cu and Zn fertilizer (***Table 6***).

Results of the semi-detailed soil mapping study at a scale of 1:50,000 (BBSDLP 2016) showed that the area of high-pH paddy soils in Indonesia, mainly of the Vertisols soil type, was around 459,450 Ha. In high-pH soil condition Cu and Zn are insoluble and therefore can be deficient for plant growth. In addition, Vertisols are dominated by montmorillonite soil clay mineral type that trigger Zn fixation, making it unavailable to plant. High-pH paddy soils that are used intensively without

application of organic fertilizer and straw will be more severely deficient in Cu and Zn. The main high-pH paddy soils potentially deficient in Cu and Zn in Indonesia were distributed in 4 provinces, namely Central Java, East Java, East Nusa Tenggara, and Special Region of Yogyakarta with a total area of around 136,625 Ha (***Table 7***).

***Table 6. Distribution of the main intensive cultivated paddy soils in Indonesia potentially requires Cu and Zn fertilizer***

| No. | Province | Area | |
|---|---|---|---|
| | | Hectare | Percent |
| 1 | Central Java | 445,636 | 36.41 |
| 2 | East Java | 381,449 | 31.17 |
| 3 | West Java | 217,541 | 17.78 |
| 4 | South Sulawesi | 101,375 | 8.28 |
| 5 | Banten | 40,669 | 3.32 |
| 6 | South Sumatera | 24,214 | 1.98 |
| 7 | Lampung | 12,931 | 1.06 |
| | **Total** | **1,223,815** | **100.00** |

***Table 7. Distribution of the main high-pH paddy soils in Indonesia potentially requires Cu and Zn fertilizer and gypsum***

| No. | Province | Area | |
|---|---|---|---|
| | | Hectare | Percent |
| 1 | Central Java | 94,952 | 69.50 |
| 2 | East Java | 31,607 | 23.13 |
| 3 | East Nusa Tenggara | 6,437 | 4.71 |
| 4 | Special Region of Yogyakarta | 3,629 | 2.66 |
| | **Total** | **136,625** | **100.00** |

Peat soils in tidal swamp area are poor in Cu and Zn content. Crop cultivation in this soil is generally requiring application of Cu and Zn fertilizer. The total tidal swamp area in Indonesia, in which part of it covered with peat soils, was around 1.52 million Ha (BPS 2016). The main tidal swamp area with peat soils in Indonesia of around 669,145 Ha were distributed in the islands of Sumatera and Kalimantan (***Table 8***).

In dry season, paddy soils affected by seawater intrusion cannot be used for cultivating any crop. This is because sodium (Na) dominates the soil solution, Calcium (Ca) in the soil is very low, and base cations (Ca, Mg, K, Na) are not available in balanced proportion. In addition, these type of paddy soils have alkaline pH (pH > 8.0), which can interfere with the crop growth, one of which is due to the decrease in Cu and Zn availability. Application of gypsum is highly recommended to decrease soil pH and at the same time increases the availability of Ca, while addition of Cu and Zn fertilizers is highly recommended as well. The area and distribution of paddy soils affected by seawater intrusion will continue to increase in Indonesia in line with the ecological damage of the upstream area. The main seawater intrusion affected paddy soils were currently distributed in 3 provinces, namely West Java, Central Java, and East Java totaling around 98,716 Ha (***Table 9***).

***Table 8. Distribution of the main tidal affected paddy soils in Indonesia potentially requires Cu and Zn fertilizer***

| No. | Province | Area | |
|---|---|---|---|
| | | Hectare | Percent |
| 1 | Aceh | 34,293 | 5.12 |
| 2 | Jambi | 16,577 | 2.48 |
| 3 | Bangka Belitung Archipelago | 5,348 | 0.80 |
| 4 | Lampung | 39,101 | 5.84 |
| 5 | Riau | 36,322 | 5.43 |
| 6 | South Sumatera | 201,325 | 30.09 |
| 7 | North Sumatera | 46,596 | 6.96 |
| 8 | West Kalimantan | 103,792 | 15.51 |
| 9 | South Kalimantan | 95,234 | 14.23 |
| 10 | Central Kalimantan | 75,057 | 11.22 |
| 11 | East Kalimantan | 12,042 | 1.80 |
| 12 | North Kalimantan | 3,457 | 0.52 |
| | **Total** | **669,145** | **100.00** |

***Table 9. Distribution of the main seawater intrusion affected paddy soils in Indonesia potentially requires Cu and Zn fertilizer and gypsum***

| No. | Province | Area | |
|---|---|---|---|
| | | Hectare | Percent |
| 1 | West Java | 43,932 | 44.50 |
| 2 | Central Java | 43,786 | 44.36 |
| 3 | East Java | 10,998 | 11.14 |
| | **Total** | **98,716** | **100.00** |

Horticultural crops, particularly potatoes, onions, and chili peppers, require very high Cu and Zn nutrients for their optimum growth and productivity. Soils used for intensive horticulture cultivation will generally be deficient in Cu and Zn and therefore require addition of Cu and Zn fertilizer. The horticulture farming development area in Indonesia were mainly distributed in 8 provinces, namely West Java, Central Java, East Java, West Sumatra, North Sumatera, Jambi, West Nusa Tenggara, and South Sulawesi with a total area of around 277,880 Ha (***Table 10***).

Oil palm plantations in Indonesia are developed on mineral and peat soils. Their development, on peat soils, generally result in Cu and Zn deficiency because of the naturally low content of these two nutrients. Without addition of both micronutrients, the crops will not grow optimally. The islands of Sumatera and Kalimantan were the centers for the development of oil palm plantation with a total area of 17,474,712 Ha potentially require Cu and Zn fertilizer (***Table 11***).

The spatial distribution of the main intensive cultivated paddy soils, high-pH paddy soils, tide-affected paddy soils, paddy soils affected by seawater intrusion, horticulture development, and oil palm plantation development area in Indonesia that were estimated to be potentially requiring gypsum and/or Cu and Zn fertilizer application is presented in **Figure 4**. The breakdown of this map into 23 maps presented at provincial and regency scales is given in the booklet of **Spatial Data Compilation.**

***Table 10. Distribution of the main horticulture development area in Indonesia potentially requires Cu and Zn fertilizer***

| No. | Province | Commodity Area | | | | | |
|---|---|---|---|---|---|---|---|
| | | Potato | | Red Onions | | Chilly Peppers | |
| | | Hectare | Percent | Hectare | Percent | Hectare | Percent |
| 1 | West Java | 40,518 | 22.68 | 15,574 | 23.70 | 1,259 | 3.76 |
| 2 | Central Java | 37,419 | 20.94 | 23,693 | 36.05 | - | - |
| 3 | East Java | 20,962 | 11.73 | 17,252 | 26.25 | 20,887 | 62.36 |
| 4 | Jambi | 36,600 | 20.48 | - | - | - | - |
| 5 | North Sumatera | 43,174 | 24.16 | - | - | 9,986 | 29.82 |
| 6 | West Nusa Tenggara | - | - | 2,165 | 3.29 | - | - |
| 7 | South Sulawesi | - | - | 7,030 | 10.70 | - | - |
| 8 | West Sumatera | - | - | - | - | 1,360 | 4.06 |
| | **Total** | **178,673** | **100.00** | **65,714** | **100.00** | **33,493** | **100.00** |

***Table 11. Distribution of the main oil palm plantation development area in Indonesia potentially requires Cu and Zn fertilizer***

| No. | Province | Area (Ha) | | Total (Ha) |
|---|---|---|---|---|
| | | Peat Soil | Mineral Soil | |
| 1 | Aceh | 80,043 | 515,858 | 595,901 |
| 2 | Bengkulu | 1,597 | 267,790 | 269,387 |
| 3 | Jambi | 216,062 | 1,043,890 | 1,259,952 |
| 4 | Bangka Belitung Island | 293 | 258,166 | 258,459 |
| 5 | Riau Island | | 9,951 | 9,951 |
| 6 | Lampung | | 325,464 | 325,464 |
| 7 | Riau | 1,621,142 | 2,859,660 | 4,480,803 |
| 8 | West Sumatera | 88,406 | 553,180 | 641,585 |
| 9 | South Sumatera | 253,183 | 1,298,485 | 1,551,668 |
| 10 | North Sumatera | 245,204 | 1,801,338 | 2,046,542 |
| 11 | West Kalimantan | 296,565 | 1,532,061 | 1,828,625 |
| 12 | South Kalimantan | 13,250 | 630,309 | 643,559 |
| 13 | Central Kalimantan | 158,307 | 1,652,216 | 1,810,523 |
| 14 | North Kalimantan | 45,961 | 1,706,331 | 1,752,292 |
| | **Total** | **3,020,012** | **14,454,700** | **17,474,712** |

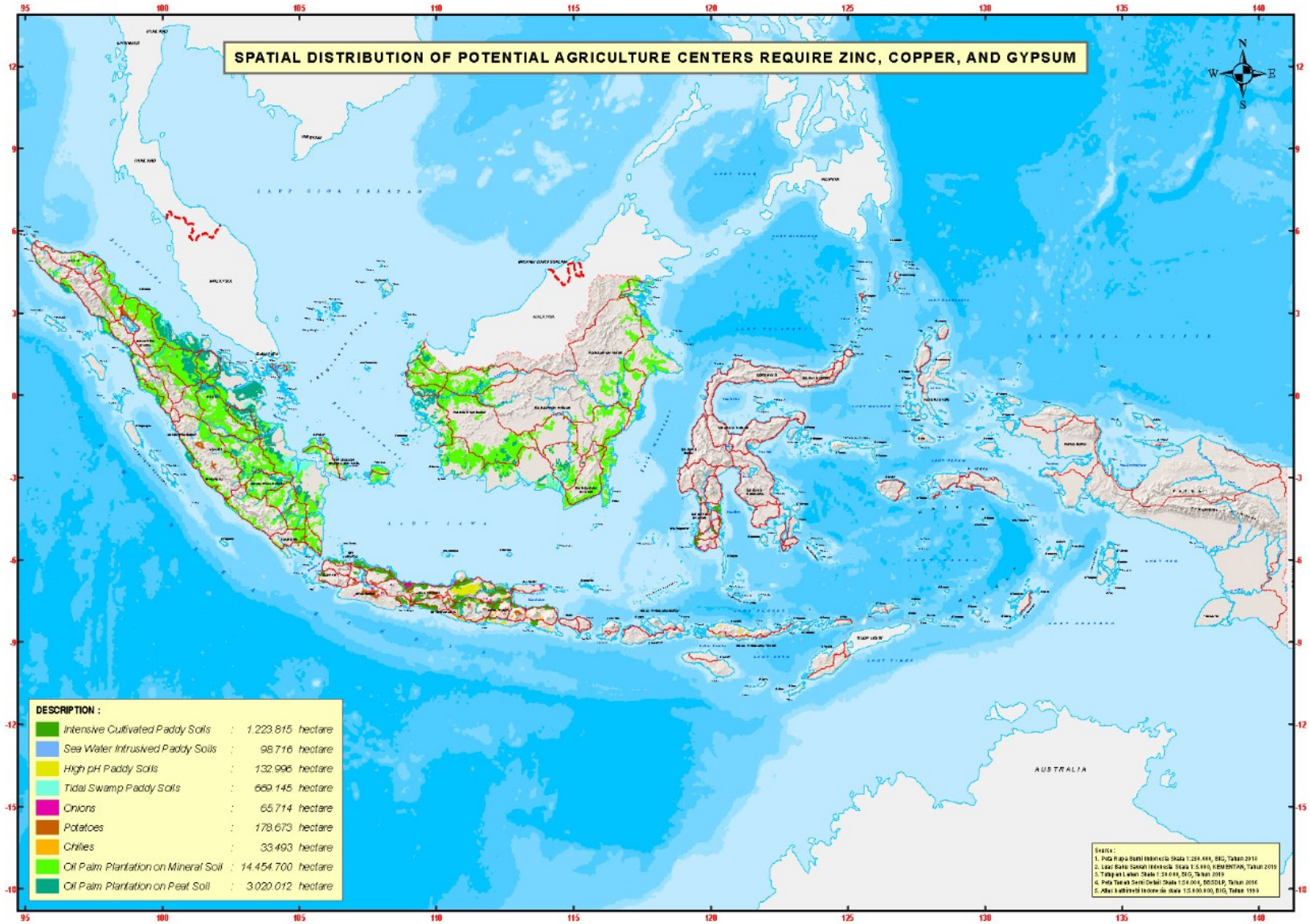


***Figure 4. Spatial distribution of the potential agriculture centers requiring Cu and Zn fertilizer and gypsum soil enhancer***

### 5.2. Potential Users of Cu and Zn Fertilizers and Gypsum Soil Enhancer

Micronutrient Cu and Zn fertilizers were mainly used in intensive cultivated ricefields, tide affected paddy soils, horticulture development area, oil palm plantation development area, both by small and corporate farmers operating particularly on peat soils. As of this report, reclamation of ex-mine lands and forest plantation were considered to also require Cu and Zn fertilizer, but the provisional information obtained showed that especially the area to be revegetated was relatively small and the miners were not pursuing prime plant growth. Meanwhile, gypsum was needed in high-pH and seawater intrusion affected paddy soils.

The group of users who have been familiar with the use of Cu and Zn fertilizers were horticulture farmers. The application of these fertilizers by small-scale farmers was generally carried out by very few people and in the mode of trial and error. Meanwhile, the use of micronutrient fertilizers by oil palm plantation corporations was based on a better understanding of its benefit to the crop growth and yield. However, not all corporations have used these fertilizers for their farming activities.

### 5.3. Preference of Potential Customer of Cu and Zn Fertilizers and Gypsum Soil Enhancer

Preference refers to certain characteristics any consumer wants to have in a good or service to make it preferable to him/her. This could be the level of happiness, degree of satisfaction, utility from the products, etc. Preference is the main factor that influence consumer demand.

In Economics, consumer preferences are defined as the subjective or individual tastes, as measured by utility, of various bundles of goods. It permits the consumers to rank these bundles of goods according to the levels of utility they give to the consumer. Note that preferences are independent of income and prices. Ability to purchase goods does not determine a consumer's likes or dislikes. One can prefer Porsches over Fords but only have the financial means to drive a Ford.

Consumers' preferences can be revealed by what they purchase under different circumstances, particularly under different income and price circumstances. The preference of this type is called revealed customer preference. Introduced by economist Paul Samuelson in 1938, the theory holds that if a consumer purchases a specific bundle of goods, then that bundle is "revealed preferred," given constant income and prices, to any other bundle that the consumer could afford. By varying income or prices or both, an observer can infer a representative model of the consumer's preferences. Under revealed preference theory, preference is defined as consumer behavior – **purchasing habit.** If their income and the item's price are held constant, purchasing habit is the best indicator of their preferences.

Samuelson offered what became known as **revealed preference theory** in attempt to build a theory of consumer behavior that was not based on utility. He argued that his new approach was based on observable behavior and that it relied on a minimal number of relatively uncontroversial assumptions. For the same argument and practical reasons, review on preference of potential customers in this study applied the revealed preference theory as an underlying framework of discussion. Using this framework the respondents were asked questions on their understanding, their opinion, the way they acquire, use, and apply Zn and Cu fertilizer and gypsum in their cultivation practices. These were more or less reflections of consumption behavior, thus preference of the potential customers of Cu and Zn fertilizer and gypsum. It is this response therefore that have been interpreted as their preference on Cu and Zn as fertilizers, and gypsum as soil enhancer.

The questions asked and the summary of the respondent responses are presented in the **Appendix 2** of this report. Pattern of preference of the potential customers is described as follows.

**Pattern of Preference on Cu and Zn Fertilizer and Gypsum Soil Enhancer**

1. **Seasonal use**. By nature demand of all fertilizers is derivative of farming activity which naturally is seasonal. It is why demand of fertilizer is called derived demand. So seasonal preference is a rational consequence of being a derivative product, namely being input in farming.
2. Preference on Cu and Zn fertilizers is following **user segmentation**. Users of Cu and Zn fertilizer is segmented naturally or culturally. Natural segmentation happens due to different soil types. From there it is understood that there were farmers working in ricefields, peat soils, etc.. Cultural segmentation comes into being due to different crops, tenure system, land size, farming organization, level of knowledge and **purchasing power** (individual household, group of farmers, cooperative, and private or state corporate, etc.) What have been revealed was that there was a tendency of **different dose** of application of fertilizers. In addition to dosage, different preference has been found out in **mode of acquisition** (buying pattern: time, size, mode of delivery, and timing) of **different types of fertilizers**. What matters from this segmentation was that different segment meant different preference and there were many reasons behind this differences. Important implication of this was that the fertilizer producer should set up a different strategy of customer relationship in order to capture the potential market.

   In order to capture the existing preference interview questionnaire was used as a guidance during the online interview. The information collected were verified further through interview during the field visit. The followings are findings regarding status of preferences.

   a. Respondents representing plantation entities (plantation segment), more specifically oil palm entities, were of relatively sufficient knowledge on micronutrients in general and Cu and Zn specifically. Respondents of this group expressed their preference more clearly compared to other groups, horticulture and food crops farmers.
   b. The respondent's favor on the use of Cu and Zn fertilizers could be categorized as: the first were plantation respondents, the second were horticulture respondents, and the third were food crop respondents.
   c. Based on the existing information and market availability expression of preferences rested in three attributes: price, types and blending contents of the fertilizers.

   **The price**. According to the interview results price as an attribute influenced very much on the preference of farmers on Cu and Zn fertilizers. Price was the only attribute that negatively influenced existing user preferences for Cu and Zn fertilizers and most possibly gypsum. This finding was consistent with rationality argument of Economics. As expressed in demand theory in Economics, the typical price and quantity demanded relationship predicts that consumer is supposed to be less likely to select higher-priced fertilizers.

   What it means for the producers in terms of pricing strategy is that Cu and Zn fertilizers should be treated as a normal good in the agricultural factors or inputs market. Critical for a normal good is the potential customer knowledge on the goods: customer decision to buy or not to be very much determined by the sufficiency level of knowledge on the good. If Cu and Zn is essentially a necessity for farming it will eventually be bought by farmers, provided that they are informed enough on that. A short and direct implication of it is that farmer education should be main part

of promotion strategy for PT Merdeka Copper Gold, Tbk once it decides to produce them commercially.

**The type**. According to the interview results there were in general three types of micronutrient fertilizers including the ones containing Cu and Zn: liquid, water-soluble powder, and granules/ pelleted. These types are dominating the commercial practices and therefore status of current preferences among farmers. If ranked, roughly speaking, the liquid micronutrient fertilizer was preferable than the powder, and the powder was preferable than the granules/pelleted. This preference status was however not necessarily the whole and true story about the one that represented the true existence of preferences among farmers. Main reason was that the farmer knowledge was still limited on the existing products. A complete information regarding the essence, functions, dosage, availability, and access, as well as application methods needed to be there in order to inform the customer decision to buy. Again immediate implication of this situation is customer education.

**The blending content**. From the interview and field visits it has been informed that the existing micronutrient fertilizers currently running in the market have been traded in the form of blend materials. It means the users get micronutrient from a commercial products of let say, liquid organic fertilizers that contains Cu and Zn or both of them. One blended product might contain herbicides or insecticides in addition to fertilizers. Based on these information the blended product was preferable among food crop and horticulture farmers than the single micronutrient fertilizers, but it was different for plantation farmers who preferred more the single micronutrient fertilizers. However, as far as effectiveness concern one needed to pose a question on dosage and purity. This finding posed an agenda on not only product type but also product level of purity.

3. **Willingness to accept**. Response and feedback from the respondents reflect their willingness to accept a new idea, including Cu and Zn as fertilizers and gypsum as soil enhancer. This willingness is conditional on their knowledge of, for example, Cu and Zn as fertilizers. The willingness support the idea of market development to the potential customer. At the same time it confirms again the need of customer education for the sake of market penetration.

### 5.4. Potential Competitor of Providers of Cu and Zn Fertilizers and Gypsum Soil Enhancer

From the supply side, the supply of micronutrients in the form of pure fertilizer is still very limited. Until now, the addition of micronutrients is generally done through the application of macronutrients that contain trace elements or micronutrients. So far, the production of micronutrient fertilizers has only been carried out by several companies, such as PT Pupuk Sriwijaya, PT Sentana Adidaya Pratama, PT Nusa Palapa Gemilang, and PT Meroke Tetap Jaya (**Table 12**). Furthermore, there is only one gypsum producer, namely PT Petro Jordan Abadi, with a production of 1,100,000 MT per year.

So far, there is no information on import of micronutrient fertilizers. However, there are data on imports in the form of $CuSO_4$ compounds as raw materials for various products, including for micronutrient fertilizers.

*Table 12. Producers of micronutrient fertilizers*

| Producer | Product Name | Production Capacity |
|---|---|---|
| PT Pupuk Sriwijaya | Pupuk MIkro Majemuk "Nutremag" | 74,948 ton/year |
| PT Sentana Adidaya Pratama (Pupuk Mahkota) | Copper Sulfate (23% Cu) | Not available |
| | Zinc Sulfate (36% Zn) | Not available |
| PT Nusa Palapa Gemilang | "Nutrimix GT" (8% Cu+8% Zn+8% $B_2O_3$ | Not available |
| PT Meroke Tetap Jaya | Single Fertilizer Cu 15% | Not available |
| | Single Fertilizer Zn 15% | Not available |
| | Compound Fertilizer (Cu-EDTA 1.6% + Zn-EDTA 1,65%) | Not available |

### 5.5. Potential Market of Cu and Zn Fertilizers and Gypsum Soil Enhancer

Market assessment component of this report delivered information on the size estimate of total addressable and potential markets for Cu and Zn fertilizers and gypsum soil enhancer. The estimation was mainly based on the area of agricultural centers with soils identified of being deficient in Cu and Zn. Total addressable market (TAM) was defined as the total identified area that was most likely deficient in Cu and Zn covering ricefields, horticulture farms, and oil palm plantations. These were types of farming system representing main agricultural areas in Indonesia, and thus considered as an addressable market for future Cu and Zn fertilizer products of PT. Merdeka Copper Gold, Tbk. This size of TAM after being deducted by the size of land area currently treated with Cu and Zn fertilizers and gypsum became area of actual demand. Since this size has been targeted by other or competitor fertilizer companies, it should be taken out to become potential market for PT. Merdeka Copper Gold, Tbk. fertilizers. Important to note is the fact that the potential market estimate delivered at this report was not yet exhausted. In addition, it is presented purposively in this report the estimate of current market size without projection of future demand.

Market is naturally buyer - people or farmers who buy fertilizer. Since it was the land size that determined amount of fertilizer to be demanded then the estimation was based on the land size. The commonly distributed forms of Cu and Zn fertilizer in Indonesia are given in ***Table 13.*** After considering the level of Cu and Zn deficiency in various types of soils the estimate of potential market for Cu fertilizers for 2022 was accordingly 18,002 ton if expressed as pure Cu (***Table 14***). With the same token, the potential market of Zn fertilizer for 2022 was 25,655 ton pure Zn (***Table 15***). As for gypsum, its market potential estimate in 2022 was 156,295 ton (***Table 16***).

Important assumption that made up the estimate of potential market for gypsum as presented in *Table 16* are as follow.

1) Based on expert judgment on the effective dose per hectare per year for gypsum. This information was used to estimate TAM.
2) Current application of gypsum is assumed to be a half of total addressable market. In this report this information became a reducing factor to the TAM.
3) Current share of competitor gypsum producers was 2.48%, leaving 97.52% to be potential market for PT Merdeka Copper Gold, Tbk..

*Table 13. Commonly distributed forms of Cu and Zn fertilizer in Indonesia*

| Commonly Distributed Form | Mass in Commercial Form (kg) | In Pure Micronutrient (kg) | Conversion Factor |
|---|---|---|---|
| CuSO4 | 10 | 2.6 | 3.85 |
| ZnSO4 | 10 | 3.6 | 2.78 |
| CuEDTA | 10 | 1.5 | 6.67 |
| ZnEDTA | 10 | 1.0 | 10.00 |

*Table 14. Current potential market of Cu fertilizer in Indonesia expressed as pure Cu, $CuSO_4$ and Cu-EDTA*

| | Pure Cu | | $CuSO_4$ | | Cu-EDTA | |
|---|---|---|---|---|---|---|
| **Study Area** | **TAM*** | **Potential Market** | **TAM*** | **Potential Market** | **TAM*** | **Potential Market** |
| | ton/year | | | | | |
| **Ricefields** | | | | | | |
| Intensive farming | 30,595 | 11,305 | 117,675 | 43,480 | 203,969 | 75,366 |
| High-pH soil | 3,416 | 1,032 | 13,137 | 3,970 | 22,771 | 6,882 |
| Tidal affected soil | 4,805 | 1,800 | 18,479 | 6,924 | 32,030 | 12,002 |
| Seawater Intrusion affected soil | 742 | 280 | 2,852 | 1,078 | 4,944 | 1,868 |
| Total | 39,557 | 14,418 | 152,143 | 55,453 | 263,714 | 96,118 |
| **Horticulture Farms** | | | | | | |
| Red Onions | 263 | 43 | 1,011 | 164 | 1,752 | 284 |
| Potatoes | 715 | 135 | 2,749 | 519 | 4,765 | 899 |
| Big Chili Peppers<br>Small Chili Peppers | 134 | 25 | 515 | 96 | 893 | 167 |
| Total | 1,112 | 202 | 4,275 | 779 | 7,410 | 1,350 |
| **Oil Palm Plantation** | | | | | | |
| Smallholder | 8,289 | 2,493 | 31,882 | 9,588 | 55,263 | 16,618 |
| Corporate | 4,273 | 797 | 16,435 | 3,065 | 28,487 | 5,313 |
| Total | 12,562 | 3,290 | 48,317 | 12,653 | 83,749 | 21,932 |
| **Forest Plantation** | 417 | 92 | 1,604 | 354 | 2,780 | 613 |
| **Total; Indonesia** | 53,648 | 18,002 | **206,339** | **69,238** | **357,654** | **120,013** |

*TAM = Total Addressable Market

*Table 15. Current potential market of Zn fertilizer in Indonesia expressed as pure Zn, $ZnSO_4$ and Zn-EDTA*

| Study Area | Pure Zn | | ZnSO4 | | Zn-EDTA | |
|---|---|---|---|---|---|---|
| | TAM* | Potential Market | TAM* | Potential Market | TAM* | Potential Market |
| | ton/year | | | | | |
| **Ricefields** | | | | | | |
| Intensive farming | 45,893 | 16,719 | 127,481 | 46,442 | 458,931 | 167,190 |
| High-pH soil | 5,123 | 1,684 | 14,232 | 4,678 | 51,234 | 16,841 |
| Tidal affected soil | 4,805 | 1,805 | 13,346 | 5,015 | 48,045 | 18,052 |
| Seawater intrusion affected soil | 742 | 280 | 2,060 | 777 | 7,416 | 2,798 |
| Total | 56,563 | 20,488 | 157,118 | 56,911 | 565,627 | 204,881 |
| **Horticulture Farms** | | | | | | |
| Red Onions | 657 | 130 | 1,825 | 361 | 6,571 | 1,301 |
| Potatoes | 1,072 | 203 | 2,978 | 563 | 10,720 | 2,026 |
| Big Chili Peppers<br>Small Chili Peppers | 201 | 38 | 558 | 106 | 2,010 | 380 |
| Total | 1,930 | 371 | 5,362 | 1,030 | 19,302 | 3,707 |
| **Oil Palm Plantation** | | | | | | |
| Smallholder | 11,148 | 4,189 | 30,967 | 11,636 | 111,480 | 41,890 |
| Corporate | 2,848 | 531 | 7,911 | 1,475 | 28,480 | 5,310 |
| Total | 13,996 | 4,720 | 38,878 | 13,111 | 139,960 | 47,200 |
| **Forest Plantation** | 278 | 76 | 772 | 211 | 2,780 | 760 |
| **Total; Indonesia** | 72,767 | 25,655 | **202,130** | **71,263** | **727,668** | **256,548** |

*TAM = Total Addressable Market

*Table 16. Current potential market of gypsum soil enhancer in Indonesia*

| Study Area | Gypsum | |
|---|---|---|
| | TAM* | Potential Market |
| | Ton/year | |
| **Ricefields** | | |
| High-pH soil | 91,083 | 90,671 |
| Seawater intrusion affected soil | 65,923 | 65,625 |
| **Total; Indonesia** | 157,006 | 156,295 |

*TAM = Total Addressable Market

# VI. CONCLUSIONS AND RECOMMENDATIONS

## 6.1. Conclusions

1. The main area of intensively cultivated and tide affected paddy soils potentially requiring Cu and Zn fertilizer was respectively 1,223,813 and 669,145 Ha. The main area of high-pH and seawater intrusion affected paddy soils potentially requiring Cu and Zn fertilizer as well as gypsum was respectively 136,625 and 98,716 Ha. The main horticulture farming development area for chili pepper, potato, and red onion potentially requiring Cu and Zn fertilizer was 277,880 Ha. The main central area for oil palm plantation development potentially requiring Cu and Zn fertilizer was 17,474,712 Ha.
2. The application of micronutrient fertilizers on small-scale farming generally carried out by a very few farmers under trial-and-error approach. The potential user group who most familiar with the fertilizer was horticulture farmer. Oil palm plantation corporate users have a better know-how on micronutrient fertilizers, but not all of them have applied the fertilizers for their crops. The preferred types of Cu and Zn fertilizer given by the potential users were Cu-sulfate, Cu-EDTA, Zn-sulfate, and Zn-EDTA mostly as liquid then as powder and the last as granule fertilizer and gypsum as pure as possible. The demand of these products was seasonal and followed users' segmentation and purchasing power. There was a tendency of different dosage preference in the mode of acquisition of different fertilizer types. Response and feedback from the respondents reflected their willingness to accept Cu and Zn fertilizer and gypsum soil enhancer and this supported the idea of market development to potential customer and confirmed the need for customer education for a better market penetration.
3. The addition of micronutrients was generally done through the application of macronutrients that contain micronutrients. The production of micronutrient fertilizers in Indonesia has been carried out by several companies, namely PT Pupuk Sriwijaya, PT Sentana Adidaya Pratama, PT Nusa Palapa Gemilang, and PT Meroke Tetap Jaya, among a few others. There was only one gypsum producer, namely PT Petro Jordan Abadi, with a production capacity of 1,100,000 MT per year. These companies are currently the potential competitors for PT Merdeka Copper Gold, Tbk as producer of Cu and Zn fertilizer and gypsum soil enhancer.
4. The total Indonesian potential market for Cu and Zn fertilizers and gypsum soil enhancer in the first quarter of 2022, calculated as pure Cu, pure Zn, and gypsum were of 18,002; 25,655; and 156,295 ton per year, respectively. When converted into Cu-Sulfate or Cu-EDTA and Zn-Sulfate or Zn-EDTA, the Cu and Zn fertilizer types most preferred by the potential user, the estimated amount became 69,238 ton per year Cu-Sulfate or 120,013 ton per year Cu-EDTA and 71,263 ton per year Zn-Sulfate or 256,548 ton per year Zn-EDTA. The process of market sizing was carried out in a conservative way. Therefore, there are still considerable opportunities to increase it even up to the total addressable market size.

## 6.2. Recommendations

1. Results of the first phase study clearly showed the currently existence of high potential market for Cu and Zn fertilizers and gypsum soil enhancer required by potential users for the improvement of agriculture production and farmers' welfare in Indonesia. it is therefore recommended to PT Merdeka Copper Gold, Tbk to take this strategic opportunity for the management of its mine processing by-products by utilizing them in an ecologically friendly and profitable manners as raw materials of Cu and Zn fertilizers and gypsum soil enhancer. Therefore, it is suggested and highly recommended soon after the completion of this first phase study to conduct the second phase study to formulate and develop specific Cu and Zn fertilizers and gypsum products most preferred by the potential costumers.
2. The recommendations consist of but not limited to do a pilot scale production of the selected products to be tested and evaluated their effectiveness in increasing yields and income and thus the welfare of farmers of the most economic crops through green house as well as field trials in selected agricultural centers in Indonesia that in the first phase study has been determined and were considered will perform significant positive responses. Then, based on the results of the trials, development stages to produce better products should be done concerning their physical types and chemical formulas or blending compositions, purity of the nutrients content, their pricing and strategic commercialization to fulfill the available potential market.
3. In line with the above suggestions, it is also highly recommended to conduct customer education for a better market penetration as the goal. It is about the primary time to do so since the most potential big customers have been familiar with the roles, functions and application practices of the products and requiring them as a necessity for achieving an optimum growth and yield of their crops under cultivation and the potential competitors of the products were currently still relatively limited in number and production capacity.

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# Appendix 1.

## Questionnaires for Study on the Use and Application Pattern of Cu and Zn Micronutrient Fertilizers

# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

A1: Padi Sawah Intensif

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis atau merek pupuk apa saja yang pernah Bapak/Ibu gunakan dalam bertani padi sawah?

   a. Urea
   b. Petro Nitrat
   c. SP36 Petro
   d. Nitrophonska / Petro Niphos / Phonska Plus
   e. NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   f. NPK Pusri / NPK PIM / NPK PIM TE
   g. ZA Petro
   h. ZK Petro
   i. KCl Kujang / KCl Petro
   j. Planta Plus
   k. Lainnya (sebutkan) ……

2. Setelah menggunakan pupuk-pupuk pada jawaban no.1 di atas, apakah Bapak/Ibu pernah melihat gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak/Ibu amati tersebut.
   …….
   …….
   …….

3. Menurut Bapak/Ibu, itu gejala kekeurangan hara apa? Atau keracunan hara apa?
   …….

4. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya padi sawah secara intensif yang sudah berlangsung lama (bertahun-tahun) mungkin terjadi kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah dan tanaman?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

5. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah sawah yang dibudidayakan intensif akan membatasi atau menghambat produksi?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

6. Apakah pada tanah sawah Bapak/Ibu, sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan setiap musim tanam
   b. Ya, tetapi tidak setiap musim tanam (sudah pernah melakukannya berapa kali? …..)
   c. Tidak, saya belum pernah melakukannya
   d. Saya ingin melakukannya
   e. ……..

7. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
   d. Saya belum pernah melakukannya
   e. Saya ingin melakukannya
   f. ……..

8. Berapa dosis pupuk Cu dan/atau Zn yang pernah Bapak/Ibu aplikasikan? (Isikan …….. kg/ha)

9. Kapan Bapak/Ibu mengaplikasikan pupuk Cu dan/atau Zn tsb? (berapa hari setelah pindah-tanam bibit …….. atau berapa hari setelah semai bibit ……..)

10. Bagaimana cara Bapak/Ibu mengaplikasikan pupuk Cu dan/atau Zn tsb?
    a. Dicampurkan dengan pupuk lainnya (Pupuk apa? …….……) dan disebarkan
    b. Tidak dicampurkan dengan pupuk lainnya dan disebarkan
    c. Disemprotkan ke tanah dan tanaman sebagai pupuk cair
    d. Cara lainnya (……...)

11. ` Dari mana Bapak/Ibu memperoleh pupuk Cu dan/atau Zn?
    a. Subdisi pemerintah
    b. Pemberian dari produsen pupuk sebagai contoh produk
    c. Membeli di toko atau kios pertanian di desa / kelurahan / kecamatan / kabupaten
    d. Lainnya (……...)

12. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan cara membeli, berapa harga pasaran pupuk Cu dan/atau Zn yang pernah Bapak/Ibu beli?
    a. Merek …….., berat per kemasan (… g), harga per kemasan (Rp. …….)
    b. Merek ..……, berat per kemasan (… g), harga per kemasan (Rp. …….)
    c. Merek …….., berat per kemasan (… g), harga per kemasan (Rp. …….)

13. Berapa luas lahan yang Bapak/Ibu garap? Berapa luas lahan total sekelompok tani Bapak/Ibu?
    a. Luas lahan / tanah sawah saya …… ha;
    b. Luas lahan / tanah sawah sekelompok tani saya ……. ha.

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

B1: Hortikultura

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus ada dan tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, daun hijau pucat dan mudah layu, pertumbuhan kerdil, serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn pada padi sawah.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran

dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harus diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis tanaman hortikultura apa saja yang pernah Bapak/Ibu tanam?

   a. Sayur-sayuran: Apa? ……
   b. Buah-buahan: Apa?……
   c. Bunga: Apa?……
   d. Lainnya (sebutkan) : ……

2. Selama ini, jenis atau merek pupuk apa saja yang pernah Bapak/Ibu gunakan dalam bertani tanaman hortikultura?

   a. Urea
   b. Petro Nitrat
   c. SP36 Petro
   d. Nitrophonska / Petro Niphos / Phonska Plus
   e. NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   f. NPK Pusri / NPK PIM / NPK PIM TE
   g. ZA Petro
   h. ZK Petro
   i. KCl Kujang / KCl Petro
   j. Planta Plus
   k. Lainnya (sebutkan) ……

3. Selain menggunakan jenis-jenis pupuk pada jawaban no. 2 di atas, bahan-bahan lain apa saja yang juga pernah Bapak/Ibu gunakan?

   a. Pupuk Kandang
   b. Kalsit atau Dolomit
   c. Gipsum
   d. Zeolit
   e. Lainnya (sebutkan) ……

4. Setelah menggunakan pupuk-pupuk pada jawaban no. 2 di atas, apakah Bapak/Ibu pernah mengamati gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak/Ibu amati tersebut.

   …….
   …….
   …….

5. Menurut Bapak/Ibu, itu gejala kekekurangan hara apa? Atau keracunan hara apa?

   …….

6. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya tanaman hortikultura secara intensif dimungkinkan terjadi kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah dan tanaman?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

7. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn dalam budidaya tanaman hortikultura akan membatasi atau menghambat produksi?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

8. Apakah pada tanah atau media budidaya tanaman hortikultura Bapak/Ibu, sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan setiap musim tanam

b. Ya, tetapi tidak setiap musim tanam (sudah pernah melakukannya berapa kali? …..)
c. Tidak, saya belum pernah melakukannya
d. Saya ingin melakukannya
e. ……..

9. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
d. Saya belum pernah melakukannya
e. Saya ingin melakukannya
f. ……..

10. Berapa dosis pupuk Cu dan/atau Zn yang pernah Bapak/Ibu aplikasikan?

(… kg/ha atau … g/tanaman);

11. Berapa populasi tanaman hortikultura Bapak/Ibu?

( … tanaman/ha}

12. Dari mana Bapak/Ibu memperoleh pupuk yang mengandung Cu dan/atau Zn?

a. Subdisi pemerintah
b. Pemberian dari produsen pupuk sebagai contoh produk
c. Membeli di toko atau kios pertanian di desa / kelurahan / kecamatan / kabupaten
d. Lainnya (……..)

13. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan cara membeli, berapa harga pasaran pupuk Cu dan/atau Zn yang pernah Bpak/Ibu beli?

a. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)
b. Merek ..……, berat per kemasan (… g), harga per kemasan (Rp. …….)
c. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)

14. Berapa luas lahan yang Bapak/Ibu garap? Berapa luas lahan total sekelompok tani Bapak/Ibu?

Luas lahan / tanah saya …….. ha;
Luas lahan / tanah sekelompok tani saya …….. ha.

15. Apakah anggota kelompok tani lainnya juga menggunakan pupuk yang mengandung Cu dan/atau Zn seperti yang Bapak/Ibu lakukan?

    a. Ya, semua seperti yang saya lakukan
    b. Ya, sebagian besar seperti yang saya lakukan
    c. Ya, sebagian kecil saja yang seperti saya lakukan

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

C1: Perkebunan Kelapa Sawit Rakyat

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis atau merek pupuk apa saja yang pernah diaplikasikan di lahan kebun kelapa sawit Bapak/Ibu?

   a. Dolomit
   b. Urea
   c. ZA
   d. NPK+$B_2O_3$ 12:12:17.2:2.5
   e. NPKS+ $B_2O_3$ 13:8:27:4:0.58
   f. NPKS 15:15:6:4
   g. Rock Phosphate (RP)
   h. MOP (KCl)
   i. Kieserite
   j. Borax
   k. Lainnya (sebutkan) ……

2. Setelah menggunakan pupuk-pupuk pada jawaban no.1 di atas, apakah Bapak/Ibu pernah melihat gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak/Ibu amati tersebut.

   …….

3. Menurut Bapak/Ibu, itu gejala kekurangan hara apa? Atau keracunan hara apa?

   …….

4. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya kelapa sawit yang sudah berlangsung lama (bertahun-tahun) mungkin terjadi kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah dan tanaman?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

5. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah yang dibudidayakan kelapa sawit dapat menghambat pertumbuhan dan produksi tanaman?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

6. Apakah pada lahan Bapak/Ibu, sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan secara periodik (……..kali setahun)
   b. Ya, tetapi tidak periodik (sudah pernah melakukannya berapa kali? …..)
   c. Tidak, saya belum pernah melakukannya
   d. Saya ingin melakukannya
   e. ……..

7. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
   d. Saya belum pernah melakukannya
   e. Saya ingin melakukannya
   f. ……..

8. Berapa dosis pupuk Cu dan/atau Zn yang pernah Bapak/Ibu aplikasikan? (Isikan masing-masing …… g/pokok)

A. LAHAN GAMBUT
LUAS: …… ha

a. TBM 1, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
b. TBM 1, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
c. TBM 2, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
d. TBM 2, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
e. TBM 3, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
f. TBM 3, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun

g. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
h. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
i. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
j. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
k. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
l. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun

m. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
n. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
o. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu, dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
p. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn, dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun

B. LAHAN MINERAL (Podsolik / Berpasir / Lainnya (sebutkan) ……)
LUAS: …… ha

a. TBM 1, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
b. TBM 1, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
c. TBM 2, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
d. TBM 2, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun
e. TBM 3, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..... / tahun
f. TBM 3, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..... / tahun

g. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
h. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
i. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
j. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
k. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
l. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

m. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
n. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
o. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu, dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
p. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn, dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

9. Dari mana Bapak/Ibu memperoleh pupuk Cu dan/atau Zn?

   a. Membeli di toko pertanian terdekat
   b. Membeli di distributor pupuk terdekat
   c. Membeli di toko on line
   d. Lainnya (Mohon diisikan ……..)

10. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan membeli, berapa harga pasarannya?

    a. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
    b. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
    c. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

C2: Perusahaan Perkebunan Kelapa Sawit

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Apakah pada perkebunan Bapak/Ibu diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu diaplikasikan secara periodik
   b. Tidak, belum pernah dilakukan
   c. Perusahaan ingin melakukannya

2. Jika sudah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Tidak tahu itu pupuk majemuk atau tunggal tetapi sudah diaplikasikan (Merek? ……..)

3. Berapa dosis pupuk Cu dan/atau Zn yang diaplikasikan di perkebunan Bapak/Ibu? (Isikan masing-masing …… g/pokok)

   A. LAHAN GAMBUT
      LUAS: …… ha

   a. TBM 1, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
   b. TBM 1, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

c. TBM 2, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
d. TBM 2, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
e. TBM 3, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
f. TBM 3, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

g. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
h. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
i. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
j. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
k. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
l. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

m. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
n. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
o. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu, dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
p. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn, dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

B. LAHAN MINERAL (Podsolik / Berpasir / Lainnya (sebutkan) ……)
LUAS: …… ha

a. TBM 1, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
b. TBM 1, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
c. TBM 2, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
d. TBM 2, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
e. TBM 3, ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
f. TBM 3, ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

g. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
h. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
i. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
j. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

k. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
l. TM 1 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

m. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu: dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
n. TM 2 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn: dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun
o. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Cu, dosis = ….. g/pokok, $CuSO_4$ **ataukah** Cu-EDTA, berapa kali ..… / tahun
p. TM 3 atau produksi TBS ≥ ….. ton/thn atau analisis tanaman ….. ppm Zn, dosis = ….. g/pokok, $ZnSO_4$ **ataukah** Zn-EDTA, berapa kali ..… / tahun

4. Dari mana perusahaan Bapak/Ibu memperoleh pupuk Cu dan/atau Zn?

a. Membeli di toko pertanian terdekat
b. Membeli di distributor pupuk terdekat
c. Membeli di toko on line
d. Lainnya (Mohon diisikan ……..)

5. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan membeli, berapa harga pasarannya?

a. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
b. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
c. Merek …….., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

C3: Hutan Tanaman Industri Lahan Gambut

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis atau merek pupuk apa saja yang pernah digunakan dalam budidaya Hutan Tanaman Industri (HTI) di perusahaan Bapak/Ibu?:

   a. Urea
   b. Petro Nitrat
   c. SP36 Petro
   d. Nitrophonska / Petro Niphos / Phonska Plus
   e. NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   f. NPK Pusri / NPK PIM / NPK PIM TE
   g. ZA Petro
   h. ZK Petro
   i. KCl Kujang / KCl Petro
   j. Planta Plus
   k. Lainnya (sebutkan) ……

2. Setelah menggunakan pupuk-pupuk pada jawaban no.1 di atas, apakah Bapak/Ibu pernah melihat gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak amati tersebut.

   …….
   …….
   …….

3. Menurut Bapak/Ibu, itu gejala kekurangan hara apa? Atau keracunan hara apa?

   …….

4. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya HTI secara intensif yang sudah berlangsung lama (bertahun-tahun) mungkin terjadi kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah dan tanaman?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

5. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn pada tanah yang dibudidayakan untuk HTI secara intensif akan membatasi atau menghambat produksi?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

6. Apakah pada lahan HTI Bapak/Ibu sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan secara periodik (……..kali setahun)
   b. Ya, tetapi tidak periodik (sudah pernah melakukannya berapa kali? …..)
   c. Tidak, saya belum pernah melakukannya
   d. Saya ingin melakukannya
   e. ……..

7. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
   d. Saya belum pernah melakukannya
   e. Saya ingin melakukannya
   f. ……..

8. Berapa dosis pupuk Cu dan/atau Zn yang pernah Bapak/Ibu aplikasikan? (Isikan masing-masing …… kg/pokok)

   a. Tahun 1, …..
   b. Tahun 2, …..
   c. Tahun 3, …..
   d. Tahun 4, …..
   e. Tahun 5, …..

9. Dari mana perusahaan Bapak/Ibu memperoleh pupuk Cu dan/atau Zn?

   a. Membeli di toko pertanian terdekat
   b. Membeli di distributor pupuk terdekat
   c. Membeli di toko online
   d. Lainnya (Mohon diisikan ……..)

10. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan cara membeli, berapa harga pasaran pupuk Cu dan/atau Zn yang pernah Bapak/Ibu beli?

    a. Merek …….., berat per kemasan (… g), harga per kemasan (Rp. …….)
    b. Merek ..……, berat per kemasan (… g), harga per kemasan (Rp. …….)
    c. Merek …….., berat per kemasan (… g), harga per kemasan (Rp. …….)

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

D1: Padi Sawah Lahan Pasang Surut

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis atau merek pupuk apa saja yang pernah Bapak/Ibu gunakan dalam bertani padi sawah?

   a. Urea
   b. Petro Nitrat
   c. SP36 Petro
   d. Nitrophonska / Petro Niphos / Phonska Plus
   e. NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   f. NPK Pusri / NPK PIM / NPK PIM TE
   g. ZA Petro
   h. ZK Petro
   i. KCl Kujang / KCl Petro
   j. Planta Plus
   k. Lainnya (sebutkan) ……

2. Selain menggunakan jenis-jenis pupuk seperti No. 1 di atas, bahan-bahan lain apa saja yang juga pernah Bapak/Ibu gunakan?

   a. Kapur Pertanian (Kalsit atau Dolomit)
   b. Gipsum
   c. Zeolit
   d. Lainnya (sebutkan) ……

3. Setelah menggunakan pupuk-pupuk pada jawaban no.1 di atas, apakah Bapak/Ibu pernah melihat gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak/Ibu amati tersebut.

   …….
   …….
   …….

4. Menurut Bapak/Ibu, itu gejala kekurangan hara apa? Atau keracunan hara apa?

   …….

5. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya padi di lahan pasang surut mungkin terjadi kondisi kekurangan hara mikro Cu dan/atau Zn ?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

6. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn pada tanaman padi akan membatasi atau menghambat produksi?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

7. Apakah pada tanah sawah Bapak/Ibu, sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan setiap musim tanam
   b. Ya, tetapi tidak di setiap musim tanam (isikan sudah pernah melakukannya berapa kali? …..)
   c. Tidak, saya belum pernah melakukannya
   d. Saya ingin melakukannya
   e. ……..

8. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)

c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
d. Saya belum pernah melakukannya
e. Saya ingin melakukannya
f. ……..

9. Berapa dosis pupuk yang mengandung Cu dan/atau Zn (jawaban no. 8) yang pernah Bapak aplikasikan?

   (Isikan …….. kg/ha)

10. Dari mana Bapak memperoleh pupuk yang mengandung Cu dan/atau Zn?

    a. Subdisi Pemerintah
    b. Pemberian dari produsen pupuk sebagai contoh produk
    c. Membeli di toko atau kios pertanian di desa / kelurahan / kecamatan / kabupaten
    d. Lainnya (Isikan ……..)

11. Jika Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan cara membeli, berapa harga pasaran pupuk Cu dan/atau Zn yang pernah Bapak/Ibu beli?

    a. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)
    b. Merek ..……, berat per kemasan (… g), harga per kemasan (Rp. …….)
    c. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)

12. Berapa luas lahan yang Bapak garap? Berapa luas lahan total sekelompok tani Bapak?

    a. Luas lahan / tanah sawah saya ……. ha;
    b. Luas lahan / tanah sawah sekelompok tani saya …….. ha.

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

E1: Padi Sawah Intensif pH Tinggi

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan Fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## Peran dan Fungsi Gipsum sebagai Bahan Pembenah Tanah

Dalam jangka panjang, irigasi dapat meningkatkan salinitas tanah. Pemupukan yang tidak berimbang dalam jangka lama juga menurunkan kesuburan dan produktivitas tanah. Kedua masalah di lahan beririgasi ini dapat diatasi dengan aplikasi gipsum [CaSO4.2H2O), bahan pembenah tanah yang mengandung hara Kalsium (Ca) dan Sulfat (S), khususnya pada tanah yang memiliki pH tinggi dengan kadar hara basa tidak seimbang, misalya kadar hara Mg jauh melebihi kadar hara Ca. Pada tanah-tanah seperti ini, aplikasi gipsum juga dapat meningkatkan stabilitas bahan organik dan agregasi tanah, peresapan air ke dalam tanah, dan mempercepat perkecambahan benih sehingga meningkatkan produktivitas pertanian.

Beberapa manfaat aplikasi gipsum pada tanah pertanian bermasalah seperti dijelaskan di atas antara laian adalah sebagai berikut:

- memperbaiki struktur tanah,
- mencegah terjadinya perkerakan dan pemadatan tanah lapisan permukaan akibat percikan air hujan dan pengolahan tanah sehingga mempercepat perkecambahan benih,
- meningkatkan peresapan air irigasi dan air hujan ke dalam tanah sehingga meningkatkan efisiensi penggunaan air oleh tanaman,
- menurunkan pengaruh negatif dari sifat tanah yang mudah mengembang (pada musim hujan) dan mengkerut (kering dan retak pada musim kemarau),
- mempermudah pengolahan tanah,
- memperbaiki kesuburan tanah berkadar Na (natrium) tinggi, misalnya di kawasan pesisir
- menurunkan pH tanah berkadar Na tinggi ke pH sekitar netral, terutama pada lapisan di bawah permukaan tanah, sehingga pHnya sesuai bagi pertumbuhan tanaman,
- menurunkan kadar Al (Aluminium) penyebab kemasaman tanah sehingga meningkatkan pH tanah masam,
- meningkatkan kadar hara Ca sehingga memperbaiki nisbah kadar Ca/Mg pada tanah berkadar Mg tinggi atau tanah yang diaplikasikan dolomit berlebih, serta memperbaiki kesimbangan kadar hara mikro seperti besi (Fe), Cu, Zn dan Mn,

- meningkatkan efektivitas aplikasi bahan organik ke lahan pertanian, antara lain dalam hal meningkatkan peran cacing tanah,
- meningkatkan serapan amonium (NH4+), salah satu bentuk hara nitrogen (N) yang dapat diserap tanaman, dan menurunkan kehilangan amonium ke udara akibat penguapan, dan pada akhirnya aplikasi gipsum dapat meningkatkan pertumbuhan dan produktivitas tanaman.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn SERTA BAHAN PEMBENAH TANAH GIPSUM

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Selama ini, jenis atau merek pupuk apa saja yang pernah Bapak/Ibu gunakan dalam bertani padi sawah?

   a. Urea
   b. Petro Nitrat
   c. SP36 Petro
   d. Nitrophonska / Petro Niphos / Phonska Plus
   e. NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   f. NPK Pusri / NPK PIM / NPK PIM TE
   g. ZA Petro
   h. ZK Petro
   i. KCl Kujang / KCl Petro
   j. Planta Plus
   k. Lainnya (sebutkan) ……

2. Selain menggunakan jenis-jenis pupuk seperti No. 1 di atas, bahan-bahan lain apa saja yang juga pernah Bapak/Ibu gunakan?

   a. Kapur Pertanian
   b. Dolomit
   c. Gipsum
   d. Zeolit
   e. Lainnya ……

3. Setelah menggunakan pupuk-pupuk pada jawaban no.1 di atas, apakah Bapak/Ibu pernah melihat gejala terjadinya kekurangan atau kelebihan/keracunan hara? Jika ya, uraikan gejala yang pernah Bapak/Ibu amati tersebut.

   …….
   …….
   …….

4. Menurut Bapak/Ibu, itu gejala kekekurangan hara apa? Atau keracunan hara apa?

   …….

5. Apakah Bapak/Ibu sudah mengetahui bahwa dalam budidaya padi di lahan sawah yang memiliki pH tinggi, pada tanah dan tanaman Bapak mungkin terjadi kondisi kekurangan hara mikro Cu dan/atau Zn?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

6. Apakah Bapak/Ibu sudah mengetahui bahwa kondisi kekurangan hara mikro Cu dan/atau Zn pada tanaman padi yang dibudidayakan akan membatasi atau menghambat produksi?

   a. Ya, saya sudah memahami hal ini
   b. Saya sudah mengetahui tetapi belum memahami hal ini
   c. Tidak, saya belum mengetahui hal ini
   d. Saya ingin lebih mengetahui dan memahami hal ini
   e. ……..

7. Apakah pada tanah sawah Bapak/Ibu, sudah pernah diaplikasikan pupuk yang mengandung Cu dan/atau Zn?

   a. Ya, selalu saya lakukan setiap musim tanam
   b. Ya, tetapi tidak setiap musim tanam (sudah pernah melakukannya berapa kali? …..)
   c. Tidak, saya belum pernah melakukannya
   d. Saya ingin melakukannya
   e. ……..

8. Jika sudah pernah mengaplikasikan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau merek pupuk yang digunakan?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Saya tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya (Merek? ……..)
   d. Saya belum pernah melakukannya
   e. Saya ingin melakukannya
   f. ……..

9. Berapa dosis pupuk yang mengandung Cu dan/atau Zn (jawaban no. 8) yang pernah Bapak/Ibu aplikasikan? (…….. kg/ha)
10. Apakah pada tanah sawah Bapak/Ibu, sudah pernah diaplikasikan gipsum?

    a. Ya, selalu saya lakukan setiap musim tanam
    b. Ya, sudah pernah melakukannya (berapa kali? …..)
    c. Tidak, saya belum pernah melakukannya
    d. Saya ingin melakukannya
    e. ……..

11. Dari mana Bapak/Ibu memperoleh pupuk yang mengandung Cu dan/atau Zn?

    a. Subdisi pemerintah
    b. Pemberian dari produsen pupuk sebagai contoh produk
    c. Membeli di toko atau kios pertanian di desa / kelurahan / kecamatan / kabupaten
    d. Lainnya (……..)

12. Bila Bapak/Ibu memperoleh pupuk Cu dan/atau Zn dengan membeli, berapa harga pasarannya?
    a. Merek ……., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
    b. Merek ……., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)
    c. Merek ……., berat per kemasan (…… g atau kg), harga per kemasan (Rp. ……..)

13. Berapa luas lahan yang Bapak/Ibu garap? Berapa luas lahan total sekelompok tani Bapak?

    a. Luas lahan / tanah sawah saya …… ha;
    b. Luas lahan / tanah sawah sekelompok tani saya …….. ha.

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

F1: Lahan Reklamasi Bekas Tambang Aluvial Daratan

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. SEKILAS INFO

### Peran dan fungsi Hara Mikro Cu dan Zn terhadap Pertumbuhan Tanaman

Selain **hara makro** (C, H, O, N, P, K, Ca, Mg, dan S), untuk dapat menyelesaikan siklus hidupnya dari berkecambah sampai berbuah, tanaman juga memerlukan **hara mikro**, diantaranya tembaga (**Cu**) dan Seng (**Zn**). Nutrisi atau hara mikro dibutuhkan tanaman dalam jumlah jauh lebih sedikit daripada hara makro, tetapi harus tersedia bagi tanaman. Beberapa penyebab terjadinya kekurangan hara mikro sehingga perlu dipenuhi dengan pemupukan terutama adalah tingkat budidaya tanaman yang intensif dan penggunaan varietas unggul sehingga memerlukan hara lebih tinggi, penggunaan pupuk hara makro (NPK) yang hanya sedikit mengandung hara mikro sebagai bahan ikutan, dan terutama adalah penurunan penggunaan bahan organik segar maupun yang sudah dikomposkan.

Tembaga (Cu) diperlukan tanaman untuk mengolah karbohidrat dan nitrogen, sehingga kekurangan Cu menyebabkan tanaman kerdil. Cu juga diperlukan untuk pembentukan lignin untuk kekuatan dinding sel tanaman dan mencegah layu. Gejala kekurangan Cu antara lain daun menguning, hijau pucat dan mudah layu, pertumbuhan kerdil serta ranting dan batang mati.

Seng (Zn) merupakan komponen penting dari berbagai sistem enzim tanaman untuk produksi energi, protein, dan pertumbuhan. Kekurangan Zn menyebabkan penundaan kematangan. Gejala kekurangan Zn terutama terjadi pada jaringan muda. Gejala kekurangan Zn yang paling mudah terlihat adalah terbentuknya ruas yang pendek dan ukuran daun yang mengecil. Daun kering dan mati merupakan gejala khas kekurangan Zn.

Banyak pupuk hara mikro yang beredar di pasaran. Sebagian besar pupuk hara mikro diaplikasikan pada tanah atau disemprotkan pada daun. Karena dosis rekomendasi pupuk mikro rendah, sebagian hara mikro dicampurkan dengan pupuk NPK sebagai pupuk majemuk, atau dicampurkan dengan pupuk cair.

Dosis pupuk mikro Cu yang direkomendasikan berkisar 3 sampai 10 kg/ha sebagai $CuSO_4$ atau CuO yang digiling halus. Efek sisa pemupukan Cu sangat nyata, masih teramati hingga 8 tahun setelah aplikasi pertama. Aplikasi Cu harus dikurangi atau dihentikan ketika kadar yang tersedia dalam tanah sudah meningkat dan melampaui batas kekurangan.

Dosis pupuk Zn yang direkomendasikan berkisar 1 sampai 10 kg/ha. Cara aplikasinya adalah disebar sepanjang alur tanaman atau disebar merata. Aplikasi dengan cara penyemprotan pada daun juga efektif. Seperti halnya Cu, efek sisa dari pemupukan Zn masih dapat teramati hingga 5 tahun setelah aplikasi pertama.

Metode aplikasi pupuk mikro yang paling umum adalah pada tanah. Empat metode aplikasi pupuk mikro dengan cara dicampurkan dengan pupuk makro adalah: (1) pencampuran dilakukan pada proses pembuatan pupuk di pabrik, (2) dilakukan pelapisan pupuk mikro pada pupuk makro butiran di pabrik, (3) pencampuran dilakukan secara manual dengan

pupuk butiran, dan (4) pencampuran secara manual dengan pupuk cair. Aplikasi pupuk mikro dengan cara disemprotkan pada daun harus dilakukan dengan hati-hati karena daun dapat terbakar.

Keuntungan dari aplikasi dengan cara penyemprotan pada daun adalah: (1) dosis aplikasi jauh lebih rendah daripada aplikasi pada tanah; (2) aplikasi lebih seragam, dan (3) respon tanaman hampir segera sehingga kekurangan hara dapat diperbaiki selama musim tanam. Kerugiannya adalah: (1) daun dapat terbakar jika kadar garam dalam larutan pupuk mikro yang disemprotkan terlalu tinggi; (2) dosis seringkali menjadi lebih tinggi ketika diaplikasikan saat tanaman masih muda karena permukaan daunnya tidak mencukupi untuk penyerapan pupuk mikro yang disemprotkan, (3) hasil maksimal tidak mungkin tercapai jika aplikasi ditunda sampai gejala kekurangan muncul, harusnya diaplikasikan sebelum muncul gejala kekurangan, dan (4) ada sedikit efek sisa. Biaya aplikasi akan lebih tinggi jika diperlukan lebih dari satu kali penyemprotan, kecuali jika dapat dikombinasikan dengan penyemprotan pestisida.

## III. INFORMASI PENGGUNAAN DAN POLA PEMANFAATAN PUPUK MIKRO Cu & Zn

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Berapa luas lahan reklamasi di perusahaan Bapak/Ibu?

   a. Yang sudah direklamasi dengan revegetasi: …… ha
   b. Yang akan direklamasi dengan revegetasi: …… ha

2. Tanaman reklamasi apa saja yang digunakan dalam kegiatan revegetasi di lahan bekas tambang perusahaan Bapak/Ibu?

   a. Jabon
   b. Sengon
   c. Karet
   d. Buah-buahan (mohon disebutkan: …….
   e. Spesies tanaman lokal: ……

3. Dalam kegiatan reklamasi di perusahaan Bapak/Ibu, selain bahan alami seperti pupuk kandang, kompos, kalsit/dolomit, dan rock phosphate, pupuk apa saja yang pernah diaplikasikan?

   a. Urea
   b. ZA
   c. ZK
   d. TSP / SP36
   e. KCl
   f. NPK Phonska / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE
   g. Lainnya (mohon disebutkan) ……

4. Apakah dalam program reklamasi dengan revegetasi di perusahaan Bapak/Ibu pernah digunakan juga pupuk yang mengandung hara mikro, khususnya Cu dan/atau Zn?

   a. Pernah
   b. Belum

5. Jika pernah menggunakan pupuk yang mengandung Cu dan/atau Zn, apa jenis atau mereknya?

   a. Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merek? ……..)
   b. Pupuk tunggal yang hanya mengandung Cu dan/atau Zn (Merek? ……..)
   c. Tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakan (Merek? ……..)

6. Berapa dosis pupuk Cu dan/atau Zn yang pernah diaplikasikan?
   (Mohon diisikan …….. kg/ha atau ……. g/tanaman; populasi..…… pohon/ha)

7. Dari mana perusahaan Bapak memperoleh pupuk Cu dan/atau Zn?

   a. Membeli di toko pertanian terdekat
   b. Membeli di distributor pupuk terdekat
   b. Membeli di toko on line
   c. Lainnya (Mohon dilsikan ……..)

8. Bila perusahaan Bapak memperoleh pupuk Cu dan/atau Zn dengan membeli, berapa harga pasarannya?

   a. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)
   b. Merek ..……, berat per kemasan (… g), harga per kemasan (Rp. …….)
   c. Merek ……., berat per kemasan (… g), harga per kemasan (Rp. …….)

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# KUESIONER PENELITIAN

## "Studi Penggunaan dan Pola Pemanfaatan Pupuk Mikro Cu dan Zn"
## Tim Peneliti Pusat Bioteknologi IPB

G1: Produsen & Distributor Pupuk Mikro Cu dan Zn

## I. PENGANTAR

Peran pupuk dan pemupukan berimbang yang tepat jenis, dosis, cara dan waktu aplikasi sangat penting dalam peningkatan produksi pertanian tanaman pangan, hortikultura, perkebunan, hutan tanaman industri, dan keragaan tumbuh tanaman reklamasi di lahan bekas tambang aluvial daratan, sehingga juga menunjang ketahanan pangan nasional. IPB berusaha terus mengembangkan pengetahuan tentang pupuk dan pemupukan, salah satunya adalah pupuk hara mikro, khususnya tembaga (simbol  Cu) dan seng (simbol Zn). Kedua unsur tersebut merupakan salah satu "hasil samping" dari kegiatan pertambangan dan proses penambangan bijih logam di Indonesia dan diketahui dapat digunakan dan diolah kembali sebagai bahan baku pembuatan pupuk hara mikro sehingga memenuhi kaidah pemanfaatan sumberdaya alam secara hemat dan ramah lingkungan.

Untuk memastikan produksi dan penerapannya secara tepat, tim peneliti dari Pusat Bioteknologi IPB melakukan kegiatan pemetaan tingkat penggunaan dan pola pemanfaatan pupuk hara mikro yang sekarang sudah beredar di Indoensia. Diharapkan dari penelitian ini akan diperoleh gambaran tentang jumlah penggunaan dan tingkat permintaannya, baik saat ini maupun di waktu mendatang. Untuk itu, tim peneliti ingin belajar dan berbagi pengalaman dengan Bapak/Ibu tentang pola penggunaan pupuk yang Bapak/Ibu terapkan.Informasi dari penelitian ini diharapkan dapat memberikan pengetahuan mengenai tingkat kebutuhan pupuk Cu dan Zn saat ini dan yang akan datang. Untuk itu kami mohon izin mendapat kesempatan mewawancarai Bapak/Ibu dengan panduan daftar pertanyaan terlampir.

Atas kesempatan yang diberikan dan kesediaan Bapak/Ibu dalam berbagi pengalaman diucapkan terima kasih.

| | |
|---|---|
| No. Responden | : |
| Tanggal Wawancara | : |
| Nama Responden | : |
| Alamat | : |
| No. HP WA | : |
| Pewawancara | : |

## II. INFORMASI TERKAIT PRODUKSI PUPUK

**Silahkan pilih huruf jawaban (boleh lebih dari satu) atau sampaikan jawaban lain yang paling sesuai dengan pengalaman Bapak/Ibu. Jawaban disampaikan pada saat wawancara.**

1. Apakah perusahaan Bapak/Ibu produsen pupuk sintetik yang mengandung Cu (tembaga) dan/atau Zn (seng)?

   a. Ya
   b. Tidak

2. Jika **Ya**, berapa kapasitas produksi pupuk sintetik mengandung Cu dan/atau Zn perusahaan Bapak/Ibu?

   a. < 50.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   b. 50.000 – 100.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   c. 100.000 – 200.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   d. 200.000 – 400.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   e. 400.000 – 600.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   f. >600.000 ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn
   g. ……..ton/tahun pupuk mengandung Cu/ Zn/ Cu&Zn

3. Jika **Tidak**, apakah perusahaan Bapak/Ibu berencana untuk memproduksi pupuk yang mengandung Cu dan/atau Zn?

   a. Ya
   b. Tidak

4. Apakah perusahaan Bapak/Ibu memproduksi pupuk tunggal atau pupuk majemuk hara mikro Cu dan/atau Zn?

   a. Ya
   b. Tidak

5. Jika **Ya**, berapa kapasitas produksi pupuk hara mikro Cu dan/atau Zn sebagai pupuk tunggal atau pupuk majemuk yang diproduksi perusahaan Bapak/Ibu?

   a. < 5.000 ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn
   b. 5.000 – 10.000 ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn
   c. 10.000 – 20.000 ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn
   d. 20.000 – 30.000 ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn
   e. > 30.000 ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn
   f. ……. ton/tahun pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn

6. Jika **Tidak**, apakah perusahaan Bapak/Ibu berencana untuk memproduksi pupuk hara mikro Cu dan/atau Zn sebagai pupuk tunggal atau pupuk majemuk?

   a. Ya
   b. Tidak

---

7. Apakah perusahaan Bapak/Ibu melakukan kegiatan perdagangan langsung pupuk yang mengandung Cu dan Zn? (Jika **Tidak**, lanjutkan ke pertanyaan no. 8)

   a. Ya
   b. Tidak

8. Jika **Ya**, berapa volume perdagangan pupuk yang mengandung Cu dan Zn?

| | |
|---|---|
| a. < 50.000 ton/tahun | pupuk mengandung Cu/ Zn/ Cu&Zn |
| b. 50.000 – 100.000 ton/tahun | pupuk mengandung Cu/ Zn/ Cu&Zn |
| b. 100.000 – 200.000 ton/tahun | pupuk mengandung Cu/ Zn/ Cu&Zn |
| c. 200.000 – 300.000 ton/tahun | pupuk mengandung Cu/ Zn/ Cu&Zn |
| d. ……..ton/tahun | pupuk mengandung Cu/ Zn/ Cu&Zn |

9. Apakah perusahaan Bapak/Ibu melakukan kegiatan perdagangan langsung pupuk hara mikro Cu dan/atau Zn sebagai pupuk tunggal atau pupuk majemuk?

   a. Ya
   b. Tidak

10. Jika **Ya**, berapa volume perdagangan pupuk hara mikro Cu dan/atau Zn sebagai pupuk tunggal atau pupuk majemuk?

| | |
|---|---|
| a. < 5.000 ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |
| b. 5.000 – 10.000 ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |
| c. 10.000 – 20.000 ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |
| d. 20.000 – 30.000 ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |
| e. > 30.000 ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |
| f. ……. ton/tahun | pupuk tunggal atau majemuk Cu/ Zn/ Cu&Zn |

11. Jika **Tidak**, apakah perusahaan Bapak/Ibu berencana untuk melakukan eprdagangan langsung pupuk hara mikro Cu dan/atau Zn sebagai pupuk tunggal atau pupuk majemuk?

    a. Ya
    b. Tidak

-o-

# Appendix 2.

## Recapitulation of the in-depth interview and field verification results

**A1. Lahan Padi Sawah Intensif**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 01/12/21 | 02/12/21 | 02/12/21 |
| Nama R | H. Salim Hariadi | Bintang Sucipto | H. Masroni |
| Poktan | Karya Mulya | Sanur Indah | Bumi Tani |
| | (Sejak 09/09/99) | | |
| Alamat | Ds. Sumber Rejo | Desa Sanur | Desa Kalensari |
| | Kec. Purwosari | Kec. Tikung | Kec. Widasari |
| | Kab. Pasuruan | Kab. Lamongan | Kab. Indramayu |
| | Jawa Timur | Jawa Timur | Jawa Barat |
| ∑ Anggota | Aktif 30 | 80 | 60 |
| Luas Poktan (ha) | 50 | 45 | 40 |
| Luas Desa (ha) | 165 | 340 | 228 |
| Altitude (m dpl) | 400 | 9 | 3 |
| IP | 3 | 2-3 | 2-3 |
| Produksi (t/ha) | 6-7 | 7 | 6-7 |
| | | | |
| **No. 1** | Urea | Urea | Urea |
| | SP-36 | SP-36 | SP-36 |
| | NPK 15-15-15 | NPK Phonska | NPK Phonska |
| | NPK Mutiara (16-16-16) | ZA Petro | MKP Pak Tani |
| | NPK Phonska (S) | Meroke Zn | Provibio |
| | Petroganik (S) | Provibio | |
| | Pupuk Hayati/Organik | | |
| | | | |
| **No- 2** | Pernah | Pernah | Pernah |
| | Daun padi sawah mengering sebelum tua (setempat dikenal sebagai “Nglaras”) | Daun menguning dan ada bercak, tanaman sulit tumbuh disebut "Malting" | Daun menguning dan ada bercak |
| | | | |
| **No. 3** | Kelebihan pupuk N | Kekurangan pupuk N | tidak bisa menje;askan |
| | | | |
| | | | |
| **No. 4** | Tidak, belum tahu | Sudah tahu | Tidak, belum tahu |
| | Ingin lebih tahu dan paham | Belum memahami | Ingin lebih tahu dan paham |
| | | | |
| **No. 5** | Tidak, belum tahu | Sudah tahu | Tidak, belum tahu |
| | Ingin lebih tahu dan paham | Belum memahami | Ingin lebih tahu dan paham |
| | | | |
| **No. 6** | Tidak, belum tahu | - | - |
| | Ingin lebih tahu dan paham | | |
| | | | |
| **No. 7** | Tidak, belum pernah | Ya, dilakukan setiap musim tanam | Tidak, belum pernah |
| | Saya ingin melakukannya | | Saya ingin melakukannya |
| | | | |
| **No. 8** | Tidak, belum pernah | Pupuk Tunggal Zn (Meroke Zn) | Tidak, belum pernah, saya ingin melakukannya |
| | | | |

## A1. Lahan Padi Sawah Intensif (Lanjutan)

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 9** | x | 50 gram/ 17 liter air diseprot 3 kali | Tidak pernah menggunakan |
| | | | |
| **No. 10** | x | sebelum tanam, 7 HST, 24 HST | Tidak pernah menggunakan |
| | | | |
| **No. 11** | x | Disemprotkan ke tanah sebagai pupuk cair | Tidak pernah menggunakan |
| | | | |
| **No. 12** | x | Membeli di toko pertanian di kecamatan | Tidak pernah menggunakan |
| | | | |
| | | | |
| **No. 13** | x | Meroke Zn, per 250 gram, Harga 30.000 | Tidak pernah menggunakan |
| | | | |
| **No. 14** | 0 ha | 5000 m2 | 7000 m2 |
| | 50 ha | 45 ha | 40 ha |
| | 165 ha | 340 ha | 228 ha |
| | | | |
| **Interpretasi** | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn | | |
| | | | |
| | PERLU VERIFIKASI LAPANG KE PETANI DI SETIAP DUSUN DARI 5 DUSUN SEDESA SUMBER REJO | | |

| **TAM** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
|---|---|---|---|
| **PENGURANG POTENSIAL** | **165 ha** | **-** | **228 ha** |
| **GROWTH FACTOR** | **165 ha** | **-** | **228 ha** |

Diprediksi dari:

- peningkatan impor selama 10 tahun terakhir

**A1. Lahan Padi Sawah Intensif (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 | Responden-06 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 02/12/21 | 03/12/21 | 09/12/21 |
| Nama R | Suryadinata | Haeruddin | Usin |
| Poktan | Barokah Tani | Alawatu | Satan Makmur 1 |
| | | | >30 tahun |
| Alamat | Desa Gempol Kolod | Kel. Lala Bata Rilau | Dusun 4, Desa Air Satan |
| | Kecamatan Banyu Sari | Kec. Lala Bata | Kec. Muara Beliti |
| | Kabupaten Karawang | Kab. Soppeng | Kab. Musi Rawas |
| | Jawa Barat | Sulawesi Selatan | Sumatera Selatan |
| ∑ Anggota | 25 | Aktif 60 | 22 |
| Luas Poktan (ha) | 40 | 90 | 22 |
| Luas Desa (ha) | 175 | | |
| Altitude (m dpl) | 25 | | |
| IP | 2-3 | 2 | 2 |
| Produksi (t/ha) | 6,7 | 6 | 6,5-7 |
| | | | |
| **No. 1** | Urea | Urea | Urea |
| | SP-36 | SP36 Petro | NPK Mutiara+TE |
| | NPK Phonska | NPK Phonska | NPK Pusri |
| | | Ca Petro | KCl |
| | | | Pestisida |
| | | | Pupuk hayati |
| | | | Bahan humat |
| | | | TSP |
| | | | Phonska |
| | | | |
| **No- 2** | Pernah | Pernah | Tidak pernah |
| | Daun menguning dan ada bercak | Pertumbuhan padi kerdil | |
| | | | |
| **No. 3** | tidak bisa menje;askan | Kurang pupuk SP36 | Tidak tahu |
| | | Kurang pupuk Urea | |
| | | | |
| **No. 4** | Tidak, belum tahu | Tidak, belum tahu | Tidak, belum tahu |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| | | | |
| **No. 5** | Tidak, belum tahu | Tidak, belum tahu | Tidak, belum tahu |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| | | | |
| **No. 6** | - | Tidak, belum tahu | Tidak, belum tahu |
| | | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| | | | |
| **No. 7** | Tidak, belum pernah | Tidak, belum pernah | Pernah, tergantung hijaunya padi |
| | Saya ingin melakukannya | Saya ingin melakukannya | bila dirasa perlu, dilakukan pemupukan NPK mutiara+TE merk Meroke di pemupukan ke-2 atau 3 |

**A1. Lahan Padi Sawah Intensif (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 | Responden-06 |
|---|---|---|---|
| | | | |
| **No. 8** | Tidak, belum pernah, saya ingin melakukannya | Tidak, belum pernah | NPK Mutiara+TE merk Meroke |
| | | Saya ingin melakukannya | |
| | | | |
| **No. 9** | Tidak pernah menggunakan | x | 200-250 kg/ha NPK Mutiara + TE merk Meroke di pemupukan ke-2 atau 3 |
| | | | |
| **No. 10** | Tidak pernah menggunakan | x | Di pemupukan ke-2 atau 3 tergantung hijaunya padi |
| | | | |
| **No. 11** | Tidak pernah menggunakan | x | Tidak dicampurkan dengan pupuk lainnya, disebarkan |
| | | | |
| **No. 12** | Tidak pernah menggunakan | x | Membeli di toko pertanian, kecamatan |
| | | | |
| | | | |
| **No. 13** | Tidak pernah menggunakan | x | NPK + TE merk Meroke, Rp 500.000/50 kg |
| | | | |
| **No. 14** | 1,5 ha | 2 ha | 2 ha |
| | 40 ha | 90 ha | 22 ha |
| | 175 ha | | |
| | | | |
| **Interpretasi** | | | |
| | | | |
| | | | |

| TAM | X ha (Spasial) | X ha (Spasial) | X ha (Spasial) |
|---|---|---|---|
| **PENGURANG POTENSIAL** | **175 ha** | **90 ha** | **-** |
| **GROWTH FACTOR** | **175 ha** | **90 ha** | **-** |

Diprediksi dari:
- peningkatan impor selama 10 tahun terakhir

**A1. Lahan Padi Sawah Intensif (Lanjutan)**

| PERTANYAAN | Responden-07 | Responden-08 | Responden-09 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 02/12/21 | 02/12/21 | 03/12/21 |
| Nama R | Setiyarman | Zuberusman | Wahyudi (Pak Wo) |
| Poktan | Tani Nastiti | | Margo Utomo |
| | 1980 | 1990 | 1990 |
| Alamat | Ds. Tegal Made | Dadapan | Ds. Getas |
| | Mojolaban | Sedan | Tanjung Anom |
| | Sukoharjo | Rembang | Nganjuk |
| | Jawa Tengah | Jawa Tengah | Jawa Timur |
| ∑ Anggota | Aktif 125 | Aktif 30 | Aktif 42 |
| Luas Poktan (ha) | 50,5 | 30 | 25 |
| Luas Desa (ha) | .... | 505,235 | 324,71 |
| Altitude (m dpl) | 104 | 158 | 46 |
| IP | 3 | 2 | 3 |
| Produksi (t/ha) | 7,5-10 | | 8-10 |
| | | | |
| **No. 1** | POP (Pukan) | Kompos | Urea |
| | POC | POC | Phonska Plus |
| | Dolomit | | ZA Petro |
| | Zeolit | | MKP |
| | | | Dolomit |
| | | | Petrovita |
| | | | POMI |
| | | | |
| **No- 2** | Tidak | | Pernah |
| | Padi tidak perlu N Urea, terlalu banyak gabah tdk bernas. Dg bagan warna daun hijau N cukup. | Tidak terjadi gejala kekurangan atau keracunan, tanaman tumbuh subur. | Kerdil (tidak modot), warna merah merat (asem-asem) |
| | Pernah, saat aplikasi 'badeg' (limbah ciu) beras mudah patah. | | |
| | | | |
| **No. 3** | Beras mudah pecah karena keracunan Cu dari 'badeg'. | | Tidak tahu, tahunya asem-asem. |
| | | | |
| **No. 4** | Tahu dan memahami | | Tahu dan memahami |
| | Aplikasi pupuk organik rutin setiap tanam, menurunkan risiko kekurangan Cu/Zn | | |
| | | | |
| **No. 5** | Tahu dan memahami | | Tahu dan memahami |
| | | | |
| | | | |
| **No. 6** | Ya, aplikasi pupuk organik (padat & cair) | | Ya, selalu pakai tiap musim tanam |
| | | | |

## A1. Lahan Padi Sawah Intensif (Lanjutan)

| PERTANYAAN | Responden-07 | Responden-08 | Responden-09 |
|---|---|---|---|
| | | | |
| No. 7 | Tidak, belum pernah | Tidak, belum pernah | Merk lupa, dari Petro (Petrovita) |
| | | | |
| | | | |
| No. 8 | Tidak, belum pernah | Tidak, belum pernah | 100 ml/ha |
| | | | |
| | | | |
| No. 9 | x | x | 21 hari |
| | | | |
| No. 10 | x | x | Disemprotkan ke tanah dan tanaman sebagai pupuk cair. |
| | | | |
| No. 11 | x | x | kios pertanian di desa |
| | | | |
| No. 12 | x | x | Petrovita, 100 ml, Rp. 80.000 |
| | | | |
| | | | |
| No. 13 | x | x | |
| | | | |
| No. 14 | 0,35 ha | 3 ha | 3 ha |
| | 50,5 ha | 30 ha | 25 ha |
| | | | |
| | | | |
| Interpretasi | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn | | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn |
| | | | |
| | PERLU VERIFIKASI LAPANG KE PETANI DI DUSUN-DUSUN DESA TEGALMANDE | | PERLU VERIFIKASI LAPANG KE PETANI DI DUSUN-DUSUN DESA GETAS |

| TAM | X ha (Spasial) | X ha (Spasial) | X ha (Spasial) |
|---|---|---|---|
| PENGURANG POTENSIAL | 50,5 ha | 30 ha | - |
| GROWTH FACTOR | - | - | - |

Diprediksi dari:

- peningkatan impor selama 10 tahun terakhir (MRA)

**A1. Lahan Padi Sawah Intensif (Lanjutan)**

| PERTANYAAN | Responden-10 | Responden-11 |
|---|---|---|
| | | |
| Tanggal Interview | 04/12/21 | 20/12/21 |
| Nama R | Rianto | Maryono |
| Poktan | | |
| | 1980an | - |
| Alamat | Karangsuko | Triyoso Bk 8 |
| | Pagelaran | Kecamatan Belitang |
| | Kab Malang | Kab OKU Timur |
| | Jawa Timur | Sumatera Selatan |
| ∑ Anggota | | |
| Luas Poktan (ha) | | |
| Luas Desa (ha) | 399 | 340 |
| Altitude (m dpl) | 500-1000 | 200 |
| IP | 3 | 2 |
| Produksi (t/ha) | 5-8 | 5 |
| | | |
| **No. 1** | Urea | Urea |
| | Phonska Plus | NPK Phonska |
| | NPK Phonska | Dolomit |
| | ZA Petro | Pupuk Organik Cair buatan sendiri |
| | Gandasil D & B | |
| | | |
| **No- 2** | Pernah | Pernah |
| | Padi dan batang padi kemerah-merahan (asem-asem) | Daun menguning dan ada bercak |
| | | |
| **No. 3** | Tidak tahu. Tahunya asem-asem diatasi dengan cara swah dikeringkan dan ditaburkan SP36, dalam seminggu tanaman segar kembali. Kalau dipupuk urea, tanaman padi mati. | tidak bisa menjelaskan |
| | | |
| **No. 4** | | Tidak, belum tahu |
| | Ya. Sudah memahami hal ini. | Ingin lebih tahu dan paham |
| | | |
| **No. 5** | Ya. Sudah memahami hal ini. | Tidak, belum tahu |
| | | Ingin lebih tahu dan paham |
| | | |
| **No. 6** | | Tidak, belum tahu |
| | | Ingin lebih tahu dan paham |
| | | |

**A1. Lahan Padi Sawah Intensif (Lanjutan)**

| PERTANYAAN | Responden-10 | Responden-11 |
|---|---|---|
| | | |
| **No. 7** | Gandasil D dan Gandasil B | Tidak, belum pernah |
| | | Saya ingin melakukannya |
| | | |
| **No. 8** | 100 g/0,25 ha | Tidak, belum pernah, saya ingin melakukannya |
| | | |
| | | |
| **No. 9** | Gandasil D: 1-30 HST; Gandasil B: > 30 HST | Tidak pernah menggunakan |
| | | |
| **No. 10** | Disemprotkan ke tanah dan tanaman sebagai pupuk cair. | Tidak pernah menggunakan |
| | | |
| **No. 11** | kios pertanian di desa | Tidak pernah menggunakan |
| | | |
| **No. 12** | Gandasil D 100 g Rp. 8.000 | Tidak pernah menggunakan |
| | Gandasil B 100 g Rp. 10.000 | |
| | | |
| **No. 13** | | Tidak pernah menggunakan |
| | | |
| **No. 14** | 0,25 ha | 1 ha |
| | 155 ha | 30 ha |
| | | 340 ha |
| | | |
| **Interpretasi** | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn | |
| | | |
| | PERLU VERIFIKASI LAPANG KE PETANI DI DUSUN-DUSUN DESA KARANGSUKO | |

| TAM | X ha (Spasial) | X ha (Spasial) |
|---|---|---|
| PENGURANG POTENSIAL | - | - |
| GROWTH FACTOR | - | - |

Diprediksi dari:

- peningkatan impor selama 10 tahun terakhir

## A1. Lahan Padi Sawah Intensif - Verifikasi Lapangan

| PERTANYAAN | Responden-12 | Responden-13 |
|---|---|---|
| | | |
| Tanggal Interview | 12/01/22 | 13/01/22 |
| Nama R | Pasiran | Punadi |
| Poktan | Sumber Makmur | Mudi Makmur |
| | - | 1980 |
| Alamat | Desa Sumberarum | Desa Mulyorejo |
| | Kecamatan Ngraho | Kecamatan Singgahan |
| | Kab. Bojonegoro | Kab. Tuban |
| | Jawa Timur | Jawa Timur |
| ∑ Anggota | | |
| Luas Poktan (ha) | 150 | |
| Luas Desa (ha) | | |
| Altitude (m dpl) | | |
| IP | 3 | |
| Produksi (t/ha) | | 5 |
| | | |
| **No. 1** | Urea | Urea |
| | NPK Phonska | NPK Phonska |
| | ZA Petrokimia | SP 36 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| **No- 2** | Pernah | |
| | Gejala potong leher | |
| | | |
| **No. 3** | Kurang P (fosfor) | |
| | | |
| **No. 4** | Tidak, belum tahu | Sudah tahu |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| **No. 5** | Tidak, belum tahu | Sudah tahu |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| **No. 6** | Tidak, belum tahu | Ya, sudah |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| **No. 7** | Tidak, belum pernah | Menggunakan racikan sendiri |
| | Saya ingin melakukannya | |
| **No. 8** | Tidak, belum pernah, saya ingin melakukannya | ZnSO4 8 kg/ha/musim<br>39 g/ha/musim |
| | | |

## A1. Lahan Padi Sawah Intensif - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-12 | Responden-13 |
|---|---|---|
| | | |
| No. 9 | Tidak pernah menggunakan | 2 kali aplikasi/musim |
| | | |
| No. 10 | Tidak pernah menggunakan | Disemprotkan ke tanah dan tanaman sebagai pupuk cair. |
| | | |
| No. 11 | Tidak pernah menggunakan | Mendapatkan langsung dari agen kecamatan |
| | | |
| No. 12 | Tidak pernah menggunakan | CuSO4 dan ZnSO4 Rp 20.000/kg |
| | | |
| | | |
| No. 13 | Tidak pernah menggunakan | |
| | | |
| No. 14 | | 1 ha |
| | 150 ha | |
| | | |
| | | |
| Interpretasi | | |
| | | |
| | | |

| TAM | X ha (Spasial) | X ha (Spasial) |
|---|---|---|
| PENGURANG POTENSIAL | - | - |
| GROWTH FACTOR | - | - |

Diprediksi dari:

- peningkatan impor selama 10 tahun terakhir

**B1. Lahan Hortikultura**

| Qoetions | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 01/12/21 | 08/12/21 | 01/12/21 |
| Nama R | Sarno | Jana Rosjana | Marsudi |
| Poktan | Lestari makmur | Mandiri | Anjasmoro 4 Jaya Abadi |
| | | | (Sejak 1994) |
| Alamat | Desa Tajuk | Desa Bengkok | Dusun Jurang Kuali |
| | Kecamatan Getasan | Kec. Cipanas | RT 05/RW 05, Desa Sumber Brantas |
| | Kabupaten Semarang | Kabupaten Cianjur | Kec. Bumi Aji, Kota Batu |
| | Jawa Tengah | Jawa Barat | Jawa Timur |
| ∑ Anggota | 46 | 32 | Aktif 30 |
| Luas Poktan (ha) | 25 | 25 | 45 |
| Luas Desa (ha) | 150 | - | |
| Altitude (m dpl) | 400 | 600 | |
| IP | - | - | |
| Produksi (t/ha) | - | | |
| | | | |
| **No. 1** | Kubis | Selada | Sayuran: Kentang, wortel, sawi putih |
| | Cabai | Bawang Daun (sedang tidak tanam) | Buah: Tomat, paprika |
| | | Krisan | Bunga: berbagai tanaman hias (pot plant) |
| | | | |
| **No- 2** | Urea | NPK Meroke | NPK non-sub merk BASF |
| | ZA Petro | Karate Plus Boroni | NPK non-sub merk Meroke |
| | NPK Phonska+ | | NPK+TE |
| | | | |
| **No. 3** | Dolomit | Pupuk Kandang | Dolomit |
| | Pupuk Kotoran ayam | Dolomit | |
| | | | Zeolit |
| | | | Pupuk organik |
| | | | Pupuk majemuk hara mikro merk Vitaflex Meroke |
| | | | |
| **No. 4** | Pernah, tanaman tidak tumbuh dengan normal disebut malting | Pernah, Tanaman kerdil dan daun berubah warna coklat | Tanaman tumbuh kerdil |
| | pada daun muda, menguning | | Tanaman terserang trip, tungau |
| | | | |
| **No. 5** | Kekurangan Urea | kekurangan N | Tidak tahu, kekurangan hara apa |
| | | | |
| | | | |
| **No. 6** | Sudah tahu tetapi belum memahami | Tidak, belum mengetahui | Mengetahui kemungkinan terjadi kondisi kekurangan hara mikro, tapi tidak spesifik Cu dan/atau Zn |
| | | ingin mengetahui dan memahami | |

**B1. Lahan Hortikultura (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 7** | Tidak, belum mengetahui | Tidak, belum mengetahui | Tidak, saya belum mengetahui hal ini |
| | | | |
| **No. 8** | ya, selalu dilakukan setiap musim tanam | ya, selalu dilakukan setiap musim tanam | Ya, saya selalu lakukan setiap musim tanam (dalam bentuk majemuk, yang juga mengandung hara-hara mikro lainnya) |
| | | | |
| **No. 9** | NPK Phonska+ | Karate Plus Boroni tidak ada Cu dan Zn | Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merk Vitaflex Meroke) |
| | | | Pupuk NPK non-sub yg mengandung TE, merk BASF dan lainnya (tidak ingat) |
| | | | |
| **No. 10** | NPK Phonska+ 200kg/ha | 50 gram/ 17 liter air | Untuk kentang, wortel, sawi putih (1 tahun 3 siklus): |
| | | | *- Dosis pupuk hara mikro majemuk: 0,04 g/tanaman/siklus* |
| | | | *- Dosis NPK + TE: 100 kg/0,5 ha/siklus* |
| | | | Untuk tomat (super intensif, media tanam arang sekam, siklus tanam-panen 7 bulan): |
| | | | *- Dosis pupuk hara mikro majemuk: 0,12 – 0,16 g/tanaman/hari* |
| | | | Untuk paprika (super intensif, media tanam arang sekam, siklus tanam-panen 14 bulan): |
| | | | *- Dosis pupuk hara mikro majemuk: 0,12 – 0,16 g/tanaman/hari* |
| | | | Untuk tanaman hias: |
| | | | *- Dosis pupuk hara mikro majemuk: 200 g/1.000 liter/10.000 pot* |
| | | | |
| **No. 11** | Kubis 500 tanaman | Selada 2500 tanaman | *- Kentang: 20.000/0,5 ha* |
| | Cabai 12000 tanaman | bunga 28000 tanaman | *- Sawi putih: 30.000/0,5 ha* |
| | | | *- Wortel: saat penanaman sebanyak 36 mangkok/0,5 ha* |
| | | | *- Tomat: 1.500/0,1 ha* |
| | | | *- Paprika: 3.000/0,1 ha* |
| | | | *- Tanaman hias: 10.000 pot* |

**B1. Lahan Hortikultura (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 12** | subsidi dan membeli di toko | membeli di toko | Membeli di toko atau kios pertanian di desa |
| | | | |
| **No. 13** | 7000/25 kg dan siap mencoba produk baru | Karate plus boroni, 285.000/ karung | Merk Vitaflex meroke Rp 200.000/kg (bentuk tepung) |
| | | | |
| | | | |
| | | | |
| **No. 14** | 2000 m2 | 1500 m2 | 1,5 ha |
| | 25 ha | 32 ha | 45 ha |
| | 120 ha | - | |
| | | | |
| **No. 15** | | | Ya, semua seperti yg saya lakukan (kurang lebih sama pola penanaman dan pemupukan dengan yg saya lakukan) |
| | | | |
| Interpretasi | | | |
| | | | |
| | | | |
| | | | |
| **Catatan** | | | |

| TAM | X ha (Spasial/Data Sekunder lainnya) | X ha (Spasial/Data Sekunder lainnya) | X ha (Spasial/Data Sekunder lainnya) |
|---|---|---|---|
| **PENGURANG POTENSIAL** | - | - | - |
| **GROWTH FACTOR** | - | - | - |

**B1. Lahan Hortikultura (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| Tanggal Interview | 01/12/21 | 06/12/21 |
| Nama R | Ulus | Santosa |
| Poktan | Wargi Panggupay | |
| | (Sejak 2000) | 2007 |
| Alamat | Ds. Sunten Jaya, Lembang | Taman Satriyan |
| | dan Ds. Jambudipa, Cisarua | Tirtoyudo |
| | Kab. Bandung Barat | Kab. Malang |
| | Jawa Barat | Jawa Timur |
| ∑ Anggota | 100 | Aktif 30 |
| Luas Poktan (ha) | 50-100 | 100 |
| Luas Desa (ha) | | 2200 |
| Altitude (m dpl) | | 1500-1750 |
| IP | | |
| Produksi (t/ha) | | |
| | | |
| **No. 1** | Sayuran: Buncis, cabe merah, cabe keriting, kol, brokoli, tomat | Sayur: |
| | | Lombok Cilik 0,5 ha |
| | | Lombok Kriting 0,5 ha |
| | | Lombok Gede 0,25 ha |
| | | Tomat 0,25 ha |
| | | Terong 0,5 ha |
| | | |
| **No- 2** | Pupuk kandang kompos kotoran ayam | Urea |
| | POC urin kelinci | ZK Petro |
| | KNO3 merah Meroke | Mahkota KCl |
| | KNO3 putih Meroke | NPK 16.16.16 Tawon |
| | MKP | NPK Mutiara Grower 15.09.20+TE |
| | Pupuk majemuk Reggae | |
| | Super Biru | |
| | Pupuk Daun Supergrow | |
| | | |
| **No. 3** | Pupuk kandang | Pukan Ayam Petelur |
| | Pestisida:Jorfex, Kurset, Makoban, Kojo, Dakonil (mengandung hara mikro) | |
| | | |
| **No. 4** | Tanaman tumbuh kerdil | Keracunan obat terbakar EC tinggi |
| | Tanaman tumbuh keriting | Tidak pernah karena kalau kurang langsung diatasi, tiap hari dilihat |
| | | |

**B1. Lahan Hortikultura (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| **No. 5** | Tidak tahu | |
| | | |
| **No. 6** | Sudah tahu tapi belum memahami (berdasarkan informasi dari sales-sales produk) | Ya, saya sudah memahami hal ini. |
| | Ingin lebih tahu dan paham | |
| | | |
| **No. 7** | Tidak, saya belum mengetahui hal ini | Ya, saya sudah memahami hal ini. |
| | Saya ingin lebih mengetahui dan memahami hal ini | |
| | | |
| **No. 8** | Ya, saya selalu lakukan setiap musim tanam | Ya, selalu saya lakukan setiap musim tanam |
| | | |
| **No. 9** | Pupuk majemuk yang juga mengandung Cu dan/atau Zn (Merk Reggae) | NPK Mutiara Grower 15.09.20+TE |
| | Pupuk KNO3 merah dan putih + TE | |
| | | |
| **No. 10** | Untuk semua tanaman (1 tahun 5-6 siklus, 1 siklus 9x aplikasi): | 21 kg/ha NPK Mutiara Grower |
| | *- Dosis KNO3 merah dan putih + TE: 1,3 g/tanaman/aplikasi* | |
| | *- Dosis pupuk hara mikro majemuk Reggae: 0,65 g/tanaman/aplikasi* | |
| | | |
| **No. 11** | 10.000 tanaman/ha | Lombok Cilik 8000/0,5 ha |
| | | Lombok Kriting 8000/0,5 ha |
| | | Lombok Gede 4000/0,25 ha |
| | | Tomat 8000/0,5 ha |
| | | Terong 7000/0,5 ha |
| | | |
| **No. 12** | Membeli di toko atau kios pertanian di desa | Membeli di kios desa |
| | | |
| **No. 13** | Merk KNO3 merah Meroke Rp 45.000/2 kg | NPK Mutiara Grower 1 kg Rp. 17.000 |
| | Merk KNO3 putih Meroke Rp 48.000/2 kg | |
| | Merk Reggae (pupuk hara mikro majemuk) Rp 25.000/kg | |

**B1. Lahan Hortikultura (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| **No. 14** | 6 ha | 2 ha |
| | 50 - 100 ha | 100 ha |
| | | |
| | | |
| **No. 15** | Ya, semua seperti yg saya lakukan | Ya, sebagian besar seperti yang saya lakukan |
| | | |
| Interpretasi | | |
| | | |
| | | |
| | | |
| **Catatan** | Pak Ulus sangat berkeinginan untuk dapat lebih memahami dampak dari kekurangan hara Cu dan Zn pada budidaya intensif hortikultura, cara menanggulanginya, dan apakah defisiensi Cu dan Zn ini dapat diatasi dengan aplikasi pupuk hara mikro tunggal | |

| TAM | X ha (Spasial/Data Sekunder lainnya) | X ha (Spasial/Data Sekunder lainnya) |
|---|---|---|
| PENGURANG POTENSIAL | - | - |
| GROWTH FACTOR | - | - |

## B1. Lahan Hortikultura - Verifikasi Lapangan

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| Tanggal Interview | **01/11/22** | **01/11/22** | **01/12/22** |
| Nama R | Daryono | Wiyono | Akat |
| Poktan | | Unggul Karya | Luru Luhur |
| | 30an tahun | 20an tahun | |
| Alamat | Kedunguter | Krasak | |
| | Brebes | Brebes | Rejoso |
| | Kab Brebes | Kab Brebes | Nganjuk |
| | Jawa Tengah | Jawa Tengah | Jatim |
| ∑ Anggota | | | |
| Luas Poktan (ha) | 90 | 100 | 146 |
| Luas Desa (ha) | | | |
| Altitude (m dpl) | | | |
| IP | 2 | 3 | 3 |
| Produksi (t/ha) | | BM MT1= 10-12 ton/ha | BwMerah MT1=12 ton |
| | | BM MT2= 15 ton/ha | BwMerah MT2=14 ton |
| | | BM MT3 = 15-18 ton/ha | BwMerah MT3=24 ton |
| | | Padi 6,5 ton/ha | |
| | | **2,7x** | 3X |
| | | | |
| **No 1** | **Bawang Merah** | **Bawang Merah (3x)** | **Bw Merah 0,25 ha** |
| | Melon | Padi (1x) | Kara 0,25 ha |
| | | | Padi 0,5 ha |
| | | Hoti-Horti-Horti-Padi | |
| | | | |
| **No. 2** | Urea | Urea | Urea |
| | Petro Nitrat | SP36 Petro | NPK |
| | SP36 Petro | PhonskaPlus | MgSO4 ZnSO4 Si B |
| | NitroPHonska | NPK Mutiara Grower (+TE) | Petrocas (ada S 26% dg pH 6) |
| | ZA Petro | ZA Petro | |
| | ZK Petro | ZK Petro | |
| | KCl Canada | KCl Mahkota | |
| | KalMag (KMg) | KalMag (KMg) | |
| | | | |
| **No. 3** | Pukan (Domba) | Dolomit | Pukan Kambing 20 ton/ha/ musim Bw Merah, 3 x/thn |
| | Dolomit | | Kara 5 ton/ha 2x/tahun |
| | Zeolit | Kompos (2,4 ton/ha) 40 kg/karung (60 karung/ha) | |
| | | | |
| **No- 4** | Pernah | Musim hujan terjadi | Tidak |
| | Bawang Merah: Pucuk kuning, pertumbuhan kurang maksimal | Batang memerah (antraknosa) karena Urea terlalu banyak. Juli Agst Urea digunakan | |
| | Melon: layu karena terlalu banyak (over) | | |

## B1. Lahan Hortikultura - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 5** | Kelebihan Na (Na terlalu tinggi, Bawang Merah lebih merah | Kelebihan N (dalam air hujan sudah mengandung N) | |
| | | | |
| **No. 6** | Ya, saya sudah memahami | Sudah tahu belum paham | Ya, saya sudah memahami |
| | | Ingin lebih mengetahui dan memahami | |
| | | | |
| **No. 7** | Ya, saya sudah memahami | Sudah tahu belum paham | Ya, saya sudah memahami |
| | | Ingin lebih mengetahui dan memahami | |
| | | | |
| **No. 8** | Ya, setiap musim | Ya tiap musim | Ya, setiap musim |
| | | Beberapa Fungisida/Pestisida mengandung Zn, Mn, Cu | |
| | | | |
| **No. 9** | Pupuk majemuk ada Cu&/atauZn. NPK+TE dari Meroke, DGW, Pak Tani | NPK Mutiara Grower (Plus TE: Cu Zn Mn Fe); NPK Phonska Plus Zn | ZnSO4 36000/kg BASF 400KG |
| | | | |
| **No. 10** | 400 kg | 400 kg | **NPK 15.15.15+TE BASF 400 kg/ha; ZnSO4 18 kg/ha Bw Merah** |
| | ***Cu Zn @ 1,2 kg/ha*** | ***Cu Zn @ 1,2 kg/ha*** | ***Zn=(3,6+1,2=4,8 kg/ha)*** |
| | ***Cu=2,7x1,2 kg/ha/th=3,24 kg/ha/th*** | ***Cu=2,7x1,2 kg/ha/th=3,24 kg/ha/th*** | ***Cu= 1,2 kg/ha*** |
| | ***Zn=2,7x1,2 kg/ha/th=3,24 kg/ha/thn*** | ***Zn=2,7x1,2 kg/ha/th=3,24 kg/ha/thn*** | |
| | | | |
| **No. 11** | Bawang Merah: 1.500 kg bibit/ha | Bawang Merah: 1.800 kg bibit/ha | Bw Merah 1,2 ton/ha bibit |
| | Melon: 12.000 /ha | Padi (Jarwo 4:1) .... | Cabe 20.000 btg /ha |
| | | | |
| **No. 12** | Kios Pertanian Desa | Subsidi | |
| | Lewat Sales & Perusahaan langsung | Beli di kios desa | |
| | | | |
| **No. 13** | Nordox (Cu); 400 g Rp. 100.000,- | NPK 16.16.16 Yaramila 13.500,-/kg | ZnSO4 (Curah tdk tahu merk) 36.000/kg |
| | Antracol (Zn 22%); 1.000 g Rp. 110.000,- | | |
| | | | |
| **No. 14** | 1 ha | 0,5 ha | 1 |
| | 90 ha | 160 ha | 146 |
| | ha | | |
| | | | |

## B1. Lahan Hortikultura - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 15** | b. Sebagian besar (60%) seperti yang saya lakukan | b. Sebagian besar (60%) seperti yang saya lakukan | Sebagian kecil saja yang sama (10%) |
| | | **ip 2,8** | **ip 3** |
| **Interpretasi** | | | |
| | | | |
| | | | |

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| Tanggal Interview | **13/1/2022** | **14/1/2022** |
| Nama R | Joni | Supriyono |
| Poktan | Sumber Jaya | Sri Rejeki |
| | | |
| Alamat | | Dkh. Supiturang, Ds. Bocek |
| | Sumberbrantas | Karang Ploso |
| | Bumiaji | Kab Malang |
| | Kota Batu | Jatim |
| ∑ Anggota | | |
| Luas Poktan (ha) | 450 | 250 |
| Luas Desa (ha) | | |
| Altitude (m dpl) | | |
| IP | 3 | 2 |
| Produksi (t/ha) | Kentang 25-40 ton/ha | Cabe 6-7 ton/ha |
| | | Tomat 15 ton/ha |
| | | |
| | | |
| | | |
| | | |
| **No 1** | **Kentang** | **Cabe** |
| | Sawi | Tomat |
| | Wortel | |
| | | |
| | | |
| **No. 2** | Urea (unt Sawi) | SP36 |
| | SP36 Petro | NPK Phonska |
| | NPK 15.15.15 BASF (+TE) | |
| | ZA Petro | |
| | ZK Petro | |
| | | |
| | | |
| | | |

## B1. Lahan Hortikultura - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| **No. 3** | Pukan (30 ton/musim) Kentang | Pukan ayam 16 ton /ha (Cabe) |
| | Sawi & Wortel tanpa Pukan | Pukan Ayam 15 ton/ha (Tomat) |
| | | Petroganik |
| | | |
| **No- 4** | Tidak | Tidak |
| | | |
| | | |
| | | |
| **No. 5** | | |
| | | |
| **No. 6** | Ya, saya sudah memahami | Sudah tahu belum paham |
| | | |
| | | |
| **No. 7** | Ya, saya sudah memahami | Tidak, belum tahu. |
| | | |
| | | |
| **No. 8** | Ya, setiap musim | Tidak, belum pernah |
| | | |
| | | |
| **No. 9** | NPK 15.15.15+TE Merk BASF (Cu & Zn 0,3%) TE 1-2% (Rata2 0,3% per unsur mikro) | x |
| | | |
| **No. 10** | NPK 15.15.15 +TE BASF 600kg/ha (Kentang); 400 kg/ha NPK+TE BASF | x |
| | ***Cu = (1,8+1,2) kg*** | |
| | ***Zn = (1,8+1,2) kg*** | |
| | ***Kentang & Wortel*** | |
| | | |
| **No. 11** | Kentang 2-3 ton/ ha tgt besar kecilnya bibit | x |
| | | |
| | | |
| **No. 12** | Kios Pertanian Desa/Kec/ | x |
| | | |
| | | |
| **No. 13** | BASF (NPK 15.15.15+TE) 50 kg/zak Rp. 700.000/zak | x |
| | | |
| | | |
| **No. 14** | 8 ha | 0,5 ha |
| | 450 ha | 250 ha |
| | | |

## B1. Lahan Hortikultura - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-04 | Responden-05 |
|---|---|---|
| | | |
| Interpretasi | | |
| | | |
| | | |

| Catatan | | |
|---|---|---|
| Bawang Merah | Penetapan dosis mengacu empiris di Rejoso Kediri (Pak Akat, petani Bawang Merah yang maju serta penemu Bawang Merah Varietas KATUMI.<br><br>Dosis Zn /ha = 5 kg/ha/musim<br>Dosis Cu /ha = 3 kg/ha/musim<br>Jateng IP 2,8<br>Jatim IP 3 | |
| Cabe | Gambut<br>CuSO4 5 kg/ha<br>ZnSO4 10 kg/ha | <br>2,00 kg/ha/tanam (Cu)<br>3,00 kg/ha/tanam (Zn) |
| Kentang | Cu 2 kg/ha<br>Zn 3 kg/ha | |

**C1.A. Perkebunan Sawit Rakyat - Gambut**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| Tanggal Wawancara | 17/12/21 | 17/12/21 |
| Nama Responden | Jonri Damanik | Eko Jaya Siallagan |
| Organisasi Pekebun | Apkasindo | Apkasindo |
| Alamat | Desa Mumugo, Kec Tanah Putih, Kab Rokan Hilir | Pelalawan |
| Luas Lahan | 1000 hektar | 180 hektar |
| | | |
| No.1 | Dolomit | dolomit |
| | NPKS+ B2O3 13:8:27:4:0.58 | Urea |
| | | NPKS 15:15:6:4 |
| | | MOP (KCl) |
| | | |
| No.2 | Daun pucuk/muda menguning, kecil, sering disebut sisir | daun muda menguning, kerdil, dan mengering |
| | tanaman/batang kerdil | |
| | | |
| No.3 | sementara ini diduga kekurangan hara mikro Cu | diduga kekurangan hara mikro Cu |
| | | |
| No.4 | sudah mengetahui, tetapi belum memahami hal ini | sudah memahami hal ini, khusus unsur mikro Cu |
| | ingin lebih mengetahui dan mendalami hal ini | |
| | | |
| No.5 | sudah mengetahui, tetapi belum memahami hal ini | sudah memahami hal ini, khusus unsur mikro Cu |
| | ingin lebih mengetahui dan mendalami hal ini | |
| | | |
| No.6 | ya, tetapi tidak periodik. | pernah aplikasi pupuk yang mengandung Cu |
| | beberapa kali aplikasi | aplikasi tidak periodik, pernah beberap kali. |
| | | |
| No.7 | pernah aplikasi pupuk yang mengandung Cu | pupuk tunggal yang mengandung Cu |
| | tidak tahu itu pupuk majemuk atau tunggal tapi pernah menggunakannya | Copper Sulphate Cap Daun Sawit |

**C1.A. Perkebunan Sawit Rakyat - Gambut (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| No.8 | pada TBM3: 100 g/pokok Cu-EDTA, 1 kali/tahun | pada TBM2: 100 g/pokok CuSO4, 1 kali/tahun |
| | pada TM: penggunaan pupuk mikro Cu dilakukan bila terdapat indikasi/gejala pada tanaman, penggunaan selama ini dgn dosis 100 g/pokok pada aplikasi ke-1 dan 75 g/pokok pada aplikasi berikutnya. Aplikasi pada TM1 – TM3/4 | pada TM: penggunaan pupuk mikro Cu dilakukan bila terdapat indikasi/gejala pada tanaman, penggunaan selama ini dgn dosis 100 g/pokok bila gejala defisiensi tinggi di blok tanam, dan 50 gram/pokok bila rendah pada TM1 – TM3/4 |
| | | |
| No.9 | membeli pupuk Cu pada toko pertanian terdekat | Membeli di toko pertanian terdekat |
| | | |
| No.10 | lupa merek pupuk Cu-nya, kemasan 20kg/sak, harga Rp1.200.000/sak | Cap Daun Sawit, kemasan 25 kg/sak, harga Rp 750.000,00/sak |
| | | |
| **TAM** | **X ha (Spasial/Data Sekunder lainnya)** | **X ha (Spasial/Data Sekunder lainnya)** |
| **PENGURANG POTENSIAL** | **1000 ha** | **180 ha** |
| **GROWTH FACTOR** | **1000 ha** | **180 ha** |

**C1.B. Perkebunan Sawit Rakyat-Mineral**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| Tanggal Wawancara | 17/12/21 | 18/12/21 | 18/12/21 |
| Nama Responden | Indra Rustandi | Iqbal | Tambunan |
| Organisasi Pekebun | Apkasindo | Apkasindo - KUD Bina Usaha | Apkasindo |
| Alamat | Sintang - Kalbar | Desa Koto Gadang - Dharmasraya - Sumbar | Simalungun - Sumut |
| Luas Lahan | 18000 hektar | 1765,5 hektar | 3000 hektar |
| | | | |
| No.1 | Dolomit | Urea | NPKS 15:15:6:4 |
| | Urea | NPKS 15:15:6:4 | MOP (KCl) |
| | ZA | MOP (KCl) | Kieserite |
| | NPKS 15:15:6:4 | Kieserite | kompos hasil pembuatan sendiri |
| | Rock Phosphate (RP) | NPK STU (organik) | |
| | | | |
| No.2 | produktivitas menurun | tanah mengeras | daun menguning |
| | timbul bercak orannye pada spot-spot pelepah kelapa sawit, dimulai dari pelepah tua | produktivitas turun drastis dari biasa 2 ton/ha menjadi 500 kg/ha | kembang bunga lambat |
| | pucuk daun berubah menjadi hijau muda atau menguning | | pelepah buah lambat |
| | pelepah mengalami perubahan warna dari hijau pucat ke warna kuning keputihan | | |
| | | | |
| No.3 | diduga kekurangan hara: kalium, nitrogen, tembaga | diduga kekurangan NPK | kekurangan unsur mikro, tapi belum tahu unsur apa |
| | | | |
| No.4 | sudah mengetahui tetapi belum memahami hal ini | Tidak, belum mengetahui hal ini | sudah mengetahui tetapi belum memahami hal ini |
| | ingin lebih mengetahui dan memahami hal ini | ingin lebih mengetahui dan memahami hal ini | ingin lebih mengetahui dan memahami hal ini |
| | | | |
| No.5 | sudah mengetahui tetapi belum memahami hal ini | Tidak, belum mengetahui hal ini | sudah mengetahui tetapi belum memahami hal ini |
| | ingin lebih mengetahui dan memahami hal ini | ingin lebih mengetahui dan memahami hal ini | ingin lebih mengetahui dan memahami hal ini |
| | | | |
| No.6 | c. Tidak, belum pernah melakukan | Tidak, belum pernah melakukannya | Tidak, belum pernah melakukannya |
| | | | |
| No.7 | | | |

**C1.B. Perkebunan Sawit Rakyat-Mineral (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| No.8 | | | |
| | | | |
| No.9 | | | |
| | | | |
| No.10 | | | |
| | | | |
| **TAM** | **X ha (Spasial/Data Sekunder lainnya)** | **X ha (Spasial/Data Sekunder lainnya)** | **X ha (Spasial/Data Sekunder lainnya)** |
| **PENGURANG POTENSIAL** | - | - | - |
| **GROWTH FACTOR** | - | - | - |

**C2. Perkebunan Sawit Korporasi**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| Tanggal Wawancara | 09/12/21 | 13/12/21 |
| Nama Responden | **Setyono** | **Septa Emu** |
| Perusahaan | PT. Hasnur Citra Terpadu + PT. Barito Putra Plantation | Wilmar group |
| Alamat | Kab Tapin + Kab Barito Kuala - Kalsel | Kalbar dan Kalteng |
| Luas Lahan | 9652 hektar + 13006 hektar (*info tambahan) | 1350 hektar gambut + 110650 hektar mineral (*info tambahan) |
| | | |
| No.1 | Tidak, belum pernah dilakukan | Ya, selalu diaplikasikan secara periodik |
| | | |
| No.2 | | Pupuk tunggal yang hanya mengandung Cu dan/atau Zn, merek Mahkota: Zinc Sulfate dan Copper Sulfate |
| | | |
| No.3 | | Pada lahan gambut dan mineral |
| | | pada TBM 2, 100-150g/pokok, CuSO4 1 kali/tahun |
| | | pada TBM 2, 100-150g/pokok, ZnSO4 1 kali/tahun |
| | | pada TM diberikan sebagai additional, bila terdapat indikasi tanaman kekurangan hara mikro Cu dan Zn baru diberikan dengan dosis 100-150 gram/pokok pada TM1-TM5/6 |
| | | |
| No.4 | | disediakan oleh divisi pupuk group perusahaan |
| | | |
| No.5 | | Mahkota Zinc Sulfate Rp 12.000,00/Kg |
| | | Mahkota Copper Sulfate Rp 29.000/Kg |
| | | |
| **TAM** | **X ha (Spasial/Data Sekunder lainnya)** | **X ha (Spasial/Data Sekunder lainnya)** |
| **PENGURANG POTENSIAL** | - | **112000** |
| **GROWTH FACTOR** | - | **112000** |

**C3. HTI di Lahan Gambut**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| Tanggal Wawancara | 01/12/21 | 19/12/21 |
| Nama Responden | Sopyan Nugraha | Munif |
| Perusahaan | Arara Abadi - Kebun Benih | Sinarmas Forestry Palembang |
| Alamat | Riau - Palembang - Jambi | OKI - Sumsel |
| Luas Lahan | 5000 hektar | 500000 hektar |
| | | |
| No.1 | NPK 15-15-15 | NPK 15-15-15 |
| | TSP | Rosasol P - Rosasol K |
| | Kompos | |
| | Dolomit | |
| | LAKABA | |
| | Sa Mikro 25 | |
| | Borate | |
| | Terusi/Copper Sulphate | |
| | | |
| No.2 | daun tanaman menguning | berkembang/bercabang di bawah, rimbun di bawah pada tanaman eucaliptus |
| | | |
| No.3 | indikasi riset menyebutkan kekurangan hara mikro | kelebihan unsur Al |
| | | |
| No.4 | sudah memahami hal ini | Tidak, belum mengetahui hal ini |
| | | ingin lebih mengetahui dan memahami hal ini |
| | | |
| No.5 | sudah mengetahui, tetapi belum memahami hal ini | Tidak, belum mengetahui hal ini |
| | | ingin lebih mengetahui dan memahami hal ini |
| | | |
| No.6 | a. Ya, selalu saya lakukan secara periodik (kebun benih: saat tanam, 6 bln pertama, setiap tahun sampai usia daur 10-15 tahun; lapangan saat tanam, 6 bln pertama) | Tidak, belum pernah melakukannya |
| | | |
| No.7 | Pupuk majemuk yang juga mengandung Cu dan Zn (Merek: Sa micro 25 dan LAKABA) | pupuk tunggal yang mengandung Cu |
| | | |

**C3. HTI di Lahan Gambut**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| No.8 | untuk kebun benih: a. Tahun 1, 20 gram (masing-masing pada saat tanam dan usia 6 bulan)<br>b. Tahun 2, 30 gram<br>c. Tahun 3, 30 gram<br>d. Tahun 4, 30 gram<br>e. Tahun 5, 30 gram...dan seterusnya sampai daur 10 tahun dan 15 tahun | |
| | untuk tanaman di lapangan: a. Tahun 1, 20 gram pada saat tanam dan<br>b. tahun 1 pada saat usia 6 bulan) | |
| | | |
| No.9 | vendor tertentu melalui mekanisme lelang | |
| | | |
| No.10 | a. Merek SA Mikro 25, berat per kemasan (25 kg), harga per kemasan (Rp 632.000)<br>b. Merek Lakaba, berat per kemasan (25 kg), harga per kemasan (Rp 632.000) | |
| | | |
| **TAM** | **X ha (Spasial/Data Sekunder lainnya)** | **X ha (Spasial/Data Sekunder lainnya)** |
| **PENGURANG POTENSIAL** | - | ? |
| **GROWTH FACTOR** | - | ? |

**D1. Lahan Padi Sawah Pasang-Surut**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 02/12/21 | 01/12/21 | 01/12/21 |
| Nama R | Abdul Rokhim | H. Ali Zukhrof (Jalur 8) | Karjo |
| Poktan | Maju Lancar | Telang Jaya | Cahaya Maju |
| | | | |
| Alamat | Desa Losari | Desa Telang Jaya | Desa Tirtalaya |
| | Kecamatan Losari | Kec. Muara Telang | Kecamatan Mesuji |
| | Kabupaten Brebes | Kab. Banyuasin | Kabupaten Mesuji |
| | | | |
| | Jawa Tengah | Sumatera Selatan | Lampung |
| ∑ Anggota | 50 | 80 | 30 |
| Luas Poktan (ha) | 90 | 450 | 120 |
| Luas Desa (ha) | 400 | - | 480 |
| Altitude (m dpl) | 5 | 5 | 3 |
| IP | 2 | 2 | 2 |
| Produksi (t/ha) | 4-5 | 4-5 | 5-6 |
| | | | |
| **No. 1** | Urea | Urea | Urea |
| | NPK Phonska | NPK Phonska | NPK Phonska |
| | Petroganik (S) | Dolomit | Verno |
| | | | Pestisida Nordox |
| | | | ZPT Siapton |
| | | | |
| **No- 2** | - | Dolomit | Dolomit |
| | - | | POME |
| | | | |
| **No. 3** | Penah, gejala kekuningan pada tanaman | Pernah, daun menguning, ketika dipupuk juga tidak mengalami perubahan | Penah, gejala kekuningan pada tanaman |
| | | | |
| **No. 4** | kekurangan hara tetapi jika kuning diberikan urea hijau kembali | Tidak mengetahui | Kekurangan hara |
| | | Belum memahami | |
| | | | |
| **No. 5** | belum mengetahui | Sudah tahu | Sudah tahu |
| | Ingin lebih tahu dan paham | Belum memahami | Belum memahami |
| | | | |
| **No. 6** | Tidak, belum tahu | Sudah tahu | Sudah tahu |
| | Ingin lebih tahu dan paham | Belum memahami | Belum memahami |
| | | | |
| **No. 7** | Tidak, belum pernah | Tidak, belum pernah | Ya, selalu dilakukan setiap musim tanam |
| | | | |
| **No. 8** | Tidak, belum pernah | Tidak, belum pernah | Verno |

**D1. Lahan Padi Sawah Pasang-Surut (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 | Responden-03 |
|---|---|---|---|
| | | | |
| **No. 9** | - | - | 50 gram/ha/aplikasi, dalam 1 musim tanam 3 kali semprot, 1 kali semprot sebelum tanam |
| | | | |
| **No. 10** | Tidak pernah membeli | belum pernah mencoba | membeli di toko |
| | | | |
| **No. 11** | - | - | verno, per 250 gram harga 75.000 |
| | | | |
| **No. 12** | 1 ha | 20 ha | 2,5 ha |
| | 90 ha | 450 ha | 120 ha |
| | 400 ha | - | 480 ha |
| | | | |
| **Interpretasi** | | | |
| | | | |
| | | | |
| | | | |
| **TAM** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | **400 ha** | **450 ha** | - |
| **GROWTH FACTOR** | - | - | - |

**D1. Lahan Padi Sawah Pasang-Surut (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 | Responden-06 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 02/12/21 | 01/12/21 | 01/12/21 |
| Nama R | Achmad Soche | Boimin | Mustangin |
| Poktan | Randu Maju | | Pelita Jaya |
| | | Bina Usaha | |
| Alamat | Desa Mojopurewetan | 1990 | 1990 |
| | Kecamatan Bungah | Ds. Tanjung Serayan | Ds. Mandala Sari |
| | Kabupaten Gresik | Kec. Mesuji | Kec. Mataram Baru |
| | | Kab. Mesuji | Lampung Timur |
| | | Lampung | Lampung |
| | Jawa Timur | Aktif 585 | 26 |
| ∑ Anggota | 65 | | 43 |
| Luas Poktan (ha) | 120 | 1050 | |
| Luas Desa (ha) | 450 | 1486 | |
| Altitude (m dpl) | 8 | <10 | |
| IP | 2 | 2 | 2 |
| Produksi (t/ha) | 6 | 4-6 | 4-6 |
| | | | |
| **No. 1** | Urea | Urea | Urea |
| | NPK Phonska | SP-36 Petro | SP-36 Petro |
| | Petroganik | Phonska Plus | Phonska Plus |
| | ZnSO4 Syngenta | NPK Phonska (S) | NPK Phonska (S) |
| | Provibio | KCl Petro | KCl Petro |
| | | Fertiphos (0-20-20+Mg.Si.B) | Fertiphos (0-20-20+Mg.Si.B) |
| | | POMI (Dekomposer, Bantuan Kementan) | Petroganik |
| | | | Kuda Laut |
| | | | Biobos |
| | | | Lob |
| | | | |
| **No- 2** | Dolomit | Dolomit (1 ton/ha -pH 5) | Kapur Pertanian atau Dolomit 500 kh/ha/tahun |
| | Pembenah tanah HUMATOP | 50 petani Gapoktan lakukan | |
| | | | |
| **No. 3** | Pernah, daun kuning dan bercak di pinggir daun | Setelah dipupuk daun dan batang kemerah-merahan seperti mau mati | Tanaman padi menguning, kurus, tumbuhnya tidak bagus, kerdil, beranak tetapi tidak tinggi. |
| | | | |
| **No. 4** | Kekurangan hra tetapi tidak mengetahui | Mungkin karena kemasaman | Rata-rata menguning kurang Urea, kurang subur (Tanah Gambut) |
| | | | Yang kerdil dan beranak tetapi tidak dapat tumbuh tinggi mungkin bukan kurang nutrisi tetapi karena penyakit di akar. |

**D1. Lahan Padi Sawah Pasang-Surut (Lanjutan)**

| PERTANYAAN | Responden-04 | Responden-05 | Responden-06 |
|---|---|---|---|
| | | | |
| **No. 5** | Sudah tahu | Tidak, belum tahu | Tidak, belum tahu |
| | Belum memahami | | Ingin lebih tahu dan paham |
| | | | |
| **No. 6** | Sudah tahu | | Sudah tahu belum paham |
| | Belum memahami | Ingin lebih tahu dan paham | |
| | | | |
| **No. 7** | Ya, selalu dilakukan setiap musim tanam | Saya tidak tahu dalam Phonska Plus ada Cu &/atau Zn. Selalu pupuk NPK Phonska & Phonska Plus | Ingin melakukannya |
| | | | |
| **No. 8** | Pupuk tunggal ZnSO4 dari Syngenta | Phonska Plus | Phonska Plus |
| | | | |
| **No. 9** | 50 gram/14 liter. 3 kali aplikasi | 75 kg/ha | 125 kg/ha |
| | | | |
| **No. 10** | membeli di toko pertanian | Kios pertanian desa | Kios pertanian desa |
| | | | |
| **No. 11** | ZnSO4 per 1000 gram harga 80.000 | 25 kg Rp. 190.000,- | 25 kg Rp. 190.000,- |
| | | | |
| **No. 12** | 2000 m2 | 3 ha | 1 ha |
| | 120 ha | | 43 ha |
| | 450 ha | 1050 ha | |
| | | | |
| **Interpretasi** | | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn SERTA GIPSUM | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn |
| | | | |
| | | PERLU VERIFIKASI LAPANG KE PETANI DESA TANJUNG SERAYAN ANGGOTA GAPOKTAN/POKTAN SETEMPAT | PERLU VERIFIKASI LAPANG KE PETANI DESA TANJUNG SERAYAN ANGGOTA GAPOKTAN/POKTAN SETEMPAT |
| | | | |
| **TAM** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | - | - | - |
| **GROWTH FACTOR** | - | **1050 ha** | **43 ha** |

**D1. Lahan Padi Sawah Pasang-Surut (Lanjutan)**

| PERTANYAAN | Responden-07 | Responden-08 | Responden-09 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 04/12/21 | 20/12/21 | 20/12/21 |
| Nama R | Tohir Mulus (Wa Mulus) | Rosimin | Slamet |
| Poktan | | Sanghyang Sri | Sanghyang Sri |
| | | | |
| Alamat | 1985 | | Desa Tirtalaya |
| | Ds. Jumbleng | Petak Batuah Blok A2 | Petak Batuah Blok A2 |
| | Kec. Losarang | Kec. Dadahup | Kec. Dadahup |
| | Kab Indramayu | Kab. Kapuas | Kab. Kapuas |
| | Jawa Barat | Kalimantan Tengah | Kalimantan Tengah |
| | | | |
| ∑ Anggota | | 25 | 25 |
| Luas Poktan (ha) | | 50 | 50 |
| Luas Desa (ha) | | 100 | 100 |
| Altitude (m dpl) | 1 | 1 | 1 |
| IP | 2 | - | - |
| Produksi (t/ha) | 2,5-6 | 1 | 1 |
| | | | |
| **No. 1** | Urea | Urea | Urea |
| | SP-36 Petro | NPK Phonska | NPK Phonska |
| | NPK Mutiara | Verno | Verno |
| | NPK Phonska (S) | SP36 | SP36 |
| | KCl Petro | KCl | KCl |
| | Petroganik | | |
| | | | |
| **No- 2** | Kaptan 25 kg | Dolomit | Dolomit |
| | | | |
| | | | |
| **No. 3** | Warna kuning, kalau lebih hijautua tidak sehat mudah terkena penyakit | Penah, gejala kekuningan pada tanaman | Penah, gejala kekuningan pada tanaman |
| | | | |
| **No. 4** | Zat tanah tidak ada. | Kekurangan hara dan keracunan pirit | Kekurangan hara dan keracunan pirit |
| | | | |
| | | | |
| **No. 5** | Ya, sudah memahami | Sudah tahu | Sudah tahu |
| | | Belum memahami | Belum memahami |
| | | | |
| **No. 6** | Ya, sudah memahami | Sudah tahu | Sudah tahu |
| | | Belum memahami | Belum memahami |
| | | | |
| **No. 7** | Tidak, belum pernah melakukan | Ya, selalu dilakukan setiap musim tanam | Ya, selalu dilakukan setiap musim tanam |
| | | | |
| **No. 8** | Belum pernah melakukan | Verno | Verno |

**D1. Lahan Padi Sawah Pasang-Surut (Lanjutan)**

| PERTANYAAN | Responden-07 | Responden-08 | Responden-09 |
|---|---|---|---|
| | | | |
| | | | |
| **No. 9** | x | 50 gram/ha/aplikasi, dalam 1 musim tanam 3 kali semprot, 1 kali semprot sebelum tanam | 50 gram/ha/aplikasi, dalam 1 musim tanam 3 kali semprot, 1 kali semprot sebelum tanam |
| | | | |
| **No. 10** | x | membeli di toko | membeli di toko |
| | | | |
| **No. 11** | x | verno, per 250 gram harga 125.000 | verno, per 250 gram harga 125.000 |
| | | | |
| **No. 12** | 2 ha | 4 ha | 2 ha |
| | | 50 ha | 50 ha |
| | | 100 ha | 100 ha |
| | | | |
| **Interpretasi** | AREA POTENSIAL PENGGUNAAN PUPUK MIKRO Cu dan Zn SERTA GIPSUM. | | |
| | | | |
| | PERLU VERIFIKASI LAPANG KE PETANI DESA JUMBLENG LAINNYA | | |
| | | | |
| **TAM** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | **2 ha** | **100 ha** | **100 ha** |
| **GROWTH FACTOR** | - | **100 ha** | **100 ha** |

## D1. Lahan Padi Sawah Pasang-Surut - Verifikasi Lapangan

| PERTANYAAN | Responden-10 | Responden-11 | Responden-12 |
|---|---|---|---|
| | | | |
| Tanggal Interview | 18/01/2022 | 18/01/2022 | 19/01/2022 |
| Nama R | Mukidi | Kusnain | Sukarto |
| Poktan | Kayra Dadi | Gapoktan Mandiri Bersama | Gapoktan Mulya Tani |
| | | | |
| Alamat | Desa Pantik | Desa Belanti Siam | Desa Terusan Mulya |
| | Kecamatan Pandih Batu | Kecamatan Pandih Batu | Kecamatan Bataguh |
| | Kabupaten Pulang Pisau | Kabupaten Pulang Pisau | Kabupaten Kapuas |
| | | | |
| | Kalimantan Tengah | Kalimantan Tengah | Kalimantan Tengah |
| ∑ Anggota | 25 | 22 KT | =17 KT x 50 org |
| Luas Poktan (ha) | 50 | 280 | 100 |
| Luas Desa (ha) | 400 | - | 9.500 |
| Altitude (m dpl) | 5 | 5 | 5 |
| IP | 2 | 2 | 2 |
| Produksi (t/ha) | 3-4 | 3-3,5 | 4-5 |
| | | | |
| **No. 1** | Urea | Urea-Pusri | Urea |
| | NPK Phonska | NPK Phonska | NPK Phonska |
| | KCl | KCl Kujang (Cair) | KCl Petro (Padat) |
| | | | |
| | | | |
| | | | |
| **No- 2** | Kapur pertanian (Dolomit) | Kapur pertanian (Dolomit) | Kapur pertanian (Dolomit) |
| | | | |
| | | | |
| **No. 3** | Penah, gejala kekuningan pada tanaman, kerdil | Penah, gejala kekuningan pada tanaman, kerdil | Penah, gejala kekuningan pada tanaman |
| | | | |
| **No. 4** | Tidak mengetahui | Tidak mengetahui | Curah hujan tinggi |
| | | Belum memahami | |
| | | | |
| **No. 5** | belum mengetahui | belum mengetahui | Sudah tahu |
| | Ingin lebih tahu dan paham | Belum memahami | Belum memahami |
| | | | |
| **No. 6** | Tidak, belum tahu | Tidak, belum tahu | Tidak, belum tahu |
| | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham | Ingin lebih tahu dan paham |
| | | | |
| **No. 7** | Pernah | Tidak, belum pernah | Ya, tetapi tidak setiap musim tanam |
| | | | |
| **No. 8** | Verno | Tidak, belum pernah | Verno |

## D1. Lahan Padi Sawah Pasang-Surut - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-10 | Responden-11 | Responden-12 |
|---|---|---|---|
| | | | |
| No. 9 | 1 kg (10 bungkus)/Ha | - | 0,2 kg (2 bungkus)/Ha |
| | | | |
| No. 10 | Membeli di Toko | belum pernah mencoba | membeli di toko |
| | | | |
| No. 11 | Verno, 10 gr/bungkus, harga Rp. 30.000/bungkus | - | Verno, 10 gr/bungkus, harga Rp. 40.000/bungkus |
| | | | |
| No. 12 | 2 ha | 2 ha | 7,5 ha |
| | 50 ha | 70 ha | 100 ha |
| | 256 ha | 280 ha | 49.500 ha |
| | | | |
| Interpretasi | | | |
| | | | |
| | | | |
| | | | |

**E1. Lahan Padi Sawah pH Tinggi**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| Tanggal Interview | 02/12/21 | 08/12/21 |
| Nama R | Aan | Rizki Adiputra Taopan |
| Poktan | Srikaton | - |
| | | |
| Alamat | Dusun Srikaton, Desa manisharjo | Kel. Tanda, |
| | Kecamatan Ngrambe | Kec. Langke Rembong |
| | Kabupaten Ngawi | Kabupaten Manggarai |
| | Jawa Timur | Nusa Tenggara Timur |
| ∑ Anggota | 150 | - |
| Luas Poktan (ha) | 93 | - |
| Luas Desa (ha) | 560 | - |
| Altitude (m dpl) | 361 | 858 |
| IP | 2 | 2 |
| Produksi (t/ha) | 9,3 | 5,5 |
| | | |
| **No. 1** | Urea | Urea |
| | NPK Phonska | Nitrophonska / Petro Niphos / Phonska Plus |
| | ZA Petro | NPK Phonska / NPK Pak Tani / NPK Mutiara / NPK 15-15-15 |
| | Rock Phospate | |
| | Mahkota | |
| | | |
| **No- 2** | Petroganik | Kapur Pertanian |
| | - | |
| | | |
| **No. 3** | Tanaman tidak segar saat awal tanam, disebut asem-aseman | Pada fase vegetatif awal (14-30 HST) tanaman padi menunjukkan gejala pertumbuhan kerdil dan daun yang terdapat bercak-bercak coklat. Gejala ini hanya terjadi pada titik-titik tertentu pada areal sawah |
| | | |
| **No. 4** | Kekurangan Zink | Kemungkinan disebabkan oleh pH tanah yang tidak seragam di areal sawah, seperti ada titik-titik tertentu yang memiliki pH asam dan atau basa |
| | | |
| **No. 5** | Ya, sudah memahami | Ya, saya sudah memahami hal ini |
| | | |
| | | |
| **No. 6** | Ya, sudah memahami | Ya, saya sudah memahami hal ini |
| | | Saya ingin lebih mengetahui dan memahami hal ini |

**E1. Lahan Padi Sawah pH Tinggi (Lanjutan)**

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| **No. 7** | Ya, tetapi tidak setiap musim tanam , baru musim tanam di tahun ini | Tidak, saya belum pernah melakukannya dan Saya ingin melakukannya |
| | | |
| **No. 8** | Mahkota ZnSO4 | Tidak, saya belum pernah melakukannya dan Saya ingin melakukannya |
| | | |
| **No. 9** | 5 kg/ ha | - |
| | | |
| **No. 10** | Tidak belum pernah melakukannya | Tidak, saya belum pernah melakukannya dan Saya ingin melakukannya |
| | | |
| **No.11** | Pemberian dari produsen pupuk | Subdisi pemerintah dan Pemberian dari produsen pupuk sebagai contoh produk |
| | | |
| **NO. 12** | di toko pertanian di kecamatan belum menjual pupuk mikro | - |
| | | |
| **No.13** | 1,5 ha | 0,6 ha |
| | 93 ha | - |
| | 560 ha | - |
| | | |
| **Interpretasi** | | |
| | | |
| | | |
| | | |
| **TAM (Cu & Zn)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | - | - |
| **GROWTH FACTOR** | - | - |
| | | |
| **TAM (Gipsum)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | - | - |
| **GROWTH FACTOR** | - | - |

**E1. Lahan Padi Sawah pH Tinggi (Lanjutan)**

| PERTANYAAN | Responden-03 | Responden-04 |
|---|---|---|
| | | |
| Tanggal Interview | 08/12/21 | 20/12/21 |
| Nama R | Eduardus Sanjaya | Siprianus Sudirman |
| Poktan | Satar Jaya | Manggarai Maju |
| | | |
| Alamat | Desa Ponggeok | Desa Ranaka |
| | Kecamatan Satar Mese | Kec. Waerii |
| | Kabupaten Manggarai | Kabupaten Manggarai |
| | Nusa Tenggara Timur | Nusa Tenggara Timur |
| ∑ Anggota | 7 | 11 |
| Luas Poktan (ha) | 10 | 2 |
| Luas Desa (ha) | - | - |
| Altitude (m dpl) | 800 | 810 |
| IP | 02-Jan | 2 |
| Produksi (t/ha) | 5-5,4 | 5 |
| | | |
| **No. 1** | Urea | Urea |
| | SP36 | SP36 |
| | NPK Phonska | NPK Phonska |
| | KCl | KCl |
| | | |
| **No- 2** | Kapur Pertanian | Kapur Pertanian |
| | | |
| | | |
| **No. 3** | 1. Usia tan1aman setelah 14 hst atau lebih kadang tanaman terlihat mulai kering tetapi bukan karena kekurangan air. Situasi ini tidak terjadi untuk semua hamparan tetapi beberapa petak sj<br>2. Kondisi tanah lebih keras pada saat musim tanam ke 2 kisaran bulan juni/juli meskipun air berkelimpahan | daun menguning |
| | | |
| **No. 4** | Menurut saya ada beberapa jenis dosis pupuk yang di aplikasikan melebihi takaran atau anjuran untuk pengaplikasian setiap tahunnya sehingga terjadi perubahan tekstur tanah yang menyebabkan terhambatnya pertumbuhan tanaman. | kekurangan nitrogen |
| | | |
| **No. 5** | Tidak, saya belum mengetahui hal ini dan Saya ingin lebih mengetahui dan memahami hal ini | Tidak, saya belum mengetahui hal ini dan Saya ingin lebih mengetahui dan memahami hal ini |
| | | |
| **No. 6** | Tidak, saya belum mengetahui hal ini dan Saya ingin lebih mengetahui dan memahami hal ini | Tidak, saya belum mengetahui hal ini dan Saya ingin lebih mengetahui dan memahami hal ini |

**E1. Lahan Padi Sawah pH Tinggi (Lanjutan)**

| PERTANYAAN | Responden-03 | Responden-04 |
|---|---|---|
| | | |
| **No. 7** | - | - |
| | | |
| **No. 8** | - | - |
| | | |
| **No. 9** | - | - |
| | | |
| **No. 10** | Tidak, saya belum pernah melakukannya dan Saya ingin melakukannya | Tidak, saya belum pernah melakukannya dan Saya ingin melakukannya |
| | | |
| **No.11** | Subsidi Pemerintah | Subsidi Pemerintah |
| | | |
| **NO. 12** | - | - |
| | | |
| **No.13** | 1 ha | 1 ha |
| | 10 ha | 10 ha |
| | - | - |
| | | |
| **Interpretasi** | | |
| | | |
| | | |
| | | |
| **TAM (Cu & Zn)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | - | - |
| **GROWTH FACTOR** | - | - |
| | | |
| **TAM (Gipsum)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | - | - |
| **GROWTH FACTOR** | - | - |

## E1. Lahan Padi Sawah pH Tinggi - Verifikasi Lapangan

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| Tanggal Interview | 12 01 2022 | 12 01 2022 |
| Nama R | Supriyanto | Sutrisno |
| Poktan/Gapoktan | Tani Makmur | Tani Makmur |
| | | |
| Alamat | Desa Sukowiyono RT 04 RW 5 | Bulong |
| | Kecamatan Padas | Kartoharjo |
| | Kabupaten Ngawi | Ngawi |
| | Jawa Timur | Jatim |
| ∑ Anggota | | |
| Luas Poktan (ha) | 450 | 319 |
| Luas Desa (ha) | | |
| Altitude (m dpl) | 361 | |
| IP | 2 | |
| Produksi (t/ha) MT 1 | 8 | 8,5 - 9 |
| MT2 | 6 - 7 | 7 - 9 |
| MT3 | 9 - 10 | 9 - 12 |
| | Pola Tanam: Padi-Padi-Padi | Pola Tanam: Padi-Padi-Padi |
| | | |
| **No. 1** | Urea Subsidi | Urea Daun (Non); Urea Pusri |
| | NPK Kujang (30.6.8) Non Subsidi | TSP Mahkota (Wilmar) |
| | | MOP Canada |
| | | Nitrea Kujang |
| | | |
| | | |
| **No- 2** | Kompos (1-2 truck @ 2 ton) - Sekam | Dolomit (MT 2), yang becek2 pH 5,8-6 (?) |
| | - | |
| | | |
| **No. 3** | Ya, | Tidak ada |
| | Tanaman warna merah, karena jerami belum matang menjadi pupuk kompos. | (Ada pengawalan / pendampingan dari Wilmar ~ 50 ha Kerjasama |
| | | |
| **No. 4** | Asem-asem, jerami yang dibenam dari combine harvester belum terdekomposisi sempurna. | Tidak ada |
| | | |
| | | |
| **No. 5** | Ya, sudah memahami | Sudah tahu belum paham |
| | | Ingin lebih tahu dan paham |
| | | |
| **No. 6** | Sudah tahu belum paham | Sudah tahu belum paham |
| | Ingin lebih mengetahui & memahaminya | Ingin lebih mengetahui & memahaminya |
| | | |
| **No. 7** | Belum pernah melakukan | Ya, selalu melakukan tiap MT |
| | | |
| **No. 8** | Belum pernah melakukan | Pupuk tunggal ZnSO4 Mahkota |
| | | |

## E1. Lahan Padi Sawah pH Tinggi - Verifikasi Lapangan (Lanjutan)

| PERTANYAAN | Responden-01 | Responden-02 |
|---|---|---|
| | | |
| **No. 9** | Belum pernah melakukan | 5 kg/ha |
| | | **Zn= (22%x5)x3 kg/ha/th= 3,3 kg/ha/th** |
| | | |
| **No. 10** | Tidak belum pernah melakukannya | Tidak belum pernah melakukannya |
| | | |
| **No.11** | x | Bagian Kerjasama 1000 ha dg Wilmar / Mahkota. Tani Makmur 50 ha MT sekarang. |
| | | 50% areal ~keberlangsungan kerjasama |
| | | |
| **NO. 12** | x | ZnSO4 (Tanpa merk, plastik polos) |
| | | |
| **No.13** | 11 ha | 4 ha |
| | 450 ha | 319 ha |
| | ha | |
| | | |
| **Interpretasi** | | |
| | | |
| | | |

**F1. Lahan Reklamasi - Perusahaan**

| PERTANYAAN | Responden 01 | Responden 02 | Responden 03 |
|---|---|---|---|
| Tanggal Wawancara | 08/12/21 | 08/12/21 | 09/12/21 |
| Nama Responden | Lukman | Wahyu Wardana | M Zaim |
| Perusahaan | PT. Jembaya Muara Bara | PT. KPC | PT. Rehabilitasi Lingkungan Indonesia - Adaro Energy |
| Alamat | Kutai Kartanegara - kaltim | Kutai Timur - Kaltim | Lokasi di Kalsel |
| Jenis Pertambangan | Batu bara | Batu bara | Batu bara |
| | | | |
| No.1 | a. Reklamasi dan revegatasi 1800 hektar | a. Reklamasi dan revegatasi 12000 hektar | a. Reklamasi dan revegatasi 2800 hektar |
| | b. Akan reklamasi dan revegatasi 158 hektar | b. Akan reklamasi dan revegatasi 5000 hektar | b. Akan reklamasi & revegatasi 10000 hektar |
| | | | |
| No.2 | Sengon, Johar, Trembesi | Sengon buto, Sengon laut, Angsana, Trembesi, Johar | Sengon, Johar, Eukaliptus |
| | buah-buahan: rambai/duku, durian, langsat | buah-buahan: beringin, jambu-jambuan, mangga hutan, nangka, cempedak | buah-buahan: Jambu-jambuan, mangga, rambutan, petai, nangka, durian |
| | tanaman lokal: meranti, kapur | tanaman lokal: pulai, bayur, laban, meranti | tanaman lokal: alaban, ficus, bambu, meranti, keruing, mahoni, ketapi, sungkai, suren |
| | | | |
| No.3 | NPK Mutiara | NPK Phonska - NPK Mutiara | tidak ada, menggunakan bahan organik |
| | | | |
| No.4 | Belum pernah | Belum pernah | Pernah, khususnya Zn |
| | | | |
| No.5 | | | Menggunakan bahan organik produksi sendiri, hasil uji lab pupuk organik mengindikasikan adanya kandungan Zn. |
| | | | |
| No.6 | | | Tidak, belum pernah melakukannya |
| | | | |
| No.7 | | | |
| | | | |
| No.8 | | | |
| | | | |
| **TAM (Cu & Zn)** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | **-** | **-** | **12800** |
| **GROWTH FACTOR** | **-** | **-** | **12800** |

**F1. Lahan Reklamasi - Perusahaan (Lanjutan)**

| PERTANYAAN | Responden 04 | Responden 05 | Responden 06 |
|---|---|---|---|
| Tanggal Wawancara | 09/12/21 | 09/12/21 | 13/12/21 |
| Nama Responden | Aries Priyo Ambodo | Fakhri | Rahardian |
| Perusahaan | PT. VALE | PT. Trisensa Mineral Utama | PT Timah Tbk - Unit Produksi Belitung |
| Alamat | Sorowako , Luwu Timur - Sulsel | Kutai Kartanegara - Kaltim | Jl. Melati A-44, Tanjung Pandan, Belitung |
| Jenis Pertambangan | Nikel | Batu bara | Timah |
| | | | |
| No.1 | a. Reklamasi dan revegatasi 4000 hektar | b. Yang akan reklamasi dan revegetasi 150 hektar | a. Yang sudah direklamasi sd 2020: 659 Ha |
| | b. Akan reklamasi dan revegatasi 1000 hektar | | b. Yang akan direklamasi per tahun 80-100 ha |
| | | | |
| No.2 | Sengon Buto, Johar, Eukaliptus | Sengon, Gamal | Sengon, Karet |
| | buah-buahan: durian, nangka, petai, rambutan, mangga | buah-buahan: pisang, durian, mangga | Buah-buahan: Jambu Mente, Alpokat. |
| | tanaman lokal: damar, kayu hitam, bintangur, cemara api | tanaman lokal: ulin meranti | Tanaman lokal: Jambu mente, blangiran. Tahun 2022: kelapa sawit & alpokat. |
| | | | |
| No.3 | Urea, TSP, KCL, Sulfomag | tidak ada | NPK (pupuk Majemuk, merk Mahkota: Pusri) |
| | | | |
| No.4 | Belum pernah | Belum pernah | Belum pernah, Tahun 2022: akan digunakan untuk kelapa sawit |
| | | | |
| No.5 | | | |
| | | | |
| No.6 | | | |
| | | | |
| | | | |
| No.7 | | | |
| | | | |
| No.8 | | | |
| | | | |
| **TAM (Cu & Zn)** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | **-** | **-** | **-** |
| **GROWTH FACTOR** | **-** | **-** | **-** |

**F1. Lahan Reklamasi - Perusahaan (Lanjutan)**

| PERTANYAAN | Responden 07 | Responden 08 | Responden 09 |
|---|---|---|---|
| | | | |
| Tanggal Wawancara | 13/12/21 | 13/12/21 | 18/12/21 |
| Nama Responden | Riki Hermansyah | Yaser Arafat | Krispani Firmansyah |
| Perusahaan | K3LH, PT Timah Tbk | PT. Alamjaya Bara Pratama | PT. Archi Indonesia (PT. Meares Soputan Mining + PT. Tambang Tondano Nusajaya) |
| Alamat | Jl. Jendral Sudirman No. 51 Pangkal Pinang | Kutai Kartanegara - Kaltim | Likupang, Minahasa Utara - Sulut |
| Jenis Pertambangan | Timah | Batu bara | Emas |
| | | | |
| No.1 | a. Yang sudah direklamasi sd 2021: 2.000 Ha | a. Reklamasi dan revegatasi 400 hektar | a. Reklamasi dan revegatasi 180 hektar |
| | b. Yang akan direklamasi per tahun 300 ha (Bangka) | b. Akan reklamasi dan revegatasi 600 hektar | b. Akan reklamasi dan revegatasi 550 hektar |
| | | | |
| No.2 | Sengon, Karet | Sengon | Jabon, Sengon, Ketapang, Angsana |
| | Buah-buahan: Jambu Mente, Alpokat. | d. Buah-buahan : nangka, durian, rambutan | Buah-buahan :rambutan, durian, matoa, mangga, nangka, sirsak, manggis |
| | Tanaman lokal: Jambu mente, blangiran. Tahun 2020: kelapa, kelapa sawit & alpokat. | tanaman lokal: kapur, meranti, mahoni | tanaman lokal: eboni, cempaka, nantu, woka, ficus, selakapu, kenanga |
| | | | |
| No.3 | NPK (pupuk Majemuk, merk Kebo Mas) | NPK 15-15-15 | TSP/SP36, f. NPK Phonska / NPK Mutiara / NPK 15-15-15 / NPK Pelangi / NPK Pelangi TE |
| | | | |
| No.4 | Pernah. | Belum pernah | Belum Pernah |
| | | | |
| No.5 | Chopper Sulphate (CuSO4), Produksi PT. Multi Mas Chemindo | | |
| | | | |
| No.6 | Dosis Cu yang diaplikasikan ke tanaman sawit: Tahun I : 0,03 kg/tanaman , Tahun II : 0,06 kg/tanaman, dan Tahun III : 0,09 kg/tanaman kg/tanaman | | |
| | | | |

**F1. Lahan Reklamasi - Perusahaan (Lanjutan)**

| PERTANYAAN | Responden 07 | Responden 08 | Responden 09 |
|---|---|---|---|
| | | | |
| No.6 (Lanjutan) | Selama 3 tahun pemeliharaan tanaman mendapatkan 0,18 kg pupuk CuSO4 / tanaman. Jarak tanam 9m x 9m, sehingga terdapat 140 tanaman per Ha. | | |
| | | | |
| No.7 | Membeli di distributor pupuk terdekat | | |
| | | | |
| No.8 | Merek Pupuk Chopper Sulphate, produksi PT Multi Mas Chemindo, berat per kemasan (25 kg), harga per kemasan (Rp. 37.400/kg). | | |
| | | | |
| **TAM (Cu & Zn)** | **X ha (Spasial)** | **X ha (Spasial)** | **X ha (Spasial)** |
| **PENGURANG POTENSIAL** | **2300** | **-** | **730** |
| **GROWTH FACTOR** | **2300** | **-** | **730** |

# Appendix 3.

## Estimated potential market of Cu and Zn fertilizers and gypsum soil enhancer in Indonesia at the first quarter of 2022

**Table A1-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## A1. Intensive Rice Field

| Identified Areas 1) | | | TAM 2) | | Reducing Factors 3) | | | | AD 4) | | PD 5) | | PCMS 6) | | Market Potential for PT MCG 7) | | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Cu | Updated Amount | Amount of Cu |
| | ha | ha | kg Cu/year | kg Cu/year | ha | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **West Jawa Province** | | | | | | | | | | | | | | | | | |
| BEKASI | 37.372 | 37.372 | 934.305 | 934.305 | 37.372 | 37.372 | 0 | - | 934 | 934 | 954 | 954 | 601 | 601 | 353 | 353 | 581 |
| BOGOR | 1.937 | 1.937 | 48.416 | 48.416 | 1.937 | 1.937 | 0 | - | 48 | 48 | 49 | 49 | 31 | 31 | 18 | 18 | 30 |
| CIAMIS | 8.071 | 8.071 | 201.766 | 201.766 | 8.071 | 8.071 | 0 | - | 202 | 202 | 206 | 206 | 130 | 130 | 76 | 76 | 126 |
| CIREBON | 22.971 | 22.971 | 574.269 | 574.269 | 22.971 | 22.971 | 0 | - | 574 | 574 | 586 | 586 | 369 | 369 | 217 | 217 | 357 |
| INDRAMAYU | 64.023 | 64.023 | 1.600.579 | 1.600.579 | 64.023 | 64.023 | 0 | - | 1.601 | 1.601 | 1.634 | 1.634 | 1.030 | 1.030 | 605 | 605 | 996 |
| KARAWANG | 39.091 | 39.091 | 977.285 | 977.285 | 39.091 | 39.091 | 0 | - | 977 | 977 | 998 | 998 | 629 | 629 | 369 | 369 | 608 |
| KOTA BANJAR | 171 | 171 | 4.276 | 4.276 | 171 | 171 | 0 | - | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 3 |
| KOTA CIREBON | 3 | 3 | 83 | 83 | 3 | 3 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAJALENGKA | 16.717 | 16.717 | 417.919 | 417.919 | 16.717 | 16.717 | 0 | - | 418 | 418 | 427 | 427 | 269 | 269 | 158 | 158 | 260 |
| PANGANDARAN | 5.029 | 5.029 | 125.716 | 125.716 | 5.029 | 5.029 | 0 | - | 126 | 126 | 128 | 128 | 81 | 81 | 47 | 47 | 78 |
| SUBANG | 22.155 | 22.155 | 553.871 | 553.871 | 22.155 | 22.155 | 0 | - | 554 | 554 | 566 | 566 | 356 | 356 | 209 | 209 | 345 |
| SUMEDANG | 1 | 1 | 32 | 32 | 1 | 1 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **217.541** | **217.541** | **5.438.517** | **5.438.517** | **217.541** | **217.541** | **-** | **-** | **5.439** | **5.439** | **5.553** | **5.553** | **3.498** | **3.498** | **2.055** | **2.055** | **3.384** |
| | | | | | | | | | | | | | | | | | |
| **Banten Province** | | | | | | | | | | | | | | | | | |
| KOTA CILEGON | 179 | 179 | 4.476 | 4.476 | 179 | 179 | 2.238 | 2.238 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 4 |
| KOTA SERANG | 2.105 | 2.105 | 52.629 | 52.629 | 2.105 | 2.105 | 26.314 | 26.314 | 26 | 26 | 27 | 27 | 17 | 17 | 10 | 10 | 43 |
| KOTA TANGERANG | 1 | 1 | 36 | 36 | 1 | 1 | 18 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LEBAK | 2.344 | 2.344 | 58.599 | 58.599 | 2.344 | 2.344 | 29.299 | 29.299 | 29 | 29 | 30 | 30 | 19 | 19 | 11 | 11 | 48 |
| PANDEGLANG | 14.041 | 14.041 | 351.023 | 351.023 | 14.041 | 14.041 | 175.511 | 175.511 | 176 | 176 | 179 | 179 | 113 | 113 | 66 | 66 | 285 |
| SERANG | 13.140 | 13.140 | 328.500 | 328.500 | 13.140 | 13.140 | 164.250 | 164.250 | 164 | 164 | 168 | 168 | 106 | 106 | 62 | 62 | 266 |
| TANGERANG | 8.858 | 8.858 | 221.458 | 221.458 | 8.858 | 8.858 | 110.729 | 110.729 | 111 | 111 | 113 | 113 | 71 | 71 | 42 | 42 | 180 |
| **Total** | **40.669** | **40.669** | **1.016.719** | **1.016.719** | **40.669** | **40.669** | **508.360** | **508.360** | **508** | **508** | **519** | **519** | **327** | **327** | **192** | **192** | **825** |
| | | | | | | | | | | | | | | | | | |
| **Central Java Province** | | | | | | | | | | | | | | | | | |
| BANJARNEGARA | 5.918 | 5.996 | 147.962 | 149.888 | 5.918 | 5.996 | 0 | - | 148 | 150 | 151 | 153 | 95 | 96 | 56 | 57 | 93 |
| BANYUMAS | 17.200 | 19.161 | 430.003 | 479.034 | 17.200 | 19.161 | 0 | - | 430 | 479 | 439 | 489 | 277 | 308 | 162 | 181 | 298 |
| BATANG | 694 | 445 | 17.361 | 11.128 | 694 | 445 | 0 | - | 17 | 11 | 18 | 11 | 11 | 7 | 7 | 4 | 7 |
| BLORA | 7.853 | 7.560 | 196.313 | 189.010 | 7.853 | 7.560 | 0 | - | 196 | 189 | 200 | 193 | 126 | 122 | 74 | 71 | 118 |
| BOYOLALI | 8.535 | 15.400 | 213.365 | 384.998 | 8.535 | 15.400 | 0 | - | 213 | 385 | 218 | 393 | 137 | 248 | 81 | 145 | 240 |
| BREBES | 40.520 | 24.918 | 1.013.009 | 622.945 | 40.520 | 24.918 | 0 | - | 1.013 | 623 | 1.034 | 636 | 652 | 401 | 383 | 235 | 388 |
| CILACAP | 27.584 | 27.546 | 689.610 | 688.656 | 27.584 | 27.546 | 0 | - | 690 | 689 | 704 | 703 | 444 | 443 | 261 | 260 | 429 |
| DEMAK | 40.226 | 38.603 | 1.005.646 | 965.074 | 40.226 | 38.603 | 0 | - | 1.006 | 965 | 1.027 | 985 | 647 | 621 | 380 | 365 | 600 |
| GROBOGAN | 17.968 | 17.440 | 449.190 | 436.008 | 17.968 | 17.440 | 0 | - | 449 | 436 | 459 | 445 | 289 | 280 | 170 | 165 | 271 |
| JEPARA | 3.186 | 3.915 | 79.660 | 97.879 | 3.186 | 3.915 | 0 | - | 80 | 98 | 81 | 100 | 51 | 63 | 30 | 37 | 61 |
| KARANGANYAR | 1.549 | 9.017 | 38.726 | 225.423 | 1.549 | 9.017 | 0 | - | 39 | 225 | 40 | 230 | 25 | 145 | 15 | 85 | 140 |
| KEBUMEN | 25.453 | 25.521 | 636.313 | 638.015 | 25.453 | 25.521 | 0 | - | 636 | 638 | 650 | 651 | 409 | 410 | 240 | 241 | 397 |
| KENDAL | 662 | 10.714 | 16.556 | 267.859 | 662 | 10.714 | 0 | - | 17 | 268 | 17 | 273 | 11 | 172 | 6 | 101 | 167 |
| KLATEN | 6.015 | 29.023 | 150.374 | 725.565 | 6.015 | 29.023 | 0 | - | 150 | 726 | 154 | 741 | 97 | 467 | 57 | 274 | 451 |
| KOTA PEKALONGAN | 101 | 101 | 2.534 | 2.534 | 101 | 101 | 0 | - | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 |
| KOTA SEMARANG | 220 | 153 | 5.507 | 3.819 | 220 | 153 | 0 | - | 6 | 4 | 6 | 4 | 4 | 2 | 2 | 1 | 2 |
| KUDUS | 10.532 | 11.387 | 263.289 | 284.686 | 10.532 | 11.387 | 0 | - | 263 | 285 | 269 | 291 | 169 | 183 | 99 | 108 | 177 |
| MAGELANG | 252 | 4.306 | 6.304 | 107.660 | 252 | 4.306 | 0 | - | 6 | 108 | 6 | 110 | 4 | 69 | 2 | 41 | 67 |
| PATI | 32.427 | 42.261 | 810.663 | 1.056.518 | 32.427 | 42.261 | 0 | - | 811 | 1.057 | 828 | 1.079 | 521 | 680 | 306 | 399 | 657 |
| PEKALONGAN | 11.414 | 13.144 | 285.342 | 328.597 | 11.414 | 13.144 | 0 | - | 285 | 329 | 291 | 335 | 184 | 211 | 108 | 124 | 204 |
| PEMALANG | 15.568 | 14.889 | 389.190 | 372.231 | 15.568 | 14.889 | 0 | - | 389 | 372 | 397 | 380 | 250 | 239 | 147 | 141 | 232 |
| PURBALINGGA | 9.072 | 9.103 | 226.809 | 227.582 | 9.072 | 9.103 | 0 | - | 227 | 228 | 232 | 232 | 146 | 146 | 86 | 86 | 142 |
| PURWOREJO | 20.191 | 20.994 | 504.775 | 524.844 | 20.191 | 20.994 | 0 | - | 505 | 525 | 515 | 536 | 325 | 338 | 191 | 198 | 327 |
| REMBANG | 5.847 | 5.813 | 146.167 | 145.327 | 5.847 | 5.813 | 0 | - | 146 | 145 | 149 | 148 | 94 | 93 | 55 | 55 | 90 |
| SEMARANG | 3.342 | 446 | 83.551 | 11.161 | 3.342 | 446 | 0 | - | 84 | 11 | 85 | 11 | 54 | 7 | 32 | 4 | 7 |
| SRAGEN | 22.225 | 36.933 | 555.618 | 923.325 | 22.225 | 36.933 | 0 | - | 556 | 923 | 567 | 943 | 357 | 594 | 210 | 349 | 575 |
| SUKOHARJO | 12.595 | 18.215 | 314.876 | 455.367 | 12.595 | 18.215 | 0 | - | 315 | 455 | 321 | 465 | 203 | 293 | 119 | 172 | 283 |
| TEGAL | 11.724 | 25.886 | 293.092 | 647.160 | 11.724 | 25.886 | 0 | - | 293 | 647 | 299 | 661 | 189 | 416 | 111 | 244 | 403 |
| WONOGIRI | 2.500 | 6.523 | 62.512 | 163.071 | 2.500 | 6.523 | 0 | - | 63 | 163 | 64 | 166 | 40 | 105 | 24 | 62 | 101 |
| WONOSOBO | 222 | 222 | 5.547 | 5.547 | 222 | 222 | 0 | - | 6 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 3 |
| **Total** | **361.595** | **445.636** | **9.039.863** | **11.140.912** | **361.595** | **445.636** | **-** | **-** | **9.040** | **11.141** | **9.230** | **11.375** | **5.815** | **7.166** | **3.415** | **4.209** | **6.932** |

## A1. Intensive Rice Field (Continued)

| Identified Areas 1) | | | TAM 2) | | Reducing Factors 3) | | | | AD 4) | | PD 5) | | PCMS 6) | | Market Potential for PT MCG 7) | | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Cu | Updated Amount | Amount of Cu |
| | ha | ha | kg Cu/year | kg Cu/year | ha | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **East Java Province** | | | | | | | | | | | | | | | | | |
| BANGKALAN | 10.770 | 10.770 | 269.260 | 269.260 | 10.770 | 10.770 | 0 | - | 269 | 269 | 275 | 275 | 173 | 173 | 102 | 102 | 168 |
| BOJONEGORO | 28.199 | 35.794 | 704.980 | 894.851 | 28.199 | 35.794 | 0 | 107 | 705 | 895 | 720 | 914 | 453 | 576 | 266 | 338 | 557 |
| BONDOWOSO | | 3.271 | | 81.787 | | 3.271 | 0 | - | - | 82 | - | 84 | | 53 | | 31 | 51 |
| GRESIK | 12.731 | 12.716 | 318.282 | 317.891 | 12.731 | 12.716 | 0 | - | 318 | 318 | 325 | 325 | 205 | 204 | 120 | 120 | 198 |
| JEMBER | 11.862 | 30.232 | 296.562 | 755.801 | 11.862 | 30.232 | 0 | - | 297 | 756 | 303 | 772 | 191 | 486 | 112 | 286 | 470 |
| JOMBANG | 13.986 | 24.339 | 349.657 | 608.472 | 13.986 | 24.339 | 0 | - | 350 | 608 | 357 | 621 | 225 | 391 | 132 | 230 | 379 |
| KEDIRI | 7.181 | 21.135 | 179.526 | 528.368 | 7.181 | 21.135 | 0 | - | 180 | 528 | 183 | 539 | 115 | 340 | 68 | 200 | 329 |
| KOTA KEDIRI | 79 | 70 | 1.971 | 1.743 | 79 | 70 | 0 | - | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| KOTA MADIUN | 560 | 556 | 14.007 | 13.910 | 560 | 556 | 0 | - | 14 | 14 | 14 | 14 | 9 | 9 | 5 | 5 | 9 |
| KOTA PASURUAN | 368 | 378 | 9.203 | 9.445 | 368 | 378 | 0 | - | 9 | 9 | 9 | 10 | 6 | 6 | 3 | 4 | 6 |
| KOTA PROBOLINGGO | | 137 | | 3.432 | | 137 | 0 | - | - | 3 | - | 4 | | 2 | | 1 | 2 |
| LAMONGAN | 56.890 | 66.961 | 1.422.238 | 1.674.022 | 56.890 | 66.961 | 0 | - | 1.422 | 1.674 | 1.452 | 1.709 | 915 | 1.077 | 537 | 632 | 1.042 |
| MADIUN | 11.369 | 14.610 | 284.235 | 365.260 | 11.369 | 14.610 | 0 | - | 284 | 365 | 290 | 373 | 183 | 235 | 107 | 138 | 227 |
| MAGETAN | 1.858 | 3.006 | 46.458 | 75.148 | 1.858 | 3.006 | 0 | - | 46 | 75 | 47 | 77 | 30 | 48 | 18 | 28 | 47 |
| MOJOKERTO | 2.294 | 2.295 | 57.349 | 57.373 | 2.294 | 2.295 | 0 | - | 57 | 57 | 59 | 59 | 37 | 37 | 22 | 22 | 36 |
| NGANJUK | 26.847 | 27.389 | 671.179 | 684.723 | 26.847 | 27.389 | 0 | - | 671 | 685 | 685 | 699 | 432 | 440 | 254 | 259 | 426 |
| NGAWI | 21.256 | 19.937 | 531.408 | 498.420 | 21.256 | 19.937 | 0 | - | 531 | 498 | 543 | 509 | 342 | 321 | 201 | 188 | 310 |
| PASURUAN | 3.811 | 16.128 | 95.273 | 403.189 | 3.811 | 16.128 | 0 | - | 95 | 403 | 97 | 412 | 61 | 259 | 36 | 152 | 251 |
| PONOROGO | 2.331 | 2.331 | 58.274 | 58.274 | 2.331 | 2.331 | 0 | - | 58 | 58 | 59 | 59 | 37 | 37 | 22 | 22 | 36 |
| PROBOLINGGO | 3.563 | 8.961 | 89.073 | 224.018 | 3.563 | 8.961 | 0 | - | 89 | 224 | 91 | 229 | 57 | 144 | 34 | 85 | 139 |
| SIDOARJO | 6.365 | 14.320 | 159.115 | 358.005 | 6.365 | 14.320 | 0 | - | 159 | 358 | 162 | 366 | 102 | 230 | 60 | 135 | 223 |
| SITUBONDO | 15.947 | 26.250 | 398.685 | 656.244 | 15.947 | 26.250 | 0 | - | 399 | 656 | 407 | 670 | 256 | 422 | 151 | 248 | 408 |
| TRENGGALEK | 1.264 | 1.264 | 31.609 | 31.609 | 1.264 | 1.264 | 0 | - | 32 | 32 | 32 | 32 | 20 | 20 | 12 | 12 | 20 |
| TUBAN | 25.639 | 26.829 | 640.968 | 670.735 | 25.639 | 26.829 | 0 | 0,02 | 641 | 671 | 654 | 685 | 412 | 431 | 242 | 253 | 417 |
| TULUNGAGUNG | 11.770 | 11.770 | 294.256 | 294.256 | 11.770 | 11.770 | 0 | - | 294 | 294 | 300 | 300 | 189 | 189 | 111 | 111 | 183 |
| **Total** | **276.943** | **381.449** | **6.923.569** | **9.536.237** | **276.943** | **381.449** | **-** | **107** | **6.924** | **9.536** | **7.069** | **9.736** | **4.453** | **6.134** | **2.616** | **3.603** | **5.934** |
| **Lampung Province** | | | | | | | | | | | | | | | | | |
| LAMPUNG SELATAN | 2.820 | 2.820 | 70.506 | 70.506 | 2.820 | 2.820 | 35.253 | 35.253 | 35 | 35 | 36 | 36 | 23 | 23 | 13 | 13 | 57 |
| LAMPUNG TENGAH | 7 | 7 | 175 | 175 | 7 | 7 | 88 | 88 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LAMPUNG TIMUR | 1.093 | 1.093 | 27.334 | 27.334 | 1.093 | 1.093 | 13.667 | 13.667 | 14 | 14 | 14 | 14 | 9 | 9 | 5 | 5 | 22 |
| PESAWARAN | 2.212 | 2.212 | 55.301 | 55.301 | 2.212 | 2.212 | 27.650 | 27.650 | 28 | 28 | 28 | 28 | 18 | 18 | 10 | 10 | 45 |
| PRINGSEWU | 936 | 936 | 23.398 | 23.398 | 936 | 936 | 11.699 | 11.699 | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 4 | 19 |
| TANGGAMUS | 4.020 | 4.020 | 100.508 | 100.508 | 4.020 | 4.020 | 50.254 | 50.254 | 50 | 50 | 51 | 51 | 32 | 32 | 19 | 19 | 82 |
| WAY KANAN | 1.842 | 1.842 | 46.047 | 46.047 | 1.842 | 1.842 | 23.024 | 23.024 | 23 | 23 | 24 | 24 | 15 | 15 | 9 | 9 | 37 |
| **Total** | **12.931** | **12.931** | **323.269** | **323.269** | **12.931** | **12.931** | **161.635** | **161.635** | **162** | **162** | **165** | **165** | **104** | **104** | **61** | **61** | **262** |
| **South Sumatera Province** | | | | | | | | | | | | | | | | | |
| OGAN KOMERING ILIR | 136 | 136 | 3.404 | 3.404 | 136 | 136 | - | - | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 |
| OGAN KOMERING ULU SELATAN | 9 | 9 | 230 | 230 | 9 | 9 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OGAN KOMERING ULU TIMUR | 24.068 | 24.068 | 601.706 | 601.706 | 24.068 | 24.068 | - | - | 602 | 602 | 614 | 614 | 387 | 387 | 227 | 227 | 374 |
| **Total** | **24.214** | **24.214** | **605.341** | **605.341** | **24.214** | **24.214** | **-** | **-** | **605** | **605** | **618** | **618** | **389** | **389** | **229** | **229** | **377** |
| **South Sulawesi Province** | | | | | | | | | | | | | | | | | |
| BONE | 26.764 | 26.764 | 669.091 | 669.091 | 26.764 | 26.764 | - | - | 669 | 669 | 683 | 683 | 430 | 430 | 253 | 253 | 416 |
| GOWA | 11.819 | 11.819 | 295.467 | 295.467 | 11.819 | 11.819 | - | - | 295 | 295 | 302 | 302 | 190 | 190 | 112 | 112 | 184 |
| JENEPONTO | 4 | 4 | 110 | 110 | 4 | 4 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA MAKASSAR | 27 | 27 | 682 | 682 | 27 | 27 | - | - | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| MAROS | 8.320 | 8.320 | 208.003 | 208.003 | 8.320 | 8.320 | - | - | 208 | 208 | 212 | 212 | 134 | 134 | 79 | 79 | 129 |
| PINRANG | 7.872 | 7.872 | 196.805 | 196.805 | 7.872 | 7.872 | - | - | 197 | 197 | 201 | 201 | 127 | 127 | 74 | 74 | 122 |
| SIDENRENG RAPPANG | 4.605 | 4.605 | 115.135 | 115.135 | 4.605 | 4.605 | - | - | 115 | 115 | 118 | 118 | 74 | 74 | 43 | 43 | 72 |
| SOPPENG | 2.870 | 2.870 | 71.745 | 71.745 | 2.870 | 2.870 | - | - | 72 | 72 | 73 | 73 | 46 | 46 | 27 | 27 | 45 |
| TAKALAR | 10.162 | 10.162 | 254.046 | 254.046 | 10.162 | 10.162 | - | - | 254 | 254 | 259 | 259 | 163 | 163 | 96 | 96 | 158 |
| WAJO | 28.932 | 28.932 | 723.291 | 723.291 | 28.932 | 28.932 | - | - | 723 | 723 | 738 | 738 | 465 | 465 | 273 | 273 | 450 |
| **Total** | **101.375** | **101.375** | **2.534.376** | **2.534.376** | **101.375** | **101.375** | **-** | **-** | **2.534** | **2.534** | **2.588** | **2.588** | **1.630** | **1.630** | **957** | **957** | **1.577** |

| | |
|---|---|
| **Updated Total Area, Indonesia, ha** | **1.223.815** |

| | |
|---|---|
| **Total Market Potential for Java, Sumatera, Sulawesi; Intensive Rice Field** | **11.305** |
| **Ton Cu/year** | |
| **TAM for Intensive Rice Field, Ton Cu/year** | **30.595** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growth Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS

**Assumption:**

Recommended dosage for Cu: 10 kg/season/ha
IP: 2,5

**Table A1-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## A1. Intensive Rice Field

| Identified Areas 1) | | | TAM 2) | | Reducing Factors 3) | | | | AD 4) | | PD 5) | | PCMS 6) | | Market Potential for PT MCG 7) | | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Zn | Updated Amount | Amount of Zn |
| | ha | ha | kg Zn/year | kg Zn/year | ha | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **West Java Province** | | | | | | | | | | | | | | | | | |
| BEKASI | 37.372 | 37.372 | 1.401.458 | 1.401.458 | 37.372 | 37.372 | 0 | 0 | 1.401 | 1.401 | 1.431 | 1.431 | 901 | 901 | 529 | 529 | 872 |
| BOGOR | 1.937 | 1.937 | 72.624 | 72.624 | 1.937 | 1.937 | 0 | 0 | 73 | 73 | 74 | 74 | 47 | 47 | 27 | 27 | 45 |
| CIAMIS | 8.071 | 8.071 | 302.649 | 302.649 | 8.071 | 8.071 | 0 | 0 | 303 | 303 | 309 | 309 | 195 | 195 | 114 | 114 | 188 |
| CIREBON | 22.971 | 22.971 | 861.404 | 861.404 | 22.971 | 22.971 | 0 | 0 | 861 | 861 | 879 | 879 | 554 | 554 | 325 | 325 | 536 |
| INDRAMAYU | 64.023 | 64.023 | 2.400.868 | 2.400.868 | 64.023 | 64.023 | 0 | 0 | 2.401 | 2.401 | 2.451 | 2.451 | 1.544 | 1.544 | 907 | 907 | 1.494 |
| KARAWANG | 39.091 | 39.091 | 1.465.927 | 1.465.927 | 39.091 | 39.091 | 0 | 0 | 1.466 | 1.466 | 1.497 | 1.497 | 943 | 943 | 554 | 554 | 912 |
| KOTA BANJAR | 171 | 171 | 6.413 | 6.413 | 171 | 171 | 0 | 0 | 6 | 6 | 7 | 7 | 4 | 4 | 2 | 2 | 4 |
| KOTA CIREBON | 3 | 3 | 125 | 125 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAJALENGKA | 16.717 | 16.717 | 626.879 | 626.879 | 16.717 | 16.717 | 0 | 0 | 627 | 627 | 640 | 640 | 403 | 403 | 237 | 237 | 390 |
| PANGANDARAN | 5.029 | 5.029 | 188.574 | 188.574 | 5.029 | 5.029 | 0 | 0 | 189 | 189 | 193 | 193 | 121 | 121 | 71 | 71 | 117 |
| SUBANG | 22.155 | 22.155 | 830.807 | 830.807 | 22.155 | 22.155 | 0 | 0 | 831 | 831 | 848 | 848 | 534 | 534 | 314 | 314 | 517 |
| SUMEDANG | 1 | 1 | 48 | 48 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **217.541** | **217.541** | **8.157.775** | **8.157.775** | **217.541** | **217.541** | **-** | **-** | **8.158** | **8.158** | **8.329** | **8.329** | **5.247** | **5.247** | **3.082** | **3.082** | **5.076** |
| **Banten Province** | | | | | | | | | | | | | | | | | |
| KOTA CILEGON | 179 | 179 | 6.714 | 6.714 | 179 | 179 | 3.357 | 3.357 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 5 |
| KOTA SERANG | 2.105 | 2.105 | 78.943 | 78.943 | 2.105 | 2.105 | 39.472 | 39.472 | 39 | 39 | 40 | 40 | 25 | 25 | 15 | 15 | 64 |
| KOTA TANGERANG | 1 | 1 | 54 | 54 | 1 | 1 | 27 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LEBAK | 2.344 | 2.344 | 87.898 | 87.898 | 2.344 | 2.344 | 43.949 | 43.949 | 44 | 44 | 45 | 45 | 28 | 28 | 17 | 17 | 71 |
| PANDEGLANG | 14.041 | 14.041 | 526.534 | 526.534 | 14.041 | 14.041 | 263.267 | 263.267 | 263 | 263 | 269 | 269 | 169 | 169 | 99 | 99 | 427 |
| SERANG | 13.140 | 13.140 | 492.750 | 492.750 | 13.140 | 13.140 | 246.375 | 246.375 | 246 | 246 | 252 | 252 | 158 | 158 | 93 | 93 | 400 |
| TANGERANG | 8.858 | 8.858 | 332.186 | 332.186 | 8.858 | 8.858 | 166.093 | 166.093 | 166 | 166 | 170 | 170 | 107 | 107 | 63 | 63 | 269 |
| **Total** | **40.669** | **40.669** | **1.525.079** | **1.525.079** | **40.669** | **40.669** | **762.540** | **762.540** | **763** | **763** | **779** | **779** | **490** | **490** | **288** | **288** | **1.237** |
| **Central Java Province** | | | | | | | | | | | | | | | | | |
| BANJARNEGARA | 5.918 | 5.996 | 221.944 | 224.832 | 5.918 | 5.996 | 0 | - | 222 | 225 | 227 | 230 | 143 | 145 | 84 | 85 | 140 |
| BANYUMAS | 17.200 | 19.161 | 645.005 | 718.551 | 17.200 | 19.161 | 0 | - | 645 | 719 | 659 | 734 | 415 | 462 | 244 | 271 | 447 |
| BATANG | 694 | 445 | 26.041 | 16.693 | 694 | 445 | 0 | - | 26 | 17 | 27 | 17 | 17 | 11 | 10 | 6 | 10 |
| BLORA | 7.853 | 7.560 | 294.469 | 283.516 | 7.853 | 7.560 | 0 | - | 294 | 284 | 301 | 289 | 189 | 182 | 111 | 107 | 176 |
| BOYOLALI | 8.535 | 15.400 | 320.048 | 577.497 | 8.535 | 15.400 | 0 | - | 320 | 577 | 327 | 590 | 206 | 371 | 121 | 218 | 359 |
| BREBES | 40.520 | 24.918 | 1.519.513 | 934.417 | 40.520 | 24.918 | 0 | - | 1.520 | 934 | 1.551 | 954 | 977 | 601 | 574 | 353 | 581 |
| CILACAP | 27.584 | 27.546 | 1.034.415 | 1.032.984 | 27.584 | 27.546 | 0 | - | 1.034 | 1.033 | 1.056 | 1.055 | 665 | 664 | 391 | 390 | 643 |
| DEMAK | 40.226 | 38.603 | 1.508.469 | 1.447.611 | 40.226 | 38.603 | 0 | - | 1.508 | 1.448 | 1.540 | 1.478 | 970 | 931 | 570 | 547 | 901 |
| GROBOGAN | 17.968 | 17.440 | 673.785 | 654.013 | 17.968 | 17.440 | 0 | - | 674 | 654 | 688 | 668 | 433 | 421 | 255 | 247 | 407 |
| JEPARA | 3.186 | 3.915 | 119.490 | 146.819 | 3.186 | 3.915 | 0 | - | 119 | 147 | 122 | 150 | 77 | 94 | 45 | 55 | 91 |
| KARANGANYAR | 1.549 | 9.017 | 58.089 | 338.134 | 1.549 | 9.017 | 0 | - | 58 | 338 | 59 | 345 | 37 | 217 | 22 | 128 | 210 |
| KEBUMEN | 25.453 | 25.521 | 954.470 | 957.022 | 25.453 | 25.521 | 0 | - | 954 | 957 | 975 | 977 | 614 | 616 | 361 | 362 | 595 |
| KENDAL | 662 | 10.714 | 24.834 | 401.788 | 662 | 10.714 | 0 | - | 25 | 402 | 25 | 410 | 16 | 258 | 9 | 152 | 250 |
| KLATEN | 6.015 | 29.023 | 225.562 | 1.088.348 | 6.015 | 29.023 | 0 | - | 226 | 1.088 | 230 | 1.111 | 145 | 700 | 85 | 411 | 677 |
| KOTA PEKALONGAN | 101 | 101 | 3.801 | 3.801 | 101 | 101 | 0 | - | 4 | 4 | 4 | 4 | 2 | 2 | 1 | 1 | 2 |
| KOTA SEMARANG | 220 | 153 | 8.260 | 5.729 | 220 | 153 | 0 | - | 8 | 6 | 8 | 6 | 5 | 4 | 3 | 2 | 4 |
| KUDUS | 10.532 | 11.387 | 394.933 | 427.029 | 10.532 | 11.387 | 0 | - | 395 | 427 | 403 | 436 | 254 | 275 | 149 | 161 | 266 |
| MAGELANG | 252 | 4.306 | 9.456 | 161.491 | 252 | 4.306 | 0 | - | 9 | 161 | 10 | 165 | 6 | 104 | 4 | 61 | 100 |
| PATI | 32.427 | 42.261 | 1.215.994 | 1.584.777 | 32.427 | 42.261 | 0 | - | 1.216 | 1.585 | 1.242 | 1.618 | 782 | 1.019 | 459 | 599 | 986 |
| PEKALONGAN | 11.414 | 13.144 | 428.013 | 492.895 | 11.414 | 13.144 | 0 | - | 428 | 493 | 437 | 503 | 275 | 317 | 162 | 186 | 307 |
| PEMALANG | 15.568 | 14.889 | 583.785 | 558.347 | 15.568 | 14.889 | 0 | - | 584 | 558 | 596 | 570 | 376 | 359 | 221 | 211 | 347 |
| PURBALINGGA | 9.072 | 9.103 | 340.214 | 341.373 | 9.072 | 9.103 | 0 | - | 340 | 341 | 347 | 349 | 219 | 220 | 129 | 129 | 212 |
| PURWOREJO | 20.191 | 20.994 | 757.163 | 787.266 | 20.191 | 20.994 | 0 | - | 757 | 787 | 773 | 804 | 487 | 506 | 286 | 297 | 490 |
| REMBANG | 5.847 | 5.813 | 219.250 | 217.990 | 5.847 | 5.813 | 0 | - | 219 | 218 | 224 | 223 | 141 | 140 | 83 | 82 | 136 |
| SEMARANG | 3.342 | 446 | 125.327 | 16.741 | 3.342 | 446 | 0 | - | 125 | 17 | 128 | 17 | 81 | 11 | 47 | 6 | 10 |
| SRAGEN | 22.225 | 36.933 | 833.427 | 1.384.987 | 22.225 | 36.933 | 0 | - | 833 | 1.385 | 851 | 1.414 | 536 | 891 | 315 | 523 | 862 |
| SUKOHARJO | 12.595 | 18.215 | 472.313 | 683.050 | 12.595 | 18.215 | 0 | - | 472 | 683 | 482 | 697 | 304 | 439 | 178 | 258 | 425 |
| TEGAL | 11.724 | 25.886 | 439.638 | 970.741 | 11.724 | 25.886 | 0 | - | 440 | 971 | 449 | 991 | 283 | 624 | 166 | 367 | 604 |
| WONOGIRI | 2.500 | 6.523 | 93.768 | 244.606 | 2.500 | 6.523 | 0 | - | 94 | 245 | 96 | 250 | 60 | 157 | 35 | 92 | 152 |
| WONOSOBO | 222 | 222 | 8.320 | 8.320 | 222 | 222 | 0 | - | 8 | 8 | 8 | 8 | 5 | 5 | 3 | 3 | 5 |
| **Total** | **361.595** | **445.636** | **13.559.795** | **16.711.368** | **361.595** | **445.636** | **-** | **-** | **13.560** | **16.711** | **13.845** | **17.062** | **8.722** | **10.749** | **5.122** | **6.313** | **10.398** |

## A1. Intensive Rice Field (Continued)

| Identified Areas 1) | | | TAM 2) | | Reducing Factors 3) | | | | AD 4) | | PD 5) | | PCMS 6) | | Market Potential for PT MCG 7) | | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Zn | Updated Amount | Amount of Zn |
| | ha | ha | kg Zn/year | kg Zn/year | ha | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **East Java Province** | | | | | | | | | | | | | | | | | |
| BANGKALAN | 10.770 | 10.770 | 403.891 | 403.891 | 10.770 | 10.770 | 21.002 | 21.002 | 383 | 383 | 391 | 391 | 246 | 246 | 145 | 145 | 259 |
| BOJONEGORO | 28.199 | 35.794 | 1.057.471 | 1.342.276 | 28.199 | 35.794 | 54.988 | 107 | 1.002 | 1.342 | 1.024 | 1.370 | 645 | 863 | 379 | 507 | 835 |
| BONDOWOSO | | 3.271 | - | 122.680 | - | 3.271 | - | 6.379 | - | 116 | - | 119 | - | 75 | - | 44 | 79 |
| GRESIK | 12.731 | 12.716 | 477.423 | 476.836 | 12.731 | 12.716 | 24.826 | 24.795 | 453 | 452 | 462 | 462 | 291 | 291 | 171 | 171 | 306 |
| JEMBER | 11.862 | 30.232 | 444.843 | 1.133.702 | 11.862 | 30.232 | 23.132 | 58.952 | 422 | 1.075 | 431 | 1.097 | 271 | 691 | 159 | 406 | 728 |
| JOMBANG | 13.986 | 24.339 | 524.486 | 912.708 | 13.986 | 24.339 | 27.273 | 47.461 | 497 | 865 | 508 | 883 | 320 | 557 | 188 | 327 | 586 |
| KEDIRI | 7.181 | 21.135 | 269.289 | 792.552 | 7.181 | 21.135 | 14.003 | 41.213 | 255 | 751 | 261 | 767 | 164 | 483 | 96 | 284 | 509 |
| KOTA KEDIRI | 79 | 70 | 2.957 | 2.615 | 79 | 70 | 154 | 136 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 |
| KOTA MADIUN | 560 | 556 | 21.011 | 20.864 | 560 | 556 | 1.093 | 1.085 | 20 | 20 | 20 | 20 | 13 | 13 | 8 | 7 | 13 |
| KOTA PASURUAN | 368 | 378 | 13.804 | 14.167 | 368 | 378 | 718 | 737 | 13 | 13 | 13 | 14 | 8 | 9 | 5 | 5 | 9 |
| KOTA PROBOLINGGO | | 137 | - | 5.147 | - | 137 | - | 268 | - | 5 | - | 5 | - | 3 | - | 2 | 3 |
| LAMONGAN | 56.890 | 66.961 | 2.133.357 | 2.511.033 | 56.890 | 66.961 | 110.935 | 130.574 | 2.022 | 2.380 | 2.065 | 2.430 | 1.301 | 1.531 | 764 | 899 | 1.612 |
| MADIUN | 11.369 | 14.610 | 426.352 | 547.890 | 11.369 | 14.610 | 22.170 | 28.490 | 404 | 519 | 413 | 530 | 260 | 334 | 153 | 196 | 352 |
| MAGETAN | 1.858 | 3.006 | 69.687 | 112.722 | 1.858 | 3.006 | 3.624 | 5.862 | 66 | 107 | 67 | 109 | 42 | 69 | 25 | 40 | 72 |
| MOJOKERTO | 2.294 | 2.295 | 86.024 | 86.059 | 2.294 | 2.295 | 4.483 | 4.484 | 82 | 82 | 83 | 83 | 52 | 52 | 31 | 31 | 55 |
| NGANJUK | 26.847 | 27.389 | 1.006.768 | 1.027.085 | 26.847 | 27.389 | 52.352 | 53.408 | 954 | 974 | 974 | 994 | 614 | 626 | 361 | 368 | 659 |
| NGAWI | 21.256 | 19.937 | 797.112 | 747.630 | 21.256 | 19.937 | 41.450 | 38.877 | 756 | 709 | 772 | 724 | 486 | 456 | 285 | 268 | 480 |
| PASURUAN | 3.811 | 16.128 | 142.909 | 604.783 | 3.811 | 16.128 | 7.431 | 31.449 | 135 | 573 | 138 | 585 | 87 | 369 | 51 | 217 | 388 |
| PONOROGO | 2.331 | 2.331 | 87.412 | 87.412 | 2.331 | 2.331 | 4.545 | 4.545 | 83 | 83 | 85 | 85 | 53 | 53 | 31 | 31 | 56 |
| PROBOLINGGO | 3.563 | 8.961 | 133.609 | 336.028 | 3.563 | 8.961 | 6.948 | 17.473 | 127 | 319 | 129 | 325 | 81 | 205 | 48 | 120 | 216 |
| SIDOARJO | 6.365 | 14.320 | 238.672 | 537.008 | 6.365 | 14.320 | 12.411 | 27.924 | 226 | 509 | 231 | 520 | 146 | 327 | 85 | 192 | 345 |
| SITUBONDO | 15.947 | 26.250 | 598.027 | 984.366 | 15.947 | 26.250 | 31.097 | 51.187 | 567 | 933 | 579 | 953 | 365 | 600 | 214 | 353 | 632 |
| TRENGGALEK | 1.264 | 1.264 | 47.414 | 47.414 | 1.264 | 1.264 | 2.466 | 2.466 | 45 | 45 | 46 | 46 | 29 | 29 | 17 | 17 | 30 |
| TUBAN | 25.639 | 26.829 | 961.452 | 1.006.103 | 25.639 | 26.829 | 49.996 | 32.195 | 911 | 974 | 931 | 994 | 586 | 626 | 344 | 368 | 638 |
| TULUNGAGUNG | 11.770 | 11.770 | 441.384 | 441.384 | 11.770 | 11.770 | - | - | 441 | 441 | 451 | 451 | 284 | 284 | 167 | 167 | 275 |
| **Total** | **276.943** | **381.449** | **10.385.353** | **14.304.356** | **276.943** | **381.449** | **517.096** | **631.071** | **9.868** | **13.673** | **10.075** | **13.960** | **6.348** | **8.795** | **3.728** | **5.165** | **9.139** |
| | | | | | | | | | | | | | | | | | |
| **Lampung Province** | | | | | | | | | | | | | | | | | |
| LAMPUNG SELATAN | 2.820 | 2.820 | 105.759 | 105.759 | 2.820 | 2.820 | 52.880 | 52.880 | 53 | 53 | 54 | 54 | 34 | 34 | 20 | 20 | 86 |
| LAMPUNG TENGAH | 7 | 7 | 263 | 263 | 7 | 7 | 131 | 131 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LAMPUNG TIMUR | 1.093 | 1.093 | 41.002 | 41.002 | 1.093 | 1.093 | 20.501 | 20.501 | 21 | 21 | 21 | 21 | 13 | 13 | 8 | 8 | 33 |
| PESAWARAN | 2.212 | 2.212 | 82.951 | 82.951 | 2.212 | 2.212 | 41.475 | 41.475 | 41 | 41 | 42 | 42 | 27 | 27 | 16 | 16 | 67 |
| PRINGSEWU | 936 | 936 | 35.097 | 35.097 | 936 | 936 | 17.549 | 17.549 | 18 | 18 | 18 | 18 | 11 | 11 | 7 | 7 | 28 |
| TANGGAMUS | 4.020 | 4.020 | 150.761 | 150.761 | 4.020 | 4.020 | 75.381 | 75.381 | 75 | 75 | 77 | 77 | 48 | 48 | 28 | 28 | 122 |
| WAY KANAN | 1.842 | 1.842 | 69.071 | 69.071 | 1.842 | 1.842 | 34.535 | 34.535 | 35 | 35 | 35 | 35 | 22 | 22 | 13 | 13 | 56 |
| **Total** | **12.931** | **12.931** | **484.904** | **484.904** | **12.931** | **12.931** | **242.452** | **242.452** | **242** | **242** | **248** | **248** | **156** | **156** | **92** | **92** | **393** |
| | | | | | | | | | | | | | | | | | |
| **South Sumatera Province** | | | | | | | | | | | | | | | | | |
| OGAN KOMERING ILIR | 136 | 136 | 5.107 | 5.107 | 136 | 136 | - | - | 5 | 5 | 5 | 5 | 3 | 3 | 2 | 2 | 3 |
| OGAN KOMERING ULU SELATAN | 9 | 9 | 345 | 345 | 9 | 9 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OGAN KOMERING ULU TIMUR | 24.068 | 24.068 | 902.560 | 902.560 | 24.068 | 24.068 | - | - | 903 | 903 | 922 | 922 | 581 | 581 | 341 | 341 | 562 |
| **Total** | **24.214** | **24.214** | **908.011** | **908.011** | **24.214** | **24.214** | **-** | **-** | **908** | **908** | **927** | **927** | **584** | **584** | **343** | **343** | **565** |
| | | | | | | | | | | | | | | | | | |
| **South Sulawesi Province** | | | | | | | | | | | | | | | | | |
| BONE | 26.764 | 26.764 | 1.003.636 | 1.003.636 | 26.764 | 26.764 | 0 | 0 | 1.004 | 1.004 | 1.025 | 1.025 | 646 | 646 | 379 | 379 | 624 |
| GOWA | 11.819 | 11.819 | 443.201 | 443.201 | 11.819 | 11.819 | 0 | 0 | 443 | 443 | 453 | 453 | 285 | 285 | 167 | 167 | 276 |
| JENEPONTO | 4 | 4 | 165 | 165 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA MAKASSAR | 27 | 27 | 1.023 | 1.023 | 27 | 27 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| MAROS | 8.320 | 8.320 | 312.005 | 312.005 | 8.320 | 8.320 | 0 | 0 | 312 | 312 | 319 | 319 | 201 | 201 | 118 | 118 | 194 |
| PINRANG | 7.872 | 7.872 | 295.208 | 295.208 | 7.872 | 7.872 | 0 | 0 | 295 | 295 | 301 | 301 | 190 | 190 | 112 | 112 | 184 |
| SIDENRENG RAPPANG | 4.605 | 4.605 | 172.702 | 172.702 | 4.605 | 4.605 | 0 | 0 | 173 | 173 | 176 | 176 | 111 | 111 | 65 | 65 | 107 |
| SOPPENG | 2.870 | 2.870 | 107.618 | 107.618 | 2.870 | 2.870 | 0 | 0 | 108 | 108 | 110 | 110 | 69 | 69 | 41 | 41 | 67 |
| TAKALAR | 10.162 | 10.162 | 381.069 | 381.069 | 10.162 | 10.162 | 0 | 0 | 381 | 381 | 389 | 389 | 245 | 245 | 144 | 144 | 237 |
| WAJO | 28.932 | 28.932 | 1.084.936 | 1.084.936 | 28.932 | 28.932 | 0 | 0 | 1.085 | 1.085 | 1.108 | 1.108 | 698 | 698 | 410 | 410 | 675 |
| **Total** | **101.375** | **101.375** | **3.801.563** | **3.801.563** | **101.375** | **101.375** | **-** | **-** | **3.802** | **3.802** | **3.881** | **3.881** | **2.445** | **2.445** | **1.436** | **1.436** | **2.365** |

| | |
|---|---|
| **Total Market Potential for Java, Sumatera, Sulawesi; Intensive Rice Field Ton Zn/year** | **16.719** |
| **TAM for Intensive Rice Field, Ton Zn/year** | **45.893** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS

**Assumption:**

Recommended dosage for Zn: 15 kg/season/ha
IP: 2,5

**Table B1-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## B1. Horticultural Commodity

**B1.1. Red Onion/Shallot**
**Recommended Dosage: 2 kg/ha**

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Cu | Amount of Cu |
| | ha | kg Cu/year | ha/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **Central Java Province, IP = 2** | | | | | | | | | |
| BREBES | 21.665 | 86.658 | 21.665 | 43.676 | 43 | 44 | 28 | 16 | 70 |
| DEMAK | 2.028 | 8.114 | 2.028 | 4.057 | 4 | 4 | 3 | 2 | 7 |
| **Total** | **23.693** | **94.772** | **23.693** | **47.733** | **47** | **48** | **30** | **18** | **77** |
| | | | | | | | | | |
| **East Java Province, IP = 2** | | | | | | | | | |
| BOJONEGORO | 2.316 | 9.265 | 2.316 | 8.339 | 1 | 1 | 1 | 0 | 9 |
| KOTA PROBOLINGGO | 189 | 754 | 189 | 679 | 0 | 0 | 0 | 0 | 1 |
| MADIUN | 107 | 429 | 107 | 386 | 0 | 0 | 0 | 0 | 0 |
| MALANG | 941 | 3.764 | 941 | 3.387 | 0 | 0 | 0 | 0 | 4 |
| NGANJUK | 5.958 | 23.832 | 5.958 | 2.145 | 22 | 22 | 14 | 8 | 16 |
| PAMEKASAN | 482 | 1.928 | 482 | 1.735 | 0 | 0 | 0 | 0 | 2 |
| PONOROGO | 47 | 189 | 47 | 170 | 0 | 0 | 0 | 0 | 0 |
| PROBOLINGGO | 4.014 | 16.057 | 4.014 | 14.452 | 2 | 2 | 1 | 1 | 15 |
| SUMENEP | 3.075 | 12.299 | 3.075 | 11.069 | 1 | 1 | 1 | 0 | 12 |
| TULUNGAGUNG | 123 | 493 | 123 | 444 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **17.252** | **69.010** | **17.252** | **42.805** | **26** | **27** | **17** | **10** | **59** |
| | | | | | | | | | |
| **West Java Province, IP = 2** | | | | | | | | | |
| BANDUNG | 6.409 | 25.635 | 6.409 | 15.381 | 10 | 10 | 7 | 4 | 22 |
| CIANJUR | 999 | 3.997 | 999 | 2.398 | 2 | 2 | 1 | 1 | 3 |
| CIREBON | 935 | 3.740 | 935 | 2.244 | 1 | 2 | 1 | 1 | 3 |
| GARUT | 5.422 | 21.688 | 5.422 | 13.013 | 9 | 9 | 6 | 3 | 18 |
| MAJALENGKA | 1.809 | 7.237 | 1.809 | 4.342 | 3 | 3 | 2 | 1 | 6 |
| **Total** | **15.574** | **62.298** | **15.574** | **37.379** | **25** | **25** | **16** | **9** | **53** |
| | | | | | | | | | |
| **West Nusa Tenggara Province, IP = 2** | | | | | | | | | |
| LOMBOK TIMUR | 51 | 204 | 51 | 122 | 0 | 0 | 0 | 0 | 0 |
| SUMBAWA | 664 | 2.657 | 664 | 1.594 | 1 | 1 | 1 | 0 | 2 |
| DOMPU | 546 | 2.185 | 546 | 1.311 | 1 | 1 | 1 | 0 | 2 |
| BIMA | 287 | 1.147 | 287 | 688 | 0 | 0 | 0 | 0 | 1 |
| SUMBAWA BARAT | 617 | 2.466 | 617 | 1.480 | 1 | 1 | 1 | 0 | 2 |
| **Total** | **2.165** | **8.658** | **2.165** | **5.195** | **3** | **4** | **2** | **1** | **7** |

## B1. Horticultural Commodity (Continued)

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Cu | Amount of Cu |
| | ha | kg Cu/year | ha/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **South Sulawesi Province, IP = 2** | | | | | | | | | |
| BANTAENG | 927 | 3.707 | 927 | 2.224 | 1 | 2 | 1 | 1 | 3 |
| JENEPONTO | 3.041 | 12.164 | 3.041 | 7.298 | 5 | 5 | 3 | 2 | 10 |
| BONE | 2.135 | 8.541 | 2.135 | 5.125 | 3 | 3 | 2 | 1 | 7 |
| ENREKANG | 927 | 3.707 | 927 | 2.224 | 1 | 2 | 1 | 1 | 3 |
| **Total** | **7.030** | **28.119** | **7.030** | **16.871** | **11** | **11** | **7** | **4** | **24** |

**B1.2. Potato**

**Recommended Dosage:** **2** **kg/ha**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **West Java Province; IP = 2** | | | | | | | | | |
| BANDUNG | 29.520 | 118.081 | 29.520 | 59.041 | 59 | 60 | 38 | 22 | 96 |
| BANDUNG BARAT | 1.775 | 7.100 | 1.775 | 3.550 | 4 | 4 | 2 | 1 | 6 |
| BOGOR | 530 | 2.122 | 530 | 1.061 | 1 | 1 | 1 | 0 | 2 |
| CIANJUR | 733 | 2.934 | 733 | 1.467 | 1 | 1 | 1 | 1 | 2 |
| GARUT | 7.171 | 28.686 | 7.171 | 14.343 | 14 | 15 | 9 | 5 | 23 |
| PURWAKARTA | 7 | 30 | 7 | 15 | 0 | 0 | 0 | 0 | 0 |
| SUBANG | 126 | 502 | 126 | 251 | 0 | 0 | 0 | 0 | 0 |
| SUKABUMI | 17 | 66 | 17 | 33 | 0 | 0 | 0 | 0 | 0 |
| SUMEDANG | 614 | 2.456 | 614 | 1.228 | 1 | 1 | 1 | 0 | 2 |
| TASIKMALAYA | 24 | 94 | 24 | 47 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **40.518** | **162.071** | **40.518** | **81.036** | **81** | **83** | **52** | **31** | **131** |
| **Central Java Province, IP = 2** | | | | | | | | | |
| BANJARNEGARA | 7.072 | 28.289 | 7.072 | 14.145 | 14 | 14 | 9 | 5 | 23 |
| BANYUMAS | 36 | 143 | 36 | 72 | 0 | 0 | 0 | 0 | 0 |
| BATANG | 855 | 3.420 | 855 | 1.710 | 2 | 2 | 1 | 1 | 3 |
| BOYOLALI | 2.484 | 9.937 | 2.484 | 4.968 | 5 | 5 | 3 | 2 | 8 |
| BREBES | 1.367 | 5.470 | 1.367 | 3.282 | 2 | 2 | 1 | 1 | 5 |
| KARANGANYAR | 4.330 | 17.320 | 4.330 | 8.660 | 9 | 9 | 6 | 3 | 14 |
| KENDAL | 285 | 1.141 | 285 | 571 | 1 | 1 | 0 | 0 | 1 |
| KLATEN | 23 | 92 | 23 | 46 | 0 | 0 | 0 | 0 | 0 |
| MAGELANG | 2.662 | 10.646 | 2.662 | 5.323 | 5 | 5 | 3 | 2 | 9 |
| PEKALONGAN | 948 | 3.792 | 948 | 1.896 | 2 | 2 | 1 | 1 | 3 |
| PEMALANG | 780 | 3.119 | 780 | 1.559 | 2 | 2 | 1 | 1 | 3 |
| PURBALINGGA | 236 | 943 | 236 | 472 | 0 | 0 | 0 | 0 | 1 |
| SEMARANG | 1.365 | 5.461 | 1.365 | 2.731 | 3 | 3 | 2 | 1 | 4 |
| TEGAL | 982 | 3.929 | 982 | 1.964 | 2 | 2 | 1 | 1 | 3 |
| TEMANGGUNG | 5.775 | 23.099 | 5.775 | 11.550 | 12 | 12 | 7 | 4 | 19 |
| WONOGIRI | 520 | 2.080 | 520 | 1.040 | 1 | 1 | 1 | 0 | 2 |
| WONOSOBO | 7.699 | 30.794 | 7.699 | 15.397 | 15 | 16 | 10 | 6 | 25 |
| **Total** | **37.419** | **149.676** | **37.419** | **75.385** | **74** | **76** | **48** | **28** | **122** |

## B1. Horticultural Commodity (Continued)

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Cu | Amount of Cu |
| | ha | kg Cu/year | ha/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **East Java Province, IP = 2** | | | | | | | | | |
| BLITAR | 12 | 50 | 12 | 25 | 0 | 0 | 0 | 0 | 0 |
| BONDOWOSO | 20 | 81 | 20 | 41 | 0 | 0 | 0 | 0 | 0 |
| KEDIRI | 8 | 34 | 8 | 17 | 0 | 0 | 0 | 0 | 0 |
| KOTA BATU | 827 | 3.308 | 827 | 1.489 | 2 | 2 | 1 | 1 | 3 |
| LUMAJANG | 1.385 | 5.540 | 1.385 | 2.770 | 3 | 3 | 2 | 1 | 4 |
| MADIUN | 89 | 357 | 89 | 178 | 0 | 0 | 0 | 0 | 0 |
| MAGETAN | 2.975 | 11.902 | 2.975 | 5.951 | 6 | 6 | 4 | 2 | 10 |
| MALANG | 905 | 3.618 | 905 | 1.809 | 2 | 2 | 1 | 1 | 3 |
| NGANJUK | 105 | 420 | 105 | 210 | 0 | 0 | 0 | 0 | 0 |
| NGAWI | 1.451 | 5.804 | 1.451 | 2.902 | 3 | 3 | 2 | 1 | 5 |
| PASURUAN | 5.391 | 21.563 | 5.391 | 10.782 | 11 | 11 | 7 | 4 | 17 |
| PONOROGO | 9 | 37 | 9 | 18 | 0 | 0 | 0 | 0 | 0 |
| PROBOLINGGO | 7.783 | 31.131 | 7.783 | 15.566 | 16 | 16 | 10 | 6 | 25 |
| SITUBONDO | 1 | 6 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **20.962** | **83.850** | **20.962** | **41.759** | **42** | **43** | **27** | **16** | **68** |
| | | | | | | | | | |
| **Jambi Province, IP = 2** | | | | | | | | | |
| KERINCI | 25.780 | 103.122 | 25.780 | 51.561 | 52 | 53 | 33 | 19 | 84 |
| MERANGIN | 10.819 | 43.278 | 10.819 | 21.639 | 22 | 22 | 14 | 8 | 35 |
| **Total** | **36.600** | **146.399** | **36.600** | **73.200** | **73** | **75** | **47** | **28** | **119** |
| | | | | | | | | | |
| **North Sumatera Province, IP = 2** | | | | | | | | | |
| SIMALUNGUN | 24.802 | 99.206 | 24.802 | 49.603 | 50 | 51 | 32 | 19 | 80 |
| KARO | 18.295 | 73.181 | 18.295 | 36.590 | 37 | 37 | 24 | 14 | 59 |
| DELI SERDANG | 77 | 308 | 77 | 154 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **43.174** | **172.696** | **43.174** | **86.348** | **86** | **88** | **56** | **33** | **140** |

## B1. Horticultural Commodity (Continued)

**Chili Pepper**
**Recommended Dosage:** **2 kg/ha**

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| **Province; Regency/Sub-District** | **Total Area** | **Amount** | **Total Area** | **Amount** | **Amount** | **Amount** | **Amount** | **Amount of Cu** | **Amount of Cu** |
| | **ha** | **kg Cu/year** | **ha/year** | **kg Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** |
| **West Sumatera Province; IP = 2** | | | | | | | | | |
| TANAH DATAR | 824 | 3.297 | 824 | 1.648 | 2 | 2 | 1 | 1 | 3 |
| AGAM | 536 | 2.143 | 536 | 1.071 | 1 | 1 | 1 | 0 | 2 |
| **Total** | **1.360** | **5.440** | **1.360** | **2.720** | **3** | **3** | **2** | **1** | **4** |
| | | | | | | | | | |
| **North Sumatera Province; IP = 2** | | | | | | | | | |
| DAIRI | 91 | 362 | 91 | 181 | 0 | 0 | 0 | 0 | 0 |
| DELI SERDANG | 143 | 573 | 143 | 287 | 0 | 0 | 0 | 0 | 0 |
| KARO | 5.114 | 20.457 | 5.114 | 10.228 | 10 | 10 | 7 | 4 | 17 |
| SIMALUNGUN | 4.130 | 16.522 | 4.130 | 8.261 | 8 | 8 | 5 | 3 | 13 |
| TOBA SAMOSIR | 508 | 2.032 | 508 | 1.016 | 1 | 1 | 1 | 0 | 2 |
| **Total** | **9.986** | **39.946** | **9.986** | **19.973** | **20** | **20** | **13** | **8** | **32** |
| | | | | | | | | | |
| **West Java Province; IP = 2** | | | | | | | | | |
| GARUT | 160 | 641 | 160 | 321 | 0 | 0 | 0 | 0 | 1 |
| CIAMIS | 1.099 | 4.394 | 1.099 | 2.197 | 2 | 2 | 1 | 1 | 4 |
| **Total** | **1.259** | **5.036** | **1.259** | **2.518** | **3** | **3** | **2** | **1** | **4** |
| | | | | | | | | | |
| **East Java Province; IP = 2** | | | | | | | | | |
| BANYUWANGI | 790 | 3.161 | 790 | 1.580 | 2 | 2 | 1 | 1 | 3 |
| BLITAR | 4.616 | 18.466 | 4.616 | 9.233 | 9 | 9 | 6 | 3 | 15 |
| BONDOWOSO | 271 | 1.086 | 271 | 543 | 1 | 1 | 0 | 0 | 1 |
| GRESIK | 1.346 | 5.385 | 1.346 | 2.692 | 3 | 3 | 2 | 1 | 4 |
| JEMBER | 1.246 | 4.984 | 1.246 | 2.492 | 2 | 3 | 2 | 1 | 4 |
| KEDIRI | 4.558 | 18.231 | 4.558 | 9.115 | 9 | 9 | 6 | 3 | 15 |
| KOTA PROBOLINGGO | 1 | 5 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| LAMONGAN | 358 | 1.430 | 358 | 715 | 1 | 1 | 0 | 0 | 1 |
| LUMAJANG | 1.148 | 4.590 | 1.148 | 2.295 | 2 | 2 | 1 | 1 | 4 |
| MAGETAN | 79 | 318 | 79 | 159 | 0 | 0 | 0 | 0 | 0 |
| MALANG | 2.417 | 9.668 | 2.417 | 4.834 | 5 | 5 | 3 | 2 | 8 |
| MOJOKERTO | 3 | 12 | 3 | 6 | 0 | 0 | 0 | 0 | 0 |
| PONOROGO | 300 | 1.200 | 300 | 600 | 1 | 1 | 0 | 0 | 1 |
| PROBOLINGGO | 882 | 3.526 | 882 | 1.763 | 2 | 2 | 1 | 1 | 3 |
| SUMENEP | 1.596 | 6.386 | 1.596 | 3.193 | 3 | 3 | 2 | 1 | 5 |
| TUBAN | 1.257 | 5.026 | 1.257 | 2.513 | 3 | 3 | 2 | 1 | 4 |
| TULUNGAGUNG | 19 | 76 | 19 | 38 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **20.887** | **83.549** | **20.887** | **41.774** | **42** | **43** | **27** | **16** | **68** |

## B1. Horticultural Commodity (Continued)

| | |
|---|---|
| **Updated Total Market Potential for Cu, Horticultural Commodity, Indonesia** | **203** |
| **Ton/year** | |
| **TAM, Ton/year** | **1.112** |

1) Based on digital soil mapping
2) Total Adressable Market = Avg productivity x Recommended dosage x efficiency
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growth Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS
8) 50% of users apply the recommended dosage (Reducing Factors)

**Table B1-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## B1. Horticultural Commodity

**B1.1. Red Onion/Shallot**
**Recommended Dosage: 5 kg/ha**

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Zn | Amount of Zn |
| | ha | kg Zn/year | ha/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **Central Java Province, IP = 2** | | | | | | | | | |
| BREBES | 21.665 | 216.646 | 21.665 | 43.676 | 173 | 177 | 111 | 65 | 151 |
| DEMAK | 2.028 | 20.285 | 2.028 | 10.142 | 10 | 10 | 7 | 4 | 16 |
| **Total** | **23.693** | **236.931** | **23.693** | **53.818** | **183** | **187** | **118** | **69** | **168** |
| | | | | | | | | | |
| **East Java Province, IP = 2** | | | | | | | | | |
| BOJONEGORO | 2.316 | 23.163 | 2.316 | 20.847 | 2 | 2 | 1 | 1 | 22 |
| KOTA PROBOLINGGO | 189 | 1.886 | 189 | 1.698 | 0 | 0 | 0 | 0 | 2 |
| MADIUN | 107 | 1.072 | 107 | 965 | 0 | 0 | 0 | 0 | 1 |
| MALANG | 941 | 9.409 | 941 | 8.468 | 1 | 1 | 1 | 0 | 9 |
| NGANJUK | 5.958 | 59.580 | 5.958 | 8.579 | 51 | 52 | 33 | 19 | 40 |
| PAMEKASAN | 482 | 4.819 | 482 | 4.337 | 0 | 0 | 0 | 0 | 5 |
| PONOROGO | 47 | 471 | 47 | 424 | 0 | 0 | 0 | 0 | 0 |
| PROBOLINGGO | 4.014 | 40.143 | 4.014 | 36.129 | 4 | 4 | 3 | 2 | 39 |
| SUMENEP | 3.075 | 30.747 | 3.075 | 27.672 | 3 | 3 | 2 | 1 | 30 |
| TULUNGAGUNG | 123 | 1.232 | 123 | 1.109 | 0 | 0 | 0 | 0 | 1 |
| **Total** | **17.252** | **172.524** | **17.252** | **110.229** | **62** | **64** | **40** | **24** | **149** |
| | | | | | | | | | |
| **West Java Province, IP = 2** | | | | | | | | | |
| BANDUNG | 6.409 | 64.088 | 6.409 | 38.453 | 26 | 26 | 16 | 10 | 54 |
| CIANJUR | 999 | 9.993 | 999 | 5.996 | 4 | 4 | 3 | 2 | 8 |
| CIREBON | 935 | 9.350 | 935 | 5.610 | 4 | 4 | 2 | 1 | 8 |
| GARUT | 5.422 | 54.220 | 5.422 | 32.532 | 22 | 22 | 14 | 8 | 46 |
| MAJALENGKA | 1.809 | 18.092 | 1.809 | 10.855 | 7 | 7 | 5 | 3 | 15 |
| **Total** | **15.574** | **155.744** | **15.574** | **93.446** | **62** | **64** | **40** | **24** | **132** |

## B1. Horticultural Commodity (Continued)

**West Nusa Tenggara Province, IP = 2**

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Zn | Amount of Zn |
| | ha | kg Zn/year | ha/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| LOMBOK TIMUR | 51 | 509 | 51 | 305 | 0 | 0 | 0 | 0 | 0 |
| SUMBAWA | 664 | 6.641 | 664 | 3.985 | 3 | 3 | 2 | 1 | 6 |
| DOMPU | 546 | 5.463 | 546 | 3.278 | 2 | 2 | 1 | 1 | 5 |
| BIMA | 287 | 2.866 | 287 | 1.720 | 1 | 1 | 1 | 0 | 2 |
| SUMBAWA BARAT | 617 | 6.166 | 617 | 3.699 | 2 | 3 | 2 | 1 | 5 |
| **Total** | **2.165** | **21.646** | **2.165** | **12.987** | **9** | **9** | **6** | **3** | **18** |
| | | | | | | | | | |
| **South Sulawesi Province, IP = 2** | | | | | | | | | |
| BANTAENG | 927 | 9.267 | 927 | 5.560 | 4 | 4 | 2 | 1 | 8 |
| JENEPONTO | 3.041 | 30.410 | 3.041 | 18.246 | 12 | 12 | 8 | 5 | 26 |
| BONE | 2.135 | 21.353 | 2.135 | 12.812 | 9 | 9 | 5 | 3 | 18 |
| ENREKANG | 927 | 9.267 | 927 | 5.560 | 4 | 4 | 2 | 1 | 8 |
| **Total** | **7.030** | **70.297** | **7.030** | **42.178** | **28** | **29** | **18** | **11** | **60** |

**B1.2. Potato**

**Recommended Dosage:** **3 kg/ha**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **West Java Province; IP = 2** | | | | | | | | | |
| BANDUNG | 29.520 | 177.122 | 29.520 | 88.561 | 89 | 90 | 57 | 33 | 144 |
| BANDUNG BARAT | 1.775 | 10.651 | 1.775 | 5.325 | 5 | 5 | 3 | 2 | 9 |
| BOGOR | 530 | 3.183 | 530 | 1.591 | 2 | 2 | 1 | 1 | 3 |
| CIANJUR | 733 | 4.400 | 733 | 2.200 | 2 | 2 | 1 | 1 | 4 |
| GARUT | 7.171 | 43.029 | 7.171 | 21.514 | 22 | 22 | 14 | 8 | 35 |
| PURWAKARTA | 7 | 44 | 7 | 22 | 0 | 0 | 0 | 0 | 0 |
| SUBANG | 126 | 753 | 126 | 377 | 0 | 0 | 0 | 0 | 1 |
| SUKABUMI | 17 | 100 | 17 | 50 | 0 | 0 | 0 | 0 | 0 |
| SUMEDANG | 614 | 3.683 | 614 | 1.842 | 2 | 2 | 1 | 1 | 3 |
| TASIKMALAYA | 24 | 142 | 24 | 71 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **40.518** | **243.107** | **40.518** | **121.554** | **122** | **124** | **78** | **46** | **197** |

## B1. Horticultural Commodity (Continued)

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Zn | Amount of Zn |
| | ha | kg Zn/year | ha/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **Central Java Province, IP = 2** | | | | | | | | | |
| BANJARNEGARA | 7.072 | 42.434 | 7.072 | 21.217 | 21 | 22 | 14 | 8 | 34 |
| BANYUMAS | 36 | 215 | 36 | 107 | 0 | 0 | 0 | 0 | 0 |
| BATANG | 855 | 5.130 | 855 | 2.565 | 3 | 3 | 2 | 1 | 4 |
| BOYOLALI | 2.484 | 14.905 | 2.484 | 7.453 | 7 | 8 | 5 | 3 | 12 |
| BREBES | 1.367 | 8.204 | 1.367 | 4.923 | 3 | 3 | 2 | 1 | 7 |
| KARANGANYAR | 4.330 | 25.979 | 4.330 | 12.990 | 13 | 13 | 8 | 5 | 21 |
| KENDAL | 285 | 1.712 | 285 | 856 | 1 | 1 | 1 | 0 | 1 |
| KLATEN | 23 | 139 | 23 | 69 | 0 | 0 | 0 | 0 | 0 |
| MAGELANG | 2.662 | 15.970 | 2.662 | 7.985 | 8 | 8 | 5 | 3 | 13 |
| PEKALONGAN | 948 | 5.687 | 948 | 2.844 | 3 | 3 | 2 | 1 | 5 |
| PEMALANG | 780 | 4.678 | 780 | 2.339 | 2 | 2 | 2 | 1 | 4 |
| PURBALINGGA | 236 | 1.415 | 236 | 708 | 1 | 1 | 0 | 0 | 1 |
| SEMARANG | 1.365 | 8.192 | 1.365 | 4.096 | 4 | 4 | 3 | 2 | 7 |
| TEGAL | 982 | 5.893 | 982 | 2.947 | 3 | 3 | 2 | 1 | 5 |
| TEMANGGUNG | 5.775 | 34.649 | 5.775 | 17.325 | 17 | 18 | 11 | 7 | 28 |
| WONOGIRI | 520 | 3.120 | 520 | 1.560 | 2 | 2 | 1 | 1 | 3 |
| WONOSOBO | 7.699 | 46.192 | 7.699 | 23.096 | 23 | 24 | 15 | 9 | 37 |
| **Total** | **37.419** | **224.514** | **37.419** | **113.077** | **111** | **114** | **72** | **42** | **182** |
| | | | | | | | | | |
| **East Java Province, IP = 2** | | | | | | | | | |
| BLITAR | 12 | 75 | 12 | 37 | 0 | 0 | 0 | 0 | 0 |
| BONDOWOSO | 20 | 122 | 20 | 61 | 0 | 0 | 0 | 0 | 0 |
| KEDIRI | 8 | 51 | 8 | 25 | 0 | 0 | 0 | 0 | 0 |
| KOTA BATU | 827 | 4.962 | 827 | 1.489 | 3 | 4 | 2 | 1 | 4 |
| LUMAJANG | 1.385 | 8.310 | 1.385 | 4.155 | 4 | 4 | 3 | 2 | 7 |
| MADIUN | 89 | 535 | 89 | 268 | 0 | 0 | 0 | 0 | 0 |
| MAGETAN | 2.975 | 17.853 | 2.975 | 8.926 | 9 | 9 | 6 | 3 | 14 |
| MALANG | 905 | 5.427 | 905 | 2.714 | 3 | 3 | 2 | 1 | 4 |
| NGANJUK | 105 | 630 | 105 | 315 | 0 | 0 | 0 | 0 | 1 |
| NGAWI | 1.451 | 8.705 | 1.451 | 4.353 | 4 | 4 | 3 | 2 | 7 |
| PASURUAN | 5.391 | 32.345 | 5.391 | 16.172 | 16 | 17 | 10 | 6 | 26 |
| PONOROGO | 9 | 55 | 9 | 27 | 0 | 0 | 0 | 0 | 0 |
| PROBOLINGGO | 7.783 | 46.697 | 7.783 | 23.349 | 23 | 24 | 15 | 9 | 38 |
| SITUBONDO | 1 | 8 | 1 | 4 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **20.962** | **125.774** | **20.962** | **61.895** | **64** | **65** | **41** | **24** | **102** |

## B1. Horticultural Commodity (Continued)

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Zn | Amount of Zn |
| | ha | kg Zn/year | ha/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **Jambi Province, IP = 2** | | | | | | | | | |
| KERINCI | 25.780 | 154.682 | 25.780 | 77.341 | 77 | 79 | 50 | 29 | 125 |
| MERANGIN | 10.819 | 64.917 | 10.819 | 32.458 | 32 | 33 | 21 | 12 | 53 |
| **Total** | **36.600** | **219.599** | **36.600** | **109.799** | **110** | **112** | **71** | **41** | **178** |
| | | | | | | | | | |
| **North Sumatera Province, IP = 2** | | | | | | | | | |
| SIMALUNGUN | 24.802 | 148.810 | 24.802 | 74.405 | 74 | 76 | 48 | 28 | 121 |
| KARO | 18.295 | 109.771 | 18.295 | 54.886 | 55 | 56 | 35 | 21 | 89 |
| DELI SERDANG | 77 | 462 | 77 | 231 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **43.174** | **259.043** | **43.174** | **129.522** | **130** | **132** | **83** | **49** | **210** |

**B1.3. Chili Pepper**

**Recommended Dosage:** **3 kg/ha**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **West Sumatera Province; IP = 2** | | | | | | | | | |
| TANAH DATAR | 824 | 4.945 | 824 | 2.473 | 2 | 3 | 2 | 1 | 4 |
| AGAM | 536 | 3.214 | 536 | 1.607 | 2 | 2 | 1 | 1 | 3 |
| **Total** | **1.360** | **8.160** | **1.360** | **4.080** | **4** | **4** | **3** | **2** | **7** |
| | | | | | | | | | |
| **North Sumatera Province; IP = 2** | | | | | | | | | |
| DAIRI | 91 | 543 | 91 | 272 | 0 | 0 | 0 | 0 | 0 |
| DELI SERDANG | 143 | 860 | 143 | 430 | 0 | 0 | 0 | 0 | 1 |
| KARO | 5.114 | 30.685 | 5.114 | 15.343 | 15 | 16 | 10 | 6 | 25 |
| SIMALUNGUN | 4.130 | 24.783 | 4.130 | 12.391 | 12 | 13 | 8 | 5 | 20 |
| TOBA SAMOSIR | 508 | 3.048 | 508 | 1.524 | 2 | 2 | 1 | 1 | 2 |
| **Total** | **9.986** | **59.919** | **9.986** | **29.959** | **30** | **31** | **19** | **11** | **49** |
| | | | | | | | | | |
| **West Java Province; IP = 2** | | | | | | | | | |
| GARUT | 160 | 962 | 160 | 481 | 0 | 0 | 0 | 0 | 1 |
| CIAMIS | 1.099 | 6.591 | 1.099 | 3.296 | 3 | 3 | 2 | 1 | 5 |
| **Total** | **1.259** | **7.553** | **1.259** | **3.777** | **4** | **4** | **2** | **1** | **6** |

## B1. Horticultural Commodity (Continued)

| Identified Areas 1) | | TAM 2) | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) | Gap TAM - MP |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Amount | Total Area | Amount | Amount | Amount | Amount | Amount of Zn | Amount of Zn |
| | ha | kg Zn/year | ha/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **East Java Province; IP = 2** | | | | | | | | | |
| BANYUWANGI | 790 | 4.741 | 790 | 2.371 | 2 | 2 | 2 | 1 | 4 |
| BLITAR | 4.616 | 27.699 | 4.616 | 13.849 | 14 | 14 | 9 | 5 | 22 |
| BONDOWOSO | 271 | 1.629 | 271 | 814 | 1 | 1 | 1 | 0 | 1 |
| GRESIK | 1.346 | 8.077 | 1.346 | 4.039 | 4 | 4 | 3 | 2 | 7 |
| JEMBER | 1.246 | 7.476 | 1.246 | 3.738 | 4 | 4 | 2 | 1 | 6 |
| KEDIRI | 4.558 | 27.346 | 4.558 | 13.673 | 14 | 14 | 9 | 5 | 22 |
| KOTA PROBOLINGGO | 1 | 7 | 1 | 4 | 0 | 0 | 0 | 0 | 0 |
| LAMONGAN | 358 | 2.145 | 358 | 1.073 | 1 | 1 | 1 | 0 | 2 |
| LUMAJANG | 1.148 | 6.885 | 1.148 | 3.443 | 3 | 4 | 2 | 1 | 6 |
| MAGETAN | 79 | 477 | 79 | 238 | 0 | 0 | 0 | 0 | 0 |
| MALANG | 2.417 | 14.502 | 2.417 | 7.251 | 7 | 7 | 5 | 3 | 12 |
| MOJOKERTO | 3 | 18 | 3 | 9 | 0 | 0 | 0 | 0 | 0 |
| PONOROGO | 300 | 1.801 | 300 | 900 | 1 | 1 | 1 | 0 | 1 |
| PROBOLINGGO | 882 | 5.289 | 882 | 2.645 | 3 | 3 | 2 | 1 | 4 |
| SUMENEP | 1.596 | 9.578 | 1.596 | 4.789 | 5 | 5 | 3 | 2 | 8 |
| TUBAN | 1.257 | 7.539 | 1.257 | 3.770 | 4 | 4 | 2 | 1 | 6 |
| TULUNGAGUNG | 19 | 114 | 19 | 57 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **20.887** | **125.323** | **20.887** | **62.662** | **63** | **64** | **40** | **24** | **102** |

| | |
|---|---|
| **Total Market Potential for Zn, Horticultural Commodity, Indonesia** | **371** |
| **Ton/year** | |
| **TAM, Ton/year** | **1.930** |

1) Based on digital soil mapping
2) Total Adressable Market = Avg productivity x Recommended dosage x efficiency
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growth Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS
8) 50% of users apply the recommended dosage (Reducing Factors)

**Table C1-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C1. Oil Palm Plantation-Smallholder

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C1.1. Riau Province** | | | | | | | | | | | | |
| BENGKALIS | 160.738 | 198.485 | 359.222 | 552.417 | 0 | 552.417 | 99.400 | 161.028 | 391 | 400 | 252 | 148 |
| INDRAGIRI HILIR | 559.539 | 119.747 | 679.287 | 1.923.001 | 0 | 1.923.001 | 346.019 | 560.551 | 1.362 | 1.391 | 876 | 515 |
| INDRAGIRI HULU | 69.149 | 345.613 | 414.762 | 237.648 | 0 | 237.648 | 42.762 | 69.274 | 168 | 172 | 108 | 64 |
| KAMPAR | 123.052 | 465.575 | 588.627 | 422.899 | 0 | 422.899 | 76.095 | 123.274 | 300 | 306 | 193 | 113 |
| KEPULAUAN MERANTI | 28.038 | 46 | 28.084 | 96.359 | 0 | 96.359 | 17.339 | 28.088 | 68 | 70 | 44 | 26 |
| KOTA DUMAI | 105.651 | 60.544 | 166.194 | 363.096 | 0 | 363.096 | 65.334 | 105.842 | 257 | 263 | 165 | 97 |
| KOTA PEKANBARU | 4.237 | 30.371 | 34.608 | 14.561 | 0 | 14.561 | 2.620 | 4.245 | 10 | 11 | 7 | 4 |
| KUANTAN SINGINGI | | 225.301 | 225.301 | - | 0 | - | - | | - | - | - | - |
| PELALAWAN | 124.841 | 343.520 | 468.360 | 429.047 | 0 | 429.047 | 77.202 | 154.844 | 274 | 280 | 176 | 104 |
| ROKAN HILIR | 240.892 | 390.439 | 631.330 | 827.887 | 0 | 827.887 | 148.967 | 183.150 | 645 | 658 | 415 | 244 |
| ROKAN HULU | 47.189 | 416.334 | 463.522 | 162.177 | 0 | 162.177 | 29.182 | 47.274 | 115 | 117 | 74 | 43 |
| SIAK | 157.817 | 263.687 | 421.504 | 542.381 | 0 | 542.381 | 97.594 | 158.103 | 384 | 392 | 247 | 145 |
| **Total** | | | **4.480.803** | **5.571.473** | **0** | **5.571.473** | | **1.595.674** | **3.976** | **4.059** | **2.557** | **1.502** |
| **%Smallholder Total Area** | **61,84%** | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **C1.2. West Sumatera Province** | | | | | | | | | | | | |
| AGAM | 10.579 | 51.316 | 61.895 | 33.425 | 0 | 33.425 | 6.014 | 0 | 33 | 34 | 21 | 13 |
| DHARMASRAYA | | 129.349 | 129.349 | - | 0 | - | - | 0 | - | - | - | - |
| KEPULAUAN MENTAWAI | | 15 | 15 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PADANG | | 1 | 1 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA SAWAHLUNTO | | 369 | 369 | - | 0 | - | - | 0 | - | - | - | - |
| LIMA PULUH KOTA | | 3.549 | 3.549 | - | 0 | - | - | 0 | - | - | - | - |
| PADANG PARIAMAN | | 2.471 | 2.471 | - | 0 | - | - | 0 | - | - | - | - |
| PASAMAN | | 13.196 | 13.196 | - | 0 | - | - | 0 | - | - | - | - |
| PASAMAN BARAT | 13.307 | 206.694 | 220.001 | 42.042 | 0 | 42.042 | 7.565 | 0 | 42 | 43 | 27 | 16 |
| PESISIR SELATAN | 64.519 | 43.269 | 107.789 | 203.845 | 0 | 203.845 | 36.679 | 0 | 204 | 208 | 131 | 77 |
| SIJUNJUNG | | 27.922 | 27.922 | - | 0 | - | - | 0 | - | - | - | - |
| SOLOK SELATAN | | 75.028 | 75.028 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | **641.585** | **279.312** | **-** | **279.312** | | **-** | **279** | **285** | **180** | **106** |
| **%Smallholder Total Area** | **56,85%** | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C1.3. North Sumatera Province** | | | | | | | | | | | | |
| ASAHAN | 24.363 | 221.370 | 245.733 | 45.643 | 0 | 45.643 | 8.213 | 0 | 46 | 47 | 29 | 17 |
| BATU BARA | | 55.319 | 55.319 | - | 0 | - | - | 0 | - | - | - | - |
| DAIRI | | 7.358 | 7.358 | - | 0 | - | - | 0 | - | - | - | - |
| DANAU TOBA | | 19 | 19 | - | 0 | - | - | 0 | - | - | - | - |
| DELI SERDANG | | 93.764 | 93.764 | - | 0 | - | - | 0 | - | - | - | - |
| HUMBANG HASUNDUTAN | | 154 | 154 | - | 0 | - | - | 0 | - | - | - | - |
| KARO | | 26.931 | 26.931 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA BINJAI | | 2.173 | 2.173 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA MEDAN | | 146 | 146 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PADANG SIDEMPUAN | | 682 | 682 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PEMATANG SIANTAR | | 686 | 686 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA TANJUNG BALAI | | 3.105 | 3.105 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA TEBING TINGGI | | 1.067 | 1.067 | - | 0 | - | - | 0 | - | - | - | - |
| LABUHAN BATU | 94.382 | 112.930 | 207.312 | 176.818 | 0 | 176.818 | 31.816 | 0 | 177 | 181 | 114 | 67 |
| LABUHAN BATU SELATAN | 38.420 | 192.685 | 231.105 | 71.977 | 0 | 71.977 | 12.951 | 0 | 72 | 73 | 46 | 27 |
| LABUHAN BATU UTARA | 59.899 | 138.757 | 198.656 | 112.217 | 0 | 112.217 | 20.192 | 0 | 112 | 115 | 72 | 42 |
| LANGKAT | | 218.376 | 218.376 | - | 0 | - | - | 0 | - | - | - | - |
| MANDAILING NATAL | 11.524 | 73.073 | 84.597 | 21.590 | 0 | 21.590 | 3.885 | 0 | 22 | 22 | 14 | 8 |
| PADANG LAWAS | | 140.999 | 140.999 | - | 0 | - | - | 0 | - | - | - | - |
| PADANG LAWAS UTARA | | 180.677 | 180.677 | - | 0 | - | - | 0 | - | - | - | - |
| PAKPAK BHARAT | | 2.431 | 2.431 | - | 0 | - | - | 0 | - | - | - | - |
| SAMOSIR | | 1.569 | 1.569 | - | 0 | - | - | 0 | - | - | - | - |
| SERDANG BEDAGAI | | 105.287 | 105.287 | - | 0 | - | - | 0 | - | - | - | - |
| SIMALUNGUN | | 162.064 | 162.064 | - | 0 | - | - | 0 | - | - | - | - |
| TAPANULI SELATAN | 9.954 | 25.922 | 35.876 | 18.649 | 0 | 18.649 | 3.356 | 0 | 19 | 19 | 12 | 7 |
| TAPANULI TENGAH | 6.662 | 28.436 | 35.098 | 12.481 | 0 | 12.481 | 2.246 | 0 | 12 | 13 | 8 | 5 |
| TAPANULI UTARA | | 324 | 324 | - | 0 | - | - | 0 | - | - | - | - |
| TOBA SAMOSIR | | 5.033 | 5.033 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | **2.046.542** | **459.373** | **-** | **459.373** | **82.658** | **-** | **459** | **469** | **295** | **174** |
| **Smallholder Total Area** | **33,71%** | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C1.4. South Sumatera Province** | | | | | | | | | | | | |
| BANYUASIN | 2.999 | 252.016 | 255.015 | 9.028 | 0 | 9.028 | 1.625 | 0 | 9 | 9 | 6 | 3 |
| EMPAT LAWANG | | 11.011 | 11.011 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA LUBUKLINGGAU | | 1.051 | 1.051 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PAGAR ALAM | | 41 | 41 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PALEMBANG | 46 | 566 | 612 | 139 | 0 | 139 | 25 | 0 | 0,14 | 0,14 | 0,09 | 0,05 |
| KOTA PRABUMULIH | | 2.332 | 2.332 | - | 0 | - | - | 0 | - | - | - | - |
| LAHAT | | 56.108 | 56.108 | - | 0 | - | - | 0 | - | - | - | - |
| MUARA ENIM | 6.844 | 67.768 | 74.612 | 20.604 | 0 | 20.604 | 3.707 | 0 | 21 | 21 | 13 | 8 |
| MUSI BANYUASIN | 109.534 | 452.017 | 561.551 | 329.752 | 0 | 329.752 | 59.335 | 0 | 330 | 337 | 212 | 125 |
| MUSI RAWAS | 2.066 | 100.173 | 102.239 | 6.219 | 0 | 6.219 | 1.119 | 0 | 6 | 6 | 4 | 2 |
| MUSI RAWAS UTARA | 22.612 | 66.945 | 89.557 | 68.073 | 0 | 68.073 | 12.249 | 0 | 68 | 70 | 44 | 26 |
| OGAN ILIR | 553 | 25.245 | 25.798 | 1.666 | 0 | 1.666 | 300 | 0 | 2 | 2 | 1 | 1 |
| OGAN KOMERING ILIR | 87.528 | 170.647 | 258.175 | 263.503 | 0 | 263.503 | 47.414 | 0 | 264 | 269 | 169 | 100 |
| OGAN KOMERING ULU | | 44.156 | 44.156 | - | 0 | - | - | 0 | - | - | - | - |
| OGAN KOMERING ULU SELATAN | | 19.848 | 19.848 | - | 0 | - | - | 0 | - | - | - | - |
| OGAN KOMERING ULU TIMUR | | 20.104 | 20.104 | - | 0 | - | - | 0 | - | - | - | - |
| PENUKAL ABAB LEMATANG ILIR | 21.000 | 8.455 | 29.456 | 63.221 | 0 | 63.221 | 11.376 | 0 | 63 | 65 | 41 | 24 |
| **Total** | | | **1.551.668** | **762.205** | **-** | **762.205** | **137.149** | **-** | **762** | **778** | **490** | **288** |
| **%Smallholder Total Area** | **54,17%** | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **C1.5. Jambi Province** | | | | | | | | | | | | |
| BATANG HARI | | 132.882 | 132.882 | - | 0 | - | - | 0 | - | - | - | - |
| BUNGO | | 102.657 | 102.657 | - | 0 | - | - | 0 | - | - | - | - |
| KERINCI | | 189 | 189 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA JAMBI | 1 | 474 | 474 | 2 | 0 | 2 | 0 | 0 | 0,002 | 0,002 | 0,001 | 0,001 |
| MERANGIN | | 76.855 | 76.855 | - | 0 | - | - | 0 | - | - | - | - |
| MUARO JAMBI | 88.358 | 108.890 | 197.248 | 303.175 | 0 | 303.175 | 54.552 | 0 | 303 | 310 | 195 | 115 |
| SAROLANGUN | 23.745 | 68.742 | 92.488 | 81.475 | 0 | 81.475 | 14.660 | 0 | 81 | 83 | 52 | 31 |
| TANJUNG JABUNG BARAT | 47.346 | 213.318 | 260.663 | 162.452 | 0 | 162.452 | 29.231 | 0 | 162 | 166 | 104 | 61 |
| TANJUNG JABUNG TIMUR | 56.612 | 181.211 | 237.824 | 194.247 | 0 | 194.247 | 34.952 | 0 | 194 | 198 | 125 | 73 |
| TEBO | | 158.673 | 158.673 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | **1.259.952** | **741.351** | **-** | **741.351** | **133.396** | **-** | **741** | **757** | **477** | **280** |
| **%Smallholder Total Area** | **61,74%** | | | | | | | | | | | |
| | | **Total Area, Sumatera ha** | **9.980.550** | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount* | Mineral Area | Amount* | Total Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C1.6. West Kalimantan Province** | | | | | | | | | | | | | | | |
| BENGKAYANG | 26.549 | 92.832 | 119.381 | 6.556 | 9.698 | 16.254 | 7.471 | 1.311 | 26.123 | 1.940 | 3.251 | 13 | 13 | 8 | 5 |
| KAPUAS HULU | 3.380 | 81.949 | 85.329 | 835 | 8.561 | 9.396 | 951 | 167 | 23.061 | 1.712 | 1.879 | 8 | 8 | 5 | 3 |
| KAYONG UTARA | 16.383 | 39.981 | 56.364 | 4.046 | 4.177 | 8.222 | 4.610 | 809 | 11.251 | 835 | 1.644 | 7 | 7 | 4 | 2 |
| KETAPANG | 39.246 | 483.281 | 522.527 | 9.691 | 50.488 | 60.179 | 11.044 | 1.938 | 135.995 | 10.098 | 12.036 | 48 | 49 | 31 | 18 |
| KOTA PONTIANAK | | 8 | 8 | - | 1 | 1 | - | - | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA SINGKAWANG | 1 | 1.471 | 1.472 | 0 | 154 | 154 | 0 | 0 | 414 | 31 | 31 | 0,12 | 0,13 | 0,08 | 0,05 |
| KUBU RAYA | 112.735 | 18.619 | 131.354 | 27.838 | 1.945 | 29.783 | 31.724 | 5.568 | 5.239 | 389 | 5.957 | 24 | 24 | 15 | 9 |
| LANDAK | 22.577 | 126.162 | 148.739 | 5.575 | 13.180 | 18.755 | 6.353 | 1.115 | 35.502 | 2.636 | 3.751 | 15 | 15 | 10 | 6 |
| MELAWI | 3.203 | 48.986 | 52.188 | 791 | 5.118 | 5.908 | 901 | 158 | 13.785 | 1.024 | 1.182 | 5 | 5 | 3 | 2 |
| MEMPAWAH | 11.730 | 6.741 | 18.471 | 2.897 | 704 | 3.601 | 3.301 | 579 | 1.897 | 141 | 720 | 3 | 3 | 2 | 1 |
| SAMBAS | 20.779 | 106.939 | 127.718 | 5.131 | 11.172 | 16.303 | 5.847 | 1.026 | 30.093 | 2.234 | 3.261 | 13 | 13 | 8 | 5 |
| SANGGAU | 19.417 | 265.094 | 284.511 | 4.795 | 27.694 | 32.489 | 5.464 | 959 | 74.597 | 5.539 | 6.498 | 26 | 27 | 17 | 10 |
| SEKADAU | 1.205 | 90.869 | 92.074 | 298 | 9.493 | 9.791 | 339 | 60 | 25.570 | 1.899 | 1.958 | 8 | 8 | 5 | 3 |
| SINTANG | 19.359 | 169.129 | 188.487 | 4.780 | 17.669 | 22.449 | 5.448 | 956 | 47.593 | 3.534 | 4.490 | 18 | 18 | 12 | 7 |
| **Total** | | | **1.045.024** | **52.104** | **87.130** | **139.233** | **59.377** | **10.421** | **234.692** | **17.426** | **27.847** | **111** | **114** | **72** | **42** |
| **Smallholder Total Area** | **28,14%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.7. Central Kalimantan Province** | | | | | | | | | | | | | | | |
| BARITO SELATAN | 5.164 | 16.589 | 21.754 | 883 | 1.200 | 2.084 | 1.007 | 177 | 3.233 | 240 | 417 | 2 | 2 | 1 | 1 |
| BARITO TIMUR | 0 | 24.344 | 24.344 | 0 | 1.761 | 1.761 | 0 | 0 | 4.745 | 352 | 352 | 1 | 1 | 1 | 1 |
| BARITO UTARA | 154 | 32.163 | 32.318 | 26 | 2.327 | 2.354 | 30 | 5 | 6.269 | 465 | 471 | 2 | 2 | 1 | 1 |
| GUNUNG MAS | 117 | 52.126 | 52.243 | 20 | 3.772 | 3.792 | 23 | 4 | 10.159 | 754 | 758 | 3 | 3 | 2 | 1 |
| KAPUAS | 36.264 | 115.473 | 151.737 | 6.202 | 8.355 | 14.557 | 7.068 | 1.240 | 22.506 | 1.671 | 2.911 | 12 | 12 | 7 | 4 |
| KATINGAN | 115 | 62.210 | 62.326 | 20 | 4.501 | 4.521 | 22 | 4 | 12.125 | 900 | 904 | 4 | 4 | 2 | 1 |
| KOTA PALANGKA RAYA | 709 | 5.441 | 6.150 | 121 | 394 | 515 | 138 | 24 | 1.060 | 79 | 103 | 0,41 | 0,42 | 0,26 | 0,16 |
| KOTAWARINGIN BARAT | 1.802 | 235.301 | 237.103 | 308 | 17.026 | 17.334 | 351 | 62 | 45.860 | 3.405 | 3.467 | 14 | 14 | 9 | 5 |
| KOTAWARINGIN TIMUR | 64.576 | 492.417 | 556.993 | 11.044 | 35.630 | 46.674 | 12.586 | 2.209 | 95.972 | 7.126 | 9.335 | 37 | 38 | 24 | 14 |
| LAMANDAU | | 119.754 | 119.754 | - | 8.665 | 8.665 | - | - | 23.340 | 1.733 | 1.733 | 7 | 7 | 4 | 3 |
| MURUNG RAYA | | 767 | 767 | - | 56 | 56 | - | - | 150 | 11 | 11 | 0,04 | 0,05 | 0,03 | 0,02 |
| PULANG PISAU | 38.585 | 67.348 | 105.934 | 6.599 | 4.873 | 11.472 | 7.520 | 1.320 | 13.126 | 975 | 2.294 | 9 | 9 | 6 | 3 |
| SERUYAN | 9.232 | 314.992 | 324.224 | 1.579 | 22.792 | 24.371 | 1.799 | 316 | 61.392 | 4.558 | 4.874 | 19 | 20 | 13 | 7 |
| SUKAMARA | 1.588 | 113.287 | 114.875 | 272 | 8.197 | 8.469 | 309 | 54 | 22.080 | 1.639 | 1.694 | 7 | 7 | 4 | 3 |
| **Total** | | | **1.810.523** | **27.074** | **119.549** | **146.623** | **30.854** | **5.415** | **322.017** | **23.910** | **29.325** | **117** | **120** | **75** | **44** |
| **Smallholder Total Area** | **19,49%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.8. East Kalimantan Province** | | | | | | | | | | | | | | | |
| BERAU | 81 | 193.737 | 193.818 | 14 | 13.989 | 14.003 | 16 | 3 | 37.682 | 2.798 | 2.801 | 11 | 11 | 7 | 4 |
| KOTA SAMARINDA | | 113 | 113 | - | 8 | 8 | - | - | 22 | 2 | 2 | 0,01 | 0,01 | 0,00 | 0,00 |
| KUTAI BARAT | | 130.316 | 130.316 | - | 9.410 | 9.410 | - | - | 25.346 | 1.882 | 1.882 | 8 | 8 | 5 | 3 |
| KUTAI KARTANEGARA | 16.430 | 244.580 | 261.010 | 2.804 | 17.661 | 20.465 | 3.196 | 561 | 47.571 | 3.532 | 4.093 | 16 | 17 | 11 | 6 |
| KUTAI TIMUR | | 529.119 | 529.119 | - | 38.207 | 38.207 | - | - | 102.914 | 7.641 | 7.641 | 31 | 31 | 20 | 12 |
| MAHAKAM HULU | | 20.048 | 20.048 | - | 1.448 | 1.448 | - | - | 3.899 | 290 | 290 | 1 | 1 | 1 | 0,44 |
| PASER | | 244.062 | 244.062 | - | 17.623 | 17.623 | - | - | 47.470 | 3.525 | 3.525 | 14 | 14 | 9 | 5 |
| PENAJAM PASER UTARA | | 66.662 | 66.662 | - | 4.814 | 4.814 | - | - | 12.966 | 963 | 963 | 4 | 4 | 2 | 1 |
| **Total** | | | **1.445.149** | **2.818** | **103.159** | **105.977** | **3.211** | **564** | **277.870** | **20.632** | **21.195** | **85** | **87** | **55** | **32** |
| **Smallholder Total Area** | **19,45%** | | | | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount* | Mineral Area | Amount* | Total Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C1.9. South Kalimantan Province** | | | | | | | | | | | | | | | |
| BALANGAN | | 2.520 | 2.520 | - | 200 | 200 | - | - | 538 | 40 | 40 | 0,16 | 0,16 | 0,10 | 0,06 |
| BANJAR | 2.018 | 27.989 | 30.006 | 378 | 2.217 | 2.595 | 431 | 76 | 5.973 | 443 | 519 | 2 | 2 | 1 | 1 |
| BARITO KUALA | 4 | 49.545 | 49.549 | 1 | 3.925 | 3.926 | 1 | 0 | 10.573 | 785 | 785 | 3 | 3 | 2 | 1 |
| HULU SUNGAI SELATAN | 0 | 15.639 | 15.639 | 0 | 1.239 | 1.239 | 0 | 0 | 3.337 | 248 | 248 | 1 | 1 | 1 | 0,37 |
| HULU SUNGAI TENGAH | 9 | 88 | 97 | 2 | 7 | 9 | 2 | 0 | 19 | 1 | 2 | 0,007 | 0,007 | 0,004 | 0,003 |
| HULU SUNGAI UTARA | 4.594 | 43 | 4.637 | 860 | 3 | 864 | 980 | 172 | 9 | 1 | 173 | 1 | 1 | 0,44 | 0,26 |
| KOTA BANJAR BARU | | 349 | 349 | - | 28 | 28 | - | - | 74 | 6 | 6 | 0,02 | 0,02 | 0,01 | 0,01 |
| KOTA BARU | | 257.109 | 257.109 | - | 20.369 | 20.369 | - | - | 54.867 | 4.074 | 4.074 | 16 | 17 | 10 | 6 |
| TABALONG | | 7.905 | 7.905 | - | 626 | 626 | - | - | 1.687 | 125 | 125 | 1 | 1 | 0,32 | 0,19 |
| TANAH BUMBU | | 131.213 | 131.213 | - | 10.395 | 10.395 | - | - | 28.001 | 2.079 | 2.079 | 8 | 8 | 5 | 3 |
| TANAH LAUT | | 78.272 | 78.272 | - | 6.201 | 6.201 | - | - | 16.703 | 1.240 | 1.240 | 5 | 5 | 3 | 2 |
| TAPIN | 6.626 | 59.639 | 66.264 | 1.241 | 4.725 | 5.966 | 1.414 | 248 | 12.727 | 945 | 1.193 | 5 | 5 | 3 | 2 |
| **Total** | | | **643.559** | **2.481** | **49.936** | **52.417** | **2.828** | **496** | **134.508** | **9.987** | **10.483** | **42** | **43** | **27** | **16** |
| **%Smallholder Total Area** | **21,34%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.10. North Kalimantan Province** | | | | | | | | | | | | | | | |
| BULUNGAN | 2.273 | 100.012 | 102.285 | 486 | 9.056 | 9.542 | 554 | 97 | 24.393 | 1.811 | 1.908 | 8 | 8 | 5 | 3 |
| MALINAU | | 1.077 | 1.077 | - | 98 | 98 | - | - | 263 | 20 | 20 | 0,08 | 0,08 | 0,05 | 0,03 |
| NUNUKAN | 4.322 | 168.612 | 172.934 | 925 | 15.267 | 16.193 | 1.054 | 185 | 41.125 | 3.053 | 3.239 | 13 | 13 | 8 | 5 |
| TANA TIDUNG | 22.855 | 7.993 | 30.847 | 4.891 | 724 | 5.615 | 5.574 | 978 | 1.949 | 145 | 1.123 | 4 | 5 | 3 | 2 |
| **Total** | | | **307.144** | **6.303** | **25.145** | **31.448** | **7.183** | **1.261** | **67.730** | **5.029** | **6.290** | **25** | **26** | **16** | **10** |
| **%Smallholder Total Area** | **24,39%** | | | | | | | | | | | | | | |
| | | **Total Area, Kalimantan ha** | **6.035.000** | | | | | | | | | **Total Market Potential for Sumatera & Kalimantan, Oil Palm Plantation, Smallholder** | | | **2.493** |
| | | | | | | | | | | | | | | **Ton Cu/year** | |
| | | | | | | | | | | | | | | **TAM, Ton Cu/year** | **8.289** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS

***Assumption:**

20% user of recommended dosage for each land type

| | |
|---|---|
| Macrofertilizer Market serviced by Pupuk Indonesia Holding: | 63% |
| Sumatera smallholders do not apply Cu fertilizer to mineral soil plantation | |
| Recommended dosage for Cu application on Sumateran peatland (CuSO4): | (100+100+100 g/3 TBM) + (150 g/y3-y4) + (250+250 g/2 TM) |
| Recommended dosage for Cu application on Kalimantan peatland (CuEDTA): | (20+20+20 g/3 TBM) + (30+30+30 g/3 TM) |
| Recommended dosage of Cu application on Kalimantan mineral soil (CuEDTA): | (20 g/1 TBM) + (30+30+30 g/3 TM) |

**Table C1-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C1. Oil Palm Plantation-Smallholder

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C1.1. Riau Province** | | | | | | | | | | | | |
| BENGKALIS | 160.738 | 198.485 | 359.222 | 764.885 | 0 | 764.885 | 99.400 | 0 | 765 | 781 | 492 | 289 |
| INDRAGIRI HILIR | 559.539 | 119.747 | 679.287 | 2.662.617 | 0 | 2.662.617 | 346.019 | 0 | 2.663 | 2.719 | 1.713 | 1.006 |
| INDRAGIRI HULU | 69.149 | 345.613 | 414.762 | 329.051 | 0 | 329.051 | 42.762 | 0 | 329 | 336 | 212 | 124 |
| KAMPAR | 123.052 | 465.575 | 588.627 | 585.553 | 0 | 585.553 | 76.095 | 0 | 586 | 598 | 377 | 221 |
| KEPULAUAN MERANTI | 28.038 | 46 | 28.084 | 133.420 | 0 | 133.420 | 17.339 | 0 | 133 | 136 | 86 | 50 |
| KOTA DUMAI | 105.651 | 60.544 | 166.194 | 502.748 | 0 | 502.748 | 65.334 | 0 | 503 | 513 | 323 | 190 |
| KOTA PEKANBARU | 4.237 | 30.371 | 34.608 | 20.162 | 0 | 20.162 | 2.620 | 0 | 20 | 21 | 13 | 8 |
| KUANTAN SINGINGI | | 225.301 | 225.301 | - | 0 | - | - | 0 | - | - | - | - |
| PELALAWAN | 124.841 | 343.520 | 468.360 | 594.066 | 0 | 594.066 | 77.202 | 0 | 594 | 607 | 382 | 224 |
| ROKAN HILIR | 240.892 | 390.439 | 631.330 | 1.146.304 | 0 | 1.146.304 | 148.967 | 0 | 1.146 | 1.170 | 737 | 433 |
| ROKAN HULU | 47.189 | 416.334 | 463.522 | 224.553 | 0 | 224.553 | 29.182 | 0 | 225 | 229 | 144 | 85 |
| SIAK | 157.817 | 263.687 | 421.504 | 750.988 | 0 | 750.988 | 97.594 | 0 | 751 | 767 | 483 | 284 |
| **Total** | | | | **7.714.347** | **0** | **7.714.347** | | **0** | **7.714** | **7.876** | **4.962** | **2.914** |
| **Smallholder Total Area** | **61,84%** | | | | | | 0 | 0 | 0 | | | |
| | | | | | | | | | | | | |
| **C1.2. West Sumatera Province** | | | | | | | | | | | | |
| AGAM | 10.579 | 51.316 | 61.895 | 46.280 | 0 | 46.280 | 6.014 | 0 | 46 | 47 | 30 | 17 |
| DHARMASRAYA | | 129.349 | 129.349 | - | 0 | - | - | 0 | - | - | - | - |
| KEPULAUAN MENTAWAI | | 15 | 15 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PADANG | | 1 | 1 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA SAWAHLUNTO | | 369 | 369 | - | 0 | - | - | 0 | - | - | - | - |
| LIMA PULUH KOTA | | 3.549 | 3.549 | - | 0 | - | - | 0 | - | - | - | - |
| PADANG PARIAMAN | | 2.471 | 2.471 | - | 0 | - | - | 0 | - | - | - | - |
| PASAMAN | | 13.196 | 13.196 | - | 0 | - | - | 0 | - | - | - | - |
| PASAMAN BARAT | 13.307 | 206.694 | 220.001 | 58.212 | 0 | 58.212 | 7.565 | 0 | 58 | 59 | 37 | 22 |
| PESISIR SELATAN | 64.519 | 43.269 | 107.789 | 282.247 | 0 | 282.247 | 36.679 | 0 | 282 | 288 | 182 | 107 |
| SIJUNJUNG | | 27.922 | 27.922 | - | 0 | - | - | 0 | - | - | - | - |
| SOLOK SELATAN | | 75.028 | 75.028 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | | **386.739** | **-** | **386.739** | | **-** | **387** | **395** | **249** | **146** |
| **Smallholder Total Area** | **56,85%** | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C.1.3. North Sumatera Province** | | | | | | | | | | | | |
| ASAHAN | 24.363 | 221.370 | 245.733 | 63.197 | 0 | 63.197 | 8.213 | 0 | 63 | 65 | 41 | 24 |
| BATU BARA | | 55.319 | 55.319 | - | 0 | - | - | 0 | - | - | - | - |
| DAIRI | | 7.358 | 7.358 | - | 0 | - | - | 0 | - | - | - | - |
| DANAU TOBA | | 19 | 19 | - | 0 | - | - | 0 | - | - | - | - |
| DELI SERDANG | | 93.764 | 93.764 | - | 0 | - | - | 0 | - | - | - | - |
| HUMBANG HASUNDUTAN | | 154 | 154 | - | 0 | - | - | 0 | - | - | - | - |
| KARO | | 26.931 | 26.931 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA BINJAI | | 2.173 | 2.173 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA MEDAN | | 146 | 146 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PADANG SIDEMPUAN | | 682 | 682 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PEMATANG SIANTAR | | 686 | 686 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA TANJUNG BALAI | | 3.105 | 3.105 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA TEBING TINGGI | | 1.067 | 1.067 | - | 0 | - | - | 0 | - | - | - | - |
| LABUHAN BATU | 94.382 | 112.930 | 207.312 | 244.825 | 0 | 244.825 | 31.816 | 0 | 245 | 250 | 157 | 92 |
| LABUHAN BATU SELATAN | 38.420 | 192.685 | 231.105 | 99.660 | 0 | 99.660 | 12.951 | 0 | 100 | 102 | 64 | 38 |
| LABUHAN BATU UTARA | 59.899 | 138.757 | 198.656 | 155.377 | 0 | 155.377 | 20.192 | 0 | 155 | 159 | 100 | 59 |
| LANGKAT | | 218.376 | 218.376 | - | 0 | - | - | 0 | - | - | - | - |
| MANDAILING NATAL | 11.524 | 73.073 | 84.597 | 29.893 | 0 | 29.893 | 3.885 | 0 | 30 | 31 | 19 | 11 |
| PADANG LAWAS | | 140.999 | 140.999 | - | 0 | - | - | 0 | - | - | - | - |
| PADANG LAWAS UTARA | | 180.677 | 180.677 | - | 0 | - | - | 0 | - | - | - | - |
| PAKPAK BHARAT | | 2.431 | 2.431 | - | 0 | - | - | 0 | - | - | - | - |
| SAMOSIR | | 1.569 | 1.569 | - | 0 | - | - | 0 | - | - | - | - |
| SERDANG BEDAGAI | | 105.287 | 105.287 | - | 0 | - | - | 0 | - | - | - | - |
| SIMALUNGUN | | 162.064 | 162.064 | - | 0 | - | - | 0 | - | - | - | - |
| TAPANULI SELATAN | 9.954 | 25.922 | 35.876 | 25.822 | 0 | 25.822 | 3.356 | 0 | 26 | 26 | 17 | 10 |
| TAPANULI TENGAH | 6.662 | 28.436 | 35.098 | 17.281 | 0 | 17.281 | 2.246 | 0 | 17 | 18 | 11 | 7 |
| TAPANULI UTARA | | 324 | 324 | - | 0 | - | - | 0 | - | - | - | - |
| TOBA SAMOSIR | | 5.033 | 5.033 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | | **636.055** | **-** | **636.055** | **82.658** | **-** | **636** | **649** | **409** | **240** |
| **Smallholder Total Area** | **33,71%** | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C1.4. South Sumatera Province** | | | | | | | | | | | | |
| BANYUASIN | 2.999 | 252.016 | 255.015 | 12.501 | 0 | 12.501 | 1.625 | 0 | 13 | 13 | 8 | 5 |
| EMPAT LAWANG | | 11.011 | 11.011 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA LUBUKLINGGAU | | 1.051 | 1.051 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PAGAR ALAM | | 41 | 41 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA PALEMBANG | 46 | 566 | 612 | 193 | 0 | 193 | 25 | 0 | 0 | 0 | 0 | 0 |
| KOTA PRABUMULIH | | 2.332 | 2.332 | - | 0 | - | - | 0 | - | - | - | - |
| LAHAT | | 56.108 | 56.108 | - | 0 | - | - | 0 | - | - | - | - |
| MUARA ENIM | 6.844 | 67.768 | 74.612 | 28.528 | 0 | 28.528 | 3.707 | 0 | 29 | 29 | 18 | 11 |
| MUSI BANYUASIN | 109.534 | 452.017 | 561.551 | 456.579 | 0 | 456.579 | 59.335 | 0 | 457 | 466 | 294 | 172 |
| MUSI RAWAS | 2.066 | 100.173 | 102.239 | 8.611 | 0 | 8.611 | 1.119 | 0 | 9 | 9 | 6 | 3 |
| MUSI RAWAS UTARA | 22.612 | 66.945 | 89.557 | 94.255 | 0 | 94.255 | 12.249 | 0 | 94 | 96 | 61 | 36 |
| OGAN ILIR | 553 | 25.245 | 25.798 | 2.307 | 0 | 2.307 | 300 | 0 | 2 | 2 | 1 | 1 |
| OGAN KOMERING ILIR | 87.528 | 170.647 | 258.175 | 364.851 | 0 | 364.851 | 47.414 | 0 | 365 | 373 | 235 | 138 |
| OGAN KOMERING ULU | | 44.156 | 44.156 | - | 0 | - | - | 0 | - | - | - | - |
| OGAN KOMERING ULU SELATAN | | 19.848 | 19.848 | - | 0 | - | - | 0 | - | - | - | - |
| OGAN KOMERING ULU TIMUR | | 20.104 | 20.104 | - | 0 | - | - | 0 | - | - | - | - |
| PENUKAL ABAB LEMATANG ILIR | 21.000 | 8.455 | 29.456 | 87.537 | 0 | 87.537 | 11.376 | 0 | 88 | 89 | 56 | 33 |
| **Total** | | | **1.551.668** | **1.055.361** | **-** | **1.055.361** | **137.149** | **-** | **1.055** | **1.078** | **679** | **399** |
| **%Smallholder Total Area** | **54,17%** | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **C1.5. Jambi Province** | | | | | | | | | | | | |
| BATANG HARI | | 132.882 | 132.882 | - | 0 | - | - | 0 | - | - | - | - |
| BUNGO | | 102.657 | 102.657 | - | 0 | - | - | 0 | - | - | - | - |
| KERINCI | | 189 | 189 | - | 0 | - | - | 0 | - | - | - | - |
| KOTA JAMBI | 1 | 474 | 474 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| MERANGIN | | 76.855 | 76.855 | - | 0 | - | - | 0 | - | - | - | - |
| MUARO JAMBI | 88.358 | 108.890 | 197.248 | 419.780 | 0 | 419.780 | 54.552 | 0 | 420 | 429 | 270 | 159 |
| SAROLANGUN | 23.745 | 68.742 | 92.488 | 112.811 | 0 | 112.811 | 14.660 | 0 | 113 | 115 | 73 | 43 |
| TANJUNG JABUNG BARAT | 47.346 | 213.318 | 260.663 | 224.934 | 0 | 224.934 | 29.231 | 0 | 225 | 230 | 145 | 85 |
| TANJUNG JABUNG TIMUR | 56.612 | 181.211 | 237.824 | 268.958 | 0 | 268.958 | 34.952 | 0 | 269 | 275 | 173 | 102 |
| TEBO | | 158.673 | 158.673 | - | 0 | - | - | 0 | - | - | - | - |
| **Total** | | | **1.259.952** | **1.026.486** | **-** | **1.026.486** | **133.396** | **-** | **1.026** | **1.048** | **660** | **388** |
| **%Smallholder Total Area** | **61,74%** | | | | | | | | | | | |
| | | **Total Area, Sumatera ha** | **9.980.550** | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount* | Mineral Area | Amount* | Total Amount | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C1.6. West Kalimantan Province** | | | | | | | | | | | | | | | |
| BENGKAYANG | 26.549 | 92.832 | 119.381 | 2.521 | 5.290 | 7.811 | 7.471 | 504 | 26.123 | 1.058 | 1.562 | 6 | 6 | 4 | 2 |
| KAPUAS HULU | 3.380 | 81.949 | 85.329 | 321 | 4.670 | 4.991 | 951 | 64 | 23.061 | 934 | 998 | 4 | 4 | 3 | 2 |
| KAYONG UTARA | 16.383 | 39.981 | 56.364 | 1.556 | 2.278 | 3.834 | 4.610 | 311 | 11.251 | 456 | 767 | 3 | 3 | 2 | 1 |
| KETAPANG | 39.246 | 483.281 | 522.527 | 3.727 | 27.539 | 31.266 | 11.044 | 745 | 135.995 | 5.508 | 6.253 | 25 | 26 | 16 | 9 |
| KOTA PONTIANAK | | 8 | 8 | - | 0 | 0 | - | - | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA SINGKAWANG | 1 | 1.471 | 1.472 | 0 | 84 | 84 | 0 | 0 | 414 | 17 | 17 | 0 | 0 | 0 | 0 |
| KUBU RAYA | 112.735 | 18.619 | 131.354 | 10.707 | 1.061 | 11.768 | 31.724 | 2.141 | 5.239 | 212 | 2.354 | 9 | 10 | 6 | 4 |
| LANDAK | 22.577 | 126.162 | 148.739 | 2.144 | 7.189 | 9.333 | 6.353 | 429 | 35.502 | 1.438 | 1.867 | 7 | 8 | 5 | 3 |
| MELAWI | 3.203 | 48.986 | 52.188 | 304 | 2.791 | 3.096 | 901 | 61 | 13.785 | 558 | 619 | 2 | 3 | 2 | 1 |
| MEMPAWAH | 11.730 | 6.741 | 18.471 | 1.114 | 384 | 1.498 | 3.301 | 223 | 1.897 | 77 | 300 | 1 | 1 | 1 | 0 |
| SAMBAS | 20.779 | 106.939 | 127.718 | 1.973 | 6.094 | 8.067 | 5.847 | 395 | 30.093 | 1.219 | 1.613 | 6 | 7 | 4 | 2 |
| SANGGAU | 19.417 | 265.094 | 284.511 | 1.844 | 15.106 | 16.950 | 5.464 | 369 | 74.597 | 3.021 | 3.390 | 14 | 14 | 9 | 5 |
| SEKADAU | 1.205 | 90.869 | 92.074 | 114 | 5.178 | 5.292 | 339 | 23 | 25.570 | 1.036 | 1.058 | 4 | 4 | 3 | 2 |
| SINTANG | 19.359 | 169.129 | 188.487 | 1.839 | 9.638 | 11.476 | 5.448 | 368 | 47.593 | 1.928 | 2.295 | 9 | 9 | 6 | 3 |
| **Total** | | | | **20.040** | **47.525** | **67.565** | | | **234.692** | **9.505** | | **54** | **55** | **35** | **20** |
| **Smallholder Total Area** | **28,14%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.7. Central Kalimantan Province** | | | | | | | | | | | | | | | |
| BARITO SELATAN | 5.164 | 16.589 | 21.754 | 340 | 800 | 1.140 | 1.007 | 68 | 3.233 | 131 | 199 | 1 | 1 | 1 | 0 |
| BARITO TIMUR | 0 | 24.344 | 24.344 | 0 | 1.174 | 1.174 | 0 | 0 | 4.745 | 192 | 192 | 1 | 1 | 1 | 0 |
| BARITO UTARA | 154 | 32.163 | 32.318 | 10 | 1.551 | 1.562 | 30 | 2 | 6.269 | 254 | 256 | 1 | 1 | 1 | 0 |
| GUNUNG MAS | 117 | 52.126 | 52.243 | 8 | 2.514 | 2.522 | 23 | 2 | 10.159 | 411 | 413 | 2 | 2 | 1 | 1 |
| KAPUAS | 36.264 | 115.473 | 151.737 | 2.385 | 5.570 | 7.956 | 7.068 | 477 | 22.506 | 911 | 1.389 | 7 | 7 | 4 | 2 |
| KATINGAN | 115 | 62.210 | 62.326 | 8 | 3.001 | 3.008 | 22 | 2 | 12.125 | 491 | 493 | 3 | 3 | 2 | 1 |
| KOTA PALANGKA RAYA | 709 | 5.441 | 6.150 | 47 | 262 | 309 | 138 | 9 | 1.060 | 43 | 52 | 0,26 | 0,26 | 0,17 | 0,10 |
| KOTAWARINGIN BARAT | 1.802 | 235.301 | 237.103 | 119 | 11.350 | 11.469 | 351 | 24 | 45.860 | 1.857 | 1.881 | 10 | 10 | 6 | 4 |
| KOTAWARINGIN TIMUR | 64.576 | 492.417 | 556.993 | 4.248 | 23.753 | 28.001 | 12.586 | 850 | 95.972 | 3.887 | 4.736 | 23 | 24 | 15 | 9 |
| LAMANDAU | | 119.754 | 119.754 | - | 5.777 | 5.777 | - | - | 23.340 | 945 | 945 | 5 | 5 | 3 | 2 |
| MURUNG RAYA | | 767 | 767 | - | 37 | 37 | - | - | 150 | 6 | 6 | 0,03 | 0,03 | 0,02 | 0,01 |
| PULANG PISAU | 38.585 | 67.348 | 105.934 | 2.538 | 3.249 | 5.787 | 7.520 | 508 | 13.126 | 532 | 1.039 | 5 | 5 | 3 | 2 |
| SERUYAN | 9.232 | 314.992 | 324.224 | 607 | 15.195 | 15.802 | 1.799 | 121 | 61.392 | 2.486 | 2.608 | 13 | 13 | 8 | 5 |
| SUKAMARA | 1.588 | 113.287 | 114.875 | 104 | 5.465 | 5.569 | 309 | 21 | 22.080 | 894 | 915 | 5 | 5 | 3 | 2 |
| **Total** | | | | **10.413** | **79.699** | **90.112** | **30.854** | **2.083** | **322.017** | **13.042** | **15.124** | **75** | **77** | **48** | **28** |
| **Smallholder Total Area** | **19,49%** | | | | | | | | | | | | | | |

## C1. Oil Palm Plantation-Smallholder (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount* | Mineral Area | Amount* | Total Amount | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C1.8. East Kalimantan Province** | | | | | | | | | | | | | | | |
| BERAU | 81 | 193.737 | 193.818 | 5 | 9.326 | 9.332 | 16 | 1 | 37.682 | 1.526 | 1.527 | 8 | 8 | 5 | 3 |
| KOTA SAMARINDA | | 113 | 113 | - | 5 | 5 | - | - | 22 | 1 | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| KUTAI BARAT | | 130.316 | 130.316 | - | 6.273 | 6.273 | - | - | 25.346 | 1.027 | 1.027 | 5 | 5 | 3 | 2 |
| KUTAI KARTANEGARA | 16.430 | 244.580 | 261.010 | 1.079 | 11.774 | 12.852 | 3.196 | 216 | 47.571 | 1.927 | 2.142 | 11 | 11 | 7 | 4 |
| KUTAI TIMUR | | 529.119 | 529.119 | - | 25.471 | 25.471 | - | - | 102.914 | 4.168 | 4.168 | 21 | 22 | 14 | 8 |
| MAHAKAM HULU | | 20.048 | 20.048 | - | 965 | 965 | - | - | 3.899 | 158 | 158 | 1 | 1 | 1 | 0,30 |
| PASER | | 244.062 | 244.062 | - | 11.749 | 11.749 | - | - | 47.470 | 1.923 | 1.923 | 10 | 10 | 6 | 4 |
| PENAJAM PASER UTARA | | 66.662 | 66.662 | - | 3.209 | 3.209 | - | - | 12.966 | 525 | 525 | 3 | 3 | 2 | 1 |
| **Total** | | | **1.445.149** | **1.084** | **68.773** | **69.857** | **3.211** | **217** | **277.870** | **11.254** | **11.471** | **58** | **60** | **38** | **22** |
| **%Smallholder Total Area** | **19,45%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.9. South Kalimantan Province** | | | | | | | | | | | | | | | |
| BALANGAN | | 2.520 | 2.520 | - | 133 | 133 | - | - | 538 | 22 | 22 | 0,11 | 0,11 | 0,07 | 0,04 |
| BANJAR | 2.018 | 27.989 | 30.006 | 145 | 1.478 | 1.624 | 431 | 29 | 5.973 | 242 | 271 | 1 | 1 | 1 | 1 |
| BARITO KUALA | 4 | 49.545 | 49.549 | 0 | 2.617 | 2.617 | 1 | 0 | 10.573 | 428 | 428 | 2 | 2 | 1 | 1 |
| HULU SUNGAI SELATAN | 0 | 15.639 | 15.639 | 0 | 826 | 826 | 0 | 0 | 3.337 | 135 | 135 | 1 | 1 | 0 | 0,26 |
| HULU SUNGAI TENGAH | 9 | 88 | 97 | 1 | 5 | 5 | 2 | 0 | 19 | 1 | 1 | 0,004 | 0,004 | 0,003 | 0,002 |
| HULU SUNGAI UTARA | 4.594 | 43 | 4.637 | 331 | 2 | 333 | 980 | 66 | 9 | 0 | 67 | 0 | 0 | 0,17 | 0,10 |
| KOTA BANJAR BARU | | 349 | 349 | - | 18 | 18 | - | - | 74 | 3 | 3 | 0,02 | 0,02 | 0,01 | 0,01 |
| KOTA BARU | | 257.109 | 257.109 | - | 13.580 | 13.580 | - | - | 54.867 | 2.222 | 2.222 | 11 | 12 | 7 | 4 |
| TABALONG | | 7.905 | 7.905 | - | 418 | 418 | - | - | 1.687 | 68 | 68 | 0 | 0 | 0,22 | 0,13 |
| TANAH BUMBU | | 131.213 | 131.213 | - | 6.930 | 6.930 | - | - | 28.001 | 1.134 | 1.134 | 6 | 6 | 4 | 2 |
| TANAH LAUT | | 78.272 | 78.272 | - | 4.134 | 4.134 | - | - | 16.703 | 676 | 676 | 3 | 4 | 2 | 1 |
| TAPIN | 6.626 | 59.639 | 66.264 | 477 | 3.150 | 3.627 | 1.414 | 95 | 12.727 | 515 | 611 | 3 | 3 | 2 | 1 |
| **Total** | | | **643.559** | **954** | **33.291** | **34.245** | **2.828** | **191** | **134.508** | **5.448** | **5.638** | **29** | **29** | **18** | **11** |
| **%Smallholder Total Area** | **21,34%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C1.10. North Kalimantan Province** | | | | | | | | | | | | | | | |
| BULUNGAN | 2.273 | 100.012 | 102.285 | 187 | 6.037 | 6.224 | 554 | 37 | 24.393 | 988 | 1.025 | 5 | 5 | 3 | 2 |
| MALINAU | | 1.077 | 1.077 | - | 65 | 65 | - | - | 263 | 11 | 11 | 0,05 | 0,06 | 0,03 | 0,02 |
| NUNUKAN | 4.322 | 168.612 | 172.934 | 356 | 10.178 | 10.534 | 1.054 | 71 | 41.125 | 1.666 | 1.737 | 9 | 9 | 6 | 3 |
| TANA TIDUNG | 22.855 | 7.993 | 30.847 | 1.881 | 482 | 2.364 | 5.574 | 376 | 1.949 | 79 | 455 | 2 | 2 | 1 | 1 |
| **Total** | | | **307.144** | **2.424** | **16.763** | **19.187** | **7.183** | **485** | **67.730** | **2.743** | **3.228** | **16** | **16** | **10** | **6** |
| **%Smallholder Total Area** | **24,39%** | | | | | | | | | | | | | | |
| | | **Total Area, Kalimantan ha** | **6.035.000** | | | | | | | | | | | | |
| | | | | | | | | | | | | | | **Total Market Potential for Sumatera & Kalimantan, Oil Palm Plantation, Smallholder** | **4.189** |
| | | | | | | | | | | | | | | **Ton Zn/year** | |
| | | | | | | | | | | | | | | **TAM, Ton Zn/year** | **11.148** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 75%
7) Market Potential = PD - PCMS

***Assumption:**

20% user of recommended dosage for each land type

Macrofertilizer Market serviced by Pupuk Indonesia Holding: 63%

Kalimantan smallholders do not apply Zn fertilizer to peatland and mineral soil plantation

No recommended dosage for Zn application on Sumateran peatland

Recommended dosage for Zn application on Kalimantan peatland (ZnEDTA): (20 g/1 TBM) + (30+30+30 g/3 TM)

Recommended dosage of Zn application on Kalimantan mineral soil (ZnEDTA): (30+30+30 g/3 TM)

**Table C2-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C2. Oil Palm Plantation-Corporate

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C2.1. West Kalimantan Province** | | | | | | | | | | | | | | | |
| BENGKAYANG | 26.549 | 92.832 | 119.381 | 10.326 | 30.090 | 40.417 | 19.123 | 5.163 | 66.867 | 15.045 | 20.208 | 20 | 21 | 13 | 8 |
| KAPUAS HULU | 3.380 | 81.949 | 85.329 | 1.315 | 26.563 | 27.877 | 2.434 | 657 | 59.028 | 13.281 | 13.939 | 14 | 14 | 9 | 5 |
| KAYONG UTARA | 16.383 | 39.981 | 56.364 | 6.373 | 12.959 | 19.332 | 11.801 | 3.186 | 28.798 | 6.480 | 9.666 | 10 | 10 | 6 | 4 |
| KETAPANG | 39.246 | 483.281 | 522.527 | 15.265 | 156.648 | 171.914 | 28.269 | 7.633 | 348.107 | 78.324 | 85.957 | 86 | 88 | 55 | 32 |
| KOTA PONTIANAK | | 8 | 8 | - | 3 | 3 | - | - | 6 | 1 | 1 | 0,001 | 0,001 | 0,001 | 0,001 |
| KOTA SINGKAWANG | 1 | 1.471 | 1.472 | 0 | 477 | 477 | 0 | 0 | 1.060 | 238 | 239 | 0,239 | 0,244 | 0,153 | 0,090 |
| KUBU RAYA | 112.735 | 18.619 | 131.354 | 43.850 | 6.035 | 49.885 | 81.203 | 1.516 | 13.411 | 250 | 1.767 | 48 | 49 | 31 | 18 |
| LANDAK | 22.577 | 126.162 | 148.739 | 8.782 | 40.894 | 49.675 | 16.262 | 4.391 | 90.875 | 20.447 | 24.838 | 25 | 25 | 16 | 9 |
| MELAWI | 3.203 | 48.986 | 52.188 | 1.246 | 15.878 | 17.124 | 2.307 | 623 | 35.284 | 7.939 | 8.562 | 9 | 9 | 6 | 3 |
| MEMPAWAH | 11.730 | 6.741 | 18.471 | 4.563 | 2.185 | 6.747 | 8.449 | 2.281 | 4.855 | 1.092 | 3.374 | 3 | 3 | 2 | 1 |
| SAMBAS | 20.779 | 106.939 | 127.718 | 8.082 | 34.663 | 42.745 | 14.967 | 4.041 | 77.028 | 17.331 | 21.372 | 21 | 22 | 14 | 8 |
| SANGGAU | 19.417 | 265.094 | 284.511 | 7.553 | 85.926 | 93.479 | 13.986 | 3.776 | 190.947 | 42.963 | 46.739 | 47 | 48 | 30 | 18 |
| SEKADAU | 1.205 | 90.869 | 92.074 | 469 | 29.454 | 29.922 | 868 | 234 | 65.453 | 14.727 | 14.961 | 15 | 15 | 10 | 6 |
| SINTANG | 19.359 | 169.129 | 188.487 | 7.530 | 54.820 | 62.350 | 13.944 | 3.765 | 121.823 | 27.410 | 31.175 | 31 | 32 | 20 | 12 |
| **Total** | **296.565** | **1.532.061** | **1.828.625** | **115.352** | **496.595** | **611.947** | **213.615** | **37.268** | **1.103.543** | **245.530** | **282.798** | **329** | **336** | **212** | **124** |
| **%Corporate Total Area** | **72,03%** | | | | | | | | | | | | | | |
| **C2.2. South Kalimantan Province** | | | | | | | | | | | | | | | |
| BALANGAN | | 2.520 | 2.520 | - | 892 | 892 | - | - | 1.982 | 446 | 446 | 0,45 | 0,46 | 0,29 | 0,17 |
| BANJAR | 2.018 | 27.989 | 30.006 | 857 | 9.907 | 10.764 | 1.587 | 428 | 22.016 | 4.954 | 5.382 | 5 | 5 | 3 | 2 |
| BARITO KUALA | 4 | 49.545 | 49.549 | 2 | 17.537 | 17.539 | 3 | 1 | 38.972 | 8.769 | 8.770 | 9 | 9 | 6 | 3 |
| HULU SUNGAI SELATAN | 0 | 15.639 | 15.639 | 0 | 5.536 | 5.536 | 0 | 0 | 12.301 | 2.768 | 2.768 | 3 | 3 | 2 | 1 |
| HULU SUNGAI TENGAH | 9 | 88 | 97 | 4 | 31 | 35 | 7 | 2 | 69 | 16 | 17 | 0,02 | 0,02 | 0,01 | 0,01 |
| HULU SUNGAI UTARA | 4.594 | 43 | 4.637 | 1.951 | 15 | 1.967 | 3.613 | 976 | 34 | 8 | 983 | 1 | 1 | 1 | 0,37 |
| KOTA BANJAR BARU | | 349 | 349 | - | 123 | 123 | - | - | 274 | 62 | 62 | 0,06 | 0,06 | 0,04 | 0,02 |
| KOTA BARU | | 257.109 | 257.109 | - | 91.009 | 91.009 | - | - | 202.242 | 45.504 | 45.504 | 46 | 46 | 29 | 17 |
| TABALONG | | 7.905 | 7.905 | - | 2.798 | 2.798 | - | - | 6.218 | 1.399 | 1.399 | 1 | 1 | 1 | 0,53 |
| TANAH BUMBU | | 131.213 | 131.213 | - | 46.446 | 46.446 | - | - | 103.212 | 23.223 | 23.223 | 23 | 24 | 15 | 9 |
| TANAH LAUT | | 78.272 | 78.272 | - | 27.706 | 27.706 | - | - | 61.568 | 13.853 | 13.853 | 14 | 14 | 9 | 5 |
| TAPIN | 6.626 | 59.639 | 66.264 | 2.814 | 21.110 | 23.925 | 5.212 | 1.407 | 46.912 | 10.555 | 11.962 | 12 | 12 | 8 | 5 |
| **Total** | **13.250** | **630.309** | **643.559** | **5.628** | **223.111** | **228.739** | **10.423** | **2.814** | **495.801** | **111.555** | **114.369** | **114** | **117** | **74** | **43** |
| **%Corporate Total Area** | **78,66%** | | | | | | | | | | | | | | |
| **C2.3. Central Kalimantan Province** | | | | | | | | | | | | | | | |
| BARITO SELATAN | 5.164 | 16.589 | 21.754 | 2.245 | 6.010 | 8.256 | 4.158 | 1.123 | 13.356 | 3.005 | 4.128 | 4 | 4 | 3 | 2 |
| BARITO TIMUR | 0 | 24.344 | 24.344 | 0 | 8.820 | 8.820 | 0 | 0 | 19.599 | 4.410 | 4.410 | 4 | 5 | 3 | 2 |
| BARITO UTARA | 154 | 32.163 | 32.318 | 67 | 11.653 | 11.720 | 124 | 34 | 25.895 | 5.826 | 5.860 | 6 | 6 | 4 | 2 |
| GUNUNG MAS | 117 | 52.126 | 52.243 | 51 | 18.885 | 18.936 | 94 | 25 | 41.967 | 9.443 | 9.468 | 9 | 10 | 6 | 4 |
| KAPUAS | 36.264 | 115.473 | 151.737 | 15.766 | 41.835 | 57.601 | 29.196 | 7.883 | 92.967 | 20.918 | 28.801 | 29 | 29 | 19 | 11 |
| KATINGAN | 115 | 62.210 | 62.326 | 50 | 22.539 | 22.589 | 93 | 25 | 50.086 | 11.269 | 11.294 | 11 | 12 | 7 | 4 |
| KOTA PALANGKA RAYA | 709 | 5.441 | 6.150 | 308 | 1.971 | 2.279 | 571 | 154 | 4.380 | 986 | 1.140 | 1 | 1 | 1 | 0,43 |
| KOTAWARINGIN BARAT | 1.802 | 235.301 | 237.103 | 783 | 85.249 | 86.032 | 1.451 | 392 | 189.441 | 42.624 | 43.016 | 43 | 44 | 28 | 16 |
| KOTAWARINGIN TIMUR | 64.576 | 492.417 | 556.993 | 28.075 | 178.400 | 206.475 | 51.990 | 14.037 | 396.445 | 139.152 | 153.190 | 53 | 54 | 34 | 20 |
| LAMANDAU | | 119.754 | 119.754 | - | 43.386 | 43.386 | - | - | 96.414 | 21.693 | 21.693 | 22 | 22 | 14 | 8 |
| MURUNG RAYA | | 767 | 767 | - | 278 | 278 | - | - | 618 | 139 | 139 | 0,14 | 0,14 | 0,09 | 0,05 |
| PULANG PISAU | 38.585 | 67.348 | 105.934 | 16.775 | 24.400 | 41.175 | 31.065 | 8.388 | 54.222 | 12.200 | 20.588 | 21 | 21 | 13 | 8 |
| SERUYAN | 9.232 | 314.992 | 324.224 | 4.014 | 114.120 | 118.134 | 7.433 | 2.007 | 253.600 | 57.060 | 59.067 | 59 | 60 | 38 | 22 |
| SUKAMARA | 1.588 | 113.287 | 114.875 | 690 | 41.043 | 41.734 | 1.278 | 345 | 91.208 | 20.522 | 20.867 | 21 | 21 | 13 | 8 |
| **Total** | **158.307** | **1.652.216** | **1.810.523** | **68.825** | **598.590** | **667.414** | **127.453** | **34.412** | **1.330.199** | **349.247** | **383.659** | **284** | **290** | **183** | **107** |
| **%Corporate Total Area** | **80,51%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C2.4. East Kalimantan Province** | | | | | | | | | | | | | | | |
| BERAU | 81 | 193.737 | 193.818 | 35 | 70.225 | 70.260 | 65 | 18 | 156.056 | 35.112 | 35.130 | 35 | 36 | 23 | 13 |
| KOTA SAMARINDA | | 113 | 113 | - | 41 | 41 | - | - | 91 | 20 | 20 | 0,02 | 0,02 | 0,01 | 0,01 |
| KUTAI BARAT | | 130.316 | 130.316 | - | 47.236 | 47.236 | - | - | 104.969 | 23.618 | 23.618 | 24 | 24 | 15 | 9 |
| KUTAI KARTANEGARA | 16.430 | 244.580 | 261.010 | 7.147 | 88.654 | 95.801 | 13.235 | 3.573 | 197.009 | 44.327 | 47.900 | 48 | 49 | 31 | 18 |
| KUTAI TIMUR | | 529.119 | 529.119 | - | 191.792 | 191.792 | - | - | 426.205 | 95.896 | 95.896 | 96 | 98 | 62 | 36 |
| MAHAKAM HULU | | 20.048 | 20.048 | - | 7.267 | 7.267 | - | - | 16.149 | 3.633 | 3.633 | 4 | 4 | 2 | 1 |
| PASER | | 244.062 | 244.062 | - | 88.466 | 88.466 | - | - | 196.592 | 44.233 | 44.233 | 44 | 45 | 28 | 17 |
| PENAJAM PASER UTARA | | 66.662 | 66.662 | - | 24.163 | 24.163 | - | - | 53.697 | 12.082 | 12.082 | 12 | 12 | 8 | 5 |
| **Total** | **16.511** | **1.428.637** | **1.445.149** | **7.182** | **517.845** | **525.027** | **13.300** | **3.591** | **1.150.767** | **258.923** | **262.514** | **263** | **268** | **169** | **99** |
| **%Corporate Total Area** | **80,55%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.5. North Kalimantan Province** | | | | | | | | | | | | | | | |
| BULUNGAN | 2.273 | 100.012 | 102.285 | 928 | 34.028 | 34.957 | 1.719 | 464 | 75.619 | 17.014 | 17.478 | 17 | 18 | 11 | 7 |
| MALINAU | | 1.077 | 1.077 | - | 367 | 367 | - | - | 815 | 183 | 183 | 0,18 | 0,19 | 0,12 | 0,07 |
| NUNUKAN | 4.322 | 168.612 | 172.934 | 1.765 | 57.369 | 59.134 | 3.268 | 882 | 127.488 | 28.685 | 29.567 | 30 | 30 | 19 | 11 |
| TANA TIDUNG | 22.855 | 7.993 | 30.847 | 9.331 | 2.719 | 12.051 | 17.280 | 4.666 | 6.043 | 1.360 | 6.025 | 6 | 6 | 4 | 2 |
| **Total** | **29.450** | **277.694** | **307.144** | **12.024** | **94.484** | **106.508** | **22.267** | **6.012** | **209.964** | **47.242** | **53.254** | **53** | **54** | **34** | **20** |
| **%Corporate Total Area** | **75,61%** | | | | | | | | | | | | | | |
| | | **Total Area, Kalimantan ha** | **6.035.000** | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.6. Riau Province** | | | | | | | | | | | | | | | |
| BENGKALIS | 160.738 | 198.485 | 359.222 | 33.122 | 34.084 | 67.206 | 61.338 | 16.561 | 75.742 | 17.042 | 33.603 | 34 | 34 | 22 | 13 |
| INDRAGIRI HILIR | 559.539 | 119.747 | 679.287 | 115.301 | 20.563 | 135.864 | 213.520 | 57.650 | 45.696 | 10.282 | 67.932 | 68 | 69 | 44 | 26 |
| INDRAGIRI HULU | 69.149 | 345.613 | 414.762 | 14.249 | 59.349 | 73.598 | 26.387 | 7.125 | 131.886 | 29.674 | 36.799 | 37 | 38 | 24 | 14 |
| KAMPAR | 123.052 | 465.575 | 588.627 | 25.357 | 79.949 | 105.305 | 46.957 | 12.678 | 177.664 | 39.974 | 52.653 | 53 | 54 | 34 | 20 |
| KEPULAUAN MERANTI | 28.038 | 46 | 28.084 | 5.778 | 8 | 5.786 | 10.699 | 2.889 | 18 | 4 | 2.893 | 3 | 3 | 2 | 1 |
| KOTA DUMAI | 105.651 | 60.544 | 166.194 | 21.771 | 10.397 | 32.167 | 40.316 | 10.885 | 23.103 | 5.198 | 16.084 | 16 | 16 | 10 | 6 |
| KOTA PEKANBARU | 4.237 | 30.371 | 34.608 | 873 | 5.215 | 6.088 | 1.617 | 437 | 11.590 | 2.608 | 3.044 | 3 | 3 | 2 | 1 |
| KUANTAN SINGINGI | | 225.301 | 225.301 | - | 38.689 | 38.689 | - | - | 85.975 | 19.344 | 19.344 | 19 | 20 | 12 | 7 |
| PELALAWAN | 124.841 | 343.520 | 468.360 | 25.725 | 58.989 | 84.714 | 47.639 | 12.863 | 131.087 | 29.495 | 42.357 | 42 | 43 | 27 | 16 |
| ROKAN HILIR | 240.892 | 390.439 | 631.330 | 49.639 | 67.046 | 116.685 | 91.924 | 24.820 | 148.991 | 33.523 | 58.343 | 58 | 60 | 38 | 22 |
| ROKAN HULU | 47.189 | 416.334 | 463.522 | 9.724 | 71.493 | 81.217 | 18.007 | 4.862 | 158.873 | 35.746 | 40.608 | 41 | 41 | 26 | 15 |
| SIAK | 157.817 | 263.687 | 421.504 | 32.521 | 45.280 | 77.801 | 60.223 | 16.260 | 100.623 | 22.640 | 38.900 | 39 | 40 | 25 | 15 |
| **Total** | **1.621.142** | **2.859.660** | **4.480.803** | **334.059** | **491.061** | **825.120** | **618.628** | **167.030** | **1.091.246** | **245.530** | **412.560** | **413** | **421** | **265** | **156** |
| **%Corporate Total Area** | **38,16%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.7. West Sumatera Province** | | | | | | | | | | | | | | | |
| AGAM | 10.579 | 51.316 | 61.895 | 2.465 | 9.964 | 12.429 | 4.565 | 1.233 | 22.143 | 4.982 | 6.215 | 6 | 6 | 4 | 2 |
| DHARMASRAYA | | 129.349 | 129.349 | - | 25.116 | 25.116 | - | - | 55.814 | 12.558 | 12.558 | 13 | 13 | 8 | 5 |
| KEPULAUAN MENTAWAI | | 15 | 15 | - | 3 | 3 | - | - | 7 | 1 | 1 | 0 | 0 | 0 | 0 |
| KOTA PADANG | | 1 | 1 | - | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA SAWAHLUNTO | | 369 | 369 | - | 72 | 72 | - | - | 159 | 36 | 36 | 0 | 0 | 0 | 0 |
| LIMA PULUH KOTA | | 3.549 | 3.549 | - | 689 | 689 | - | - | 1.532 | 345 | 345 | 0 | 0 | 0 | 0 |
| PADANG PARIAMAN | | 2.471 | 2.471 | - | 480 | 480 | - | - | 1.066 | 240 | 240 | 0 | 0 | 0 | 0 |
| PASAMAN | | 13.196 | 13.196 | - | 2.562 | 2.562 | - | - | 5.694 | 1.281 | 1.281 | 1 | 1 | 1 | 0 |
| PASAMAN BARAT | 13.307 | 206.694 | 220.001 | 3.101 | 40.135 | 43.235 | 5.742 | 1.550 | 89.188 | 20.067 | 21.618 | 22 | 22 | 14 | 8 |
| PESISIR SELATAN | 64.519 | 43.269 | 107.789 | 15.034 | 8.402 | 23.435 | 27.840 | 7.517 | 18.671 | 4.201 | 11.718 | 12 | 12 | 8 | 4 |
| SIJUNJUNG | | 27.922 | 27.922 | - | 5.422 | 5.422 | - | - | 12.048 | 2.711 | 2.711 | 3 | 3 | 2 | 1 |
| SOLOK SELATAN | | 75.028 | 75.028 | - | 14.568 | 14.568 | - | - | 32.374 | 7.284 | 7.284 | 7 | 7 | 5 | 3 |
| **Total** | **88.406** | **553.180** | **641.585** | **20.599** | **107.414** | **128.013** | **38.147** | **10.300** | **238.697** | **53.707** | **64.007** | **64** | **65** | **41** | **24** |
| **%Corporate Total Area** | **43,15%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C2.8. North Sumatera Province** | | | | | | | | | | | | | | | |
| ASAHAN | 24.363 | 221.370 | 245.733 | 8.721 | 66.036 | 74.757 | 16.150 | 4.361 | 146.746 | 33.018 | 37.378 | 37 | 38 | 24 | 14 |
| BATU BARA | | 55.319 | 55.319 | - | 16.502 | 16.502 | - | - | 36.671 | 8.251 | 8.251 | 8 | 8 | 5 | 3 |
| DAIRI | | 7.358 | 7.358 | - | 2.195 | 2.195 | - | - | 4.877 | 1.097 | 1.097 | 1 | 1 | 1 | 0 |
| DANAU TOBA | | 19 | 19 | - | 6 | 6 | - | - | 13 | 3 | 3 | 0 | 0 | 0 | 0 |
| DELI SERDANG | | 93.764 | 93.764 | - | 27.970 | 27.970 | - | - | 62.156 | 13.985 | 13.985 | 14 | 14 | 9 | 5 |
| HUMBANG HASUNDUTAN | | 154 | 154 | - | 46 | 46 | - | - | 102 | 23 | 23 | 0 | 0 | 0 | 0 |
| KARO | | 26.931 | 26.931 | - | 8.034 | 8.034 | - | - | 17.853 | 4.017 | 4.017 | 4 | 4 | 3 | 2 |
| KOTA BINJAI | | 2.173 | 2.173 | - | 648 | 648 | - | - | 1.441 | 324 | 324 | 0 | 0 | 0 | 0 |
| KOTA MEDAN | | 146 | 146 | - | 44 | 44 | - | - | 97 | 22 | 22 | 0 | 0 | 0 | 0 |
| KOTA PADANG SIDEMPUAN | | 682 | 682 | - | 204 | 204 | - | - | 452 | 102 | 102 | 0 | 0 | 0 | 0 |
| KOTA PEMATANG SIANTAR | | 686 | 686 | - | 205 | 205 | - | - | 455 | 102 | 102 | 0 | 0 | 0 | 0 |
| KOTA TANJUNG BALAI | | 3.105 | 3.105 | - | 926 | 926 | - | - | 2.059 | 463 | 463 | 0 | 0 | 0 | 0 |
| KOTA TEBING TINGGI | | 1.067 | 1.067 | - | 318 | 318 | - | - | 708 | 159 | 159 | 0 | 0 | 0 | 0 |
| LABUHAN BATU | 94.382 | 112.930 | 207.312 | 33.785 | 33.688 | 67.473 | 62.566 | 16.893 | 74.861 | 16.844 | 33.737 | 34 | 34 | 22 | 13 |
| LABUHAN BATU SELATAN | 38.420 | 192.685 | 231.105 | 13.753 | 57.479 | 71.232 | 25.468 | 6.876 | 127.731 | 28.739 | 35.616 | 36 | 36 | 23 | 13 |
| LABUHAN BATU UTARA | 59.899 | 138.757 | 198.656 | 21.442 | 41.392 | 62.834 | 39.707 | 10.721 | 91.982 | 20.696 | 31.417 | 31 | 32 | 20 | 12 |
| LANGKAT | | 218.376 | 218.376 | - | 65.143 | 65.143 | - | - | 144.762 | 32.571 | 32.571 | 33 | 33 | 21 | 12 |
| MANDAILING NATAL | 11.524 | 73.073 | 84.597 | 4.125 | 21.798 | 25.923 | 7.639 | 2.063 | 48.440 | 10.899 | 12.962 | 13 | 13 | 8 | 5 |
| PADANG LAWAS | | 140.999 | 140.999 | - | 42.061 | 42.061 | - | - | 93.468 | 21.030 | 21.030 | 21 | 21 | 14 | 8 |
| PADANG LAWAS UTARA | | 180.677 | 180.677 | - | 53.897 | 53.897 | - | - | 119.771 | 26.948 | 26.948 | 27 | 28 | 17 | 10 |
| PAKPAK BHARAT | | 2.431 | 2.431 | - | 725 | 725 | - | - | 1.611 | 363 | 363 | 0 | 0 | 0 | 0 |
| SAMOSIR | | 1.569 | 1.569 | - | 468 | 468 | - | - | 1.040 | 234 | 234 | 0 | 0 | 0 | 0 |
| SERDANG BEDAGAI | | 105.287 | 105.287 | - | 31.408 | 31.408 | - | - | 69.795 | 15.704 | 15.704 | 16 | 16 | 10 | 6 |
| SIMALUNGUN | | 162.064 | 162.064 | - | 48.345 | 48.345 | - | - | 107.432 | 24.172 | 24.172 | 24 | 25 | 16 | 9 |
| TAPANULI SELATAN | 9.954 | 25.922 | 35.876 | 3.563 | 7.733 | 11.296 | 6.599 | 1.782 | 17.184 | 3.866 | 5.648 | 6 | 6 | 4 | 2 |
| TAPANULI TENGAH | 6.662 | 28.436 | 35.098 | 2.385 | 8.483 | 10.867 | 4.416 | 1.192 | 18.850 | 4.241 | 5.434 | 5 | 6 | 3 | 2 |
| TAPANULI UTARA | | 324 | 324 | - | 97 | 97 | - | - | 215 | 48 | 48 | 0 | 0 | 0 | 0 |
| TOBA SAMOSIR | | 5.033 | 5.033 | - | 1.501 | 1.501 | - | - | 3.336 | 751 | 751 | 1 | 1 | 0 | 0 |
| **Total** | **245.204** | **1.801.338** | **2.046.542** | **87.775** | **537.348** | **625.123** | **162.546** | **43.887** | **1.194.107** | **268.674** | **312.561** | **313** | **319** | **201** | **118** |
| **%Corporate Total Area** | **66,29%** | | | | | | | | | | | | | | |
| **C2.9. South Sumatera Province** | | | | | | | | | | | | | | | |
| BANYUASIN | 2.999 | 252.016 | 255.015 | 742 | 51.975 | 52.717 | 1.374 | 371 | 115.499 | 25.987 | 26.358 | 26 | 27 | 17 | 10 |
| EMPAT LAWANG | | 11.011 | 11.011 | - | 2.271 | 2.271 | - | - | 5.047 | 1.135 | 1.135 | 1 | 1 | 1 | 0 |
| KOTA LUBUKLINGGAU | | 1.051 | 1.051 | - | 217 | 217 | - | - | 482 | 108 | 108 | 0 | 0 | 0 | 0 |
| KOTA PAGAR ALAM | | 41 | 41 | - | 9 | 9 | - | - | 19 | 4 | 4 | 0 | 0 | 0 | 0 |
| KOTA PALEMBANG | 46 | 566 | 612 | 11 | 117 | 128 | 21 | 6 | 259 | 58 | 64 | 0 | 0 | 0 | 0 |
| KOTA PRABUMULIH | | 2.332 | 2.332 | - | 481 | 481 | - | - | 1.069 | 240 | 240 | 0 | 0 | 0 | 0 |
| LAHAT | | 56.108 | 56.108 | - | 11.572 | 11.572 | - | - | 25.714 | 5.786 | 5.786 | 6 | 6 | 4 | 2 |
| MUARA ENIM | 6.844 | 67.768 | 74.612 | 1.694 | 13.976 | 15.670 | 3.137 | 847 | 31.058 | 6.988 | 7.835 | 8 | 8 | 5 | 3 |
| MUSI BANYUASIN | 109.534 | 452.017 | 561.551 | 27.108 | 93.222 | 120.329 | 50.199 | 13.554 | 207.159 | 46.611 | 60.165 | 60 | 61 | 39 | 23 |
| MUSI RAWAS | 2.066 | 100.173 | 102.239 | 511 | 20.659 | 21.170 | 947 | 256 | 45.909 | 10.330 | 10.585 | 11 | 11 | 7 | 4 |
| MUSI RAWAS UTARA | 22.612 | 66.945 | 89.557 | 5.596 | 13.806 | 19.402 | 10.363 | 2.798 | 30.681 | 6.903 | 9.701 | 10 | 10 | 6 | 4 |
| OGAN ILIR | 553 | 25.245 | 25.798 | 137 | 5.206 | 5.343 | 254 | 68 | 11.570 | 2.603 | 2.672 | 3 | 3 | 2 | 1 |
| OGAN KOMERING ILIR | 87.528 | 170.647 | 258.175 | 21.662 | 35.193 | 56.855 | 40.114 | 10.831 | 78.207 | 17.597 | 28.427 | 28 | 29 | 18 | 11 |
| OGAN KOMERING ULU | | 44.156 | 44.156 | - | 9.107 | 9.107 | - | - | 20.237 | 4.553 | 4.553 | 5 | 5 | 3 | 2 |
| OGAN KOMERING ULU SELATAN | | 19.848 | 19.848 | - | 4.093 | 4.093 | - | - | 9.096 | 2.047 | 2.047 | 2 | 2 | 1 | 1 |
| OGAN KOMERING ULU TIMUR | | 20.104 | 20.104 | - | 4.146 | 4.146 | - | - | 9.214 | 2.073 | 2.073 | 2 | 2 | 1 | 1 |
| PENUKAL ABAB LEMATANG ILIR | 21.000 | 8.455 | 29.456 | 5.197 | 1.744 | 6.941 | 9.624 | 2.599 | 3.875 | 872 | 3.470 | 3 | 4 | 2 | 1 |
| **Total** | **253.183** | **1.298.485** | **1.551.668** | **62.658** | **267.793** | **330.451** | **116.034** | **31.329** | **595.096** | **133.897** | **165.226** | **165** | **169** | **106** | **62** |
| **%Corporate Total Area** | **45,83%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | kg Cu/year | ha | kg Cu/year | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **C2.10. Jambi Province** | | | | | | | | | | | | | | | |
| BATANG HARI | | 132.882 | 132.882 | - | 22.878 | 22.878 | - | - | 50.841 | 11.439 | 11.439 | 11 | 12 | 7 | 4 |
| BUNGO | | 102.657 | 102.657 | - | 17.674 | 17.674 | - | - | 39.277 | 8.837 | 8.837 | 9 | 9 | 6 | 3 |
| KERINCI | | 189 | 189 | - | 33 | 33 | - | - | 72 | 16 | 16 | 0 | 0 | 0 | 0 |
| KOTA JAMBI | 1 | 474 | 474 | 0 | 82 | 82 | 0 | 0 | 181 | 41 | 41 | 0 | 0 | 0 | 0 |
| MERANGIN | | 76.855 | 76.855 | - | 13.232 | 13.232 | - | - | 29.405 | 6.616 | 6.616 | 7 | 7 | 4 | 2 |
| MUARO JAMBI | 88.358 | 108.890 | 197.248 | 18.255 | 18.748 | 37.003 | 33.806 | 9.128 | 41.661 | 9.374 | 18.501 | 19 | 19 | 12 | 7 |
| SAROLANGUN | 23.745 | 68.742 | 92.488 | 4.906 | 11.835 | 16.741 | 9.085 | 2.453 | 26.301 | 5.918 | 8.371 | 8 | 9 | 5 | 3 |
| TANJUNG JABUNG BARAT | 47.346 | 213.318 | 260.663 | 9.782 | 36.727 | 46.509 | 18.114 | 4.891 | 81.615 | 18.363 | 23.254 | 23 | 24 | 15 | 9 |
| TANJUNG JABUNG TIMUR | 56.612 | 181.211 | 237.824 | 11.696 | 31.199 | 42.895 | 21.660 | 5.848 | 69.332 | 15.600 | 21.448 | 21 | 22 | 14 | 8 |
| TEBO | | 158.673 | 158.673 | - | 27.319 | 27.319 | - | - | 60.708 | 13.659 | 13.659 | 14 | 14 | 9 | 5 |
| **Total** | **216.062** | **1.043.890** | **1.259.952** | **44.639** | **179.727** | **224.366** | **82.665** | **22.320** | **399.392** | **89.863** | **112.183** | **112** | **115** | **72** | **42** |
| **%Corporate Total Area** | **38,26%** | | | | | | | | | | | | | | |
| | | **Total Area, Sumatera ha** | **9.980.550** | | | | | | | | | **Total Market Potential for Sumatera & Kalimantan, Oil Palm Plantation, Corporate** | | | **797** |
| | | | | | | | | | | | | | | **Ton Cu/year** | |
| | | | | | | | | | | | | | | **TAM, Ton Cu/year** | **4.273** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 75%
7) Market Potential = PD - PCMS

**Table C2-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C2. Oil Palm Plantation-Corporate

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C2.1. West Kalimantan Province** | | | | | | | | | | | | | | | |
| BENGKAYANG | 26.549 | 92.832 | 119.381 | 6.884 | 20.060 | 26.944 | 19.123 | 3.442 | 66.867 | 10.030 | 13.472 | 13 | 14 | 9 | 5 |
| KAPUAS HULU | 3.380 | 81.949 | 85.329 | 876 | 17.708 | 18.585 | 2.434 | 438 | 59.028 | 8.854 | 9.292 | 9 | 9 | 6 | 4 |
| KAYONG UTARA | 16.383 | 39.981 | 56.364 | 4.248 | 8.639 | 12.888 | 11.801 | 2.124 | 28.798 | 4.320 | 6.444 | 6 | 7 | 4 | 2 |
| KETAPANG | 39.246 | 483.281 | 522.527 | 10.177 | 104.432 | 114.609 | 28.269 | 5.088 | 348.107 | 52.216 | 57.305 | 57 | 59 | 37 | 22 |
| KOTA PONTIANAK | | 8 | 8 | - | 2 | 2 | - | - | 6 | 1 | 1 | 0,001 | 0,001 | 0,001 | 0,000 |
| KOTA SINGKAWANG | 1 | 1.471 | 1.472 | 0 | 318 | 318 | 0,48 | 0 | 1.060 | 159 | 159 | 0,159 | 0,162 | 0,102 | 0,060 |
| KUBU RAYA | 112.735 | 18.619 | 131.354 | 29.233 | 4.023 | 33.257 | 81.203 | 1.011 | 13.411 | 167 | 1.178 | 32 | 33 | 21 | 12 |
| LANDAK | 22.577 | 126.162 | 148.739 | 5.854 | 27.262 | 33.117 | 16.262 | 2.927 | 90.875 | 13.631 | 16.558 | 17 | 17 | 11 | 6 |
| MELAWI | 3.203 | 48.986 | 52.188 | 831 | 10.585 | 11.416 | 2.307 | 415 | 35.284 | 5.293 | 5.708 | 6 | 6 | 4 | 2 |
| MEMPAWAH | 11.730 | 6.741 | 18.471 | 3.042 | 1.457 | 4.498 | 8.449 | 1.521 | 4.855 | 728 | 2.249 | 2 | 2 | 1 | 1 |
| SAMBAS | 20.779 | 106.939 | 127.718 | 5.388 | 23.108 | 28.497 | 14.967 | 2.694 | 77.028 | 11.554 | 14.248 | 14 | 15 | 9 | 5 |
| SANGGAU | 19.417 | 265.094 | 284.511 | 5.035 | 57.284 | 62.319 | 13.986 | 2.518 | 190.947 | 28.642 | 31.160 | 31 | 32 | 20 | 12 |
| SEKADAU | 1.205 | 90.869 | 92.074 | 312 | 19.636 | 19.948 | 868 | 156 | 65.453 | 9.818 | 9.974 | 10 | 10 | 6 | 4 |
| SINTANG | 19.359 | 169.129 | 188.487 | 5.020 | 36.547 | 41.567 | 13.944 | 2.510 | 121.823 | 18.273 | 20.783 | 21 | 21 | 13 | 8 |
| **Total** | **296.565** | **1.532.061** | **1.828.625** | **76.902** | **331.063** | **407.965** | **213.615** | **24.845** | **1.103.543** | **163.687** | **188.532** | **219** | **224** | **141** | **83** |
| **Corporate Total Area** | **72,03%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.2. South Kalimantan Province** | | | | | | | | | | | | | | | |
| BALANGAN | | 2.520 | 2.520 | - | 595 | 595 | - | - | 1.982 | 297 | 297 | 0,30 | 0,30 | 0,19 | 0,11 |
| BANJAR | 2.018 | 27.989 | 30.006 | 571 | 6.605 | 7.176 | 1.587 | 286 | 22.016 | 3.302 | 3.588 | 4 | 4 | 2 | 1 |
| BARITO KUALA | 4 | 49.545 | 49.549 | 1 | 11.692 | 11.693 | 3 | 1 | 38.972 | 5.846 | 5.846 | 6 | 6 | 4 | 2 |
| HULU SUNGAI SELATAN | 0 | 15.639 | 15.639 | 0 | 3.690 | 3.690 | 0,08 | 0 | 12.301 | 1.845 | 1.845 | 2 | 2 | 1 | 1 |
| HULU SUNGAI TENGAH | 9 | 88 | 97 | 3 | 21 | 23 | 7 | 1 | 69 | 10 | 12 | 0,01 | 0,01 | 0,01 | 0,00 |
| HULU SUNGAI UTARA | 4.594 | 43 | 4.637 | 1.301 | 10 | 1.311 | 3.613 | 650 | 34 | 5 | 656 | 1 | 1 | 0 | 0,25 |
| KOTA BANJAR BARU | | 349 | 349 | - | 82 | 82 | - | - | 274 | 41 | 41 | 0,04 | 0,04 | 0,03 | 0,02 |
| KOTA BARU | | 257.109 | 257.109 | - | 60.673 | 60.673 | - | - | 202.242 | 30.336 | 30.336 | 30 | 31 | 20 | 11 |
| TABALONG | | 7.905 | 7.905 | - | 1.865 | 1.865 | - | - | 6.218 | 933 | 933 | 1 | 1 | 1 | 0,35 |
| TANAH BUMBU | | 131.213 | 131.213 | - | 30.964 | 30.964 | - | - | 103.212 | 15.482 | 15.482 | 15 | 16 | 10 | 6 |
| TANAH LAUT | | 78.272 | 78.272 | - | 18.471 | 18.471 | - | - | 61.568 | 9.235 | 9.235 | 9 | 9 | 6 | 3 |
| TAPIN | 6.626 | 59.639 | 66.264 | 1.876 | 14.074 | 15.950 | 5.212 | 938 | 46.912 | 7.037 | 7.975 | 8 | 8 | 5 | 3 |
| **Total** | **13.250** | **630.309** | **643.559** | **3.752** | **148.740** | **152.493** | **10.423** | **1.876** | **495.801** | **74.370** | **76.246** | **76** | **78** | **49** | **29** |
| **Corporate Total Area** | **78,66%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.3. Central Kalimantan Province** | | | | | | | | | | | | | | | |
| BARITO SELATAN | 5.164 | 16.589 | 21.754 | 1.497 | 4.007 | 5.504 | 4.158 | 748 | 13.356 | 2.003 | 2.752 | 3 | 3 | 2 | 1 |
| BARITO TIMUR | 0 | 24.344 | 24.344 | 0 | 5.880 | 5.880 | 0 | 0 | 19.599 | 2.940 | 2.940 | 3 | 3 | 2 | 1 |
| BARITO UTARA | 154 | 32.163 | 32.318 | 45 | 7.768 | 7.813 | 124 | 22 | 25.895 | 3.884 | 3.907 | 4 | 4 | 3 | 1 |
| GUNUNG MAS | 117 | 52.126 | 52.243 | 34 | 12.590 | 12.624 | 94 | 17 | 41.967 | 6.295 | 6.312 | 6 | 6 | 4 | 2 |
| KAPUAS | 36.264 | 115.473 | 151.737 | 10.511 | 27.890 | 38.401 | 29.196 | 5.255 | 92.967 | 13.945 | 19.200 | 19 | 20 | 12 | 7 |
| KATINGAN | 115 | 62.210 | 62.326 | 33 | 15.026 | 15.059 | 93 | 17 | 50.086 | 7.513 | 7.530 | 8 | 8 | 5 | 3 |
| KOTA PALANGKA RAYA | 709 | 5.441 | 6.150 | 205 | 1.314 | 1.520 | 571 | 103 | 4.380 | 657 | 760 | 1 | 1 | 0 | 0,29 |
| KOTAWARINGIN BARAT | 1.802 | 235.301 | 237.103 | 522 | 56.832 | 57.355 | 1.451 | 261 | 189.441 | 28.416 | 28.677 | 29 | 29 | 18 | 11 |
| KOTAWARINGIN TIMUR | 64.576 | 492.417 | 556.993 | 18.716 | 118.934 | 137.650 | 51.990 | 9.358 | 396.445 | 92.768 | 102.126 | 36 | 36 | 23 | 13 |
| LAMANDAU | | 119.754 | 119.754 | - | 28.924 | 28.924 | - | - | 96.414 | 14.462 | 14.462 | 14 | 15 | 9 | 5 |
| MURUNG RAYA | | 767 | 767 | - | 185 | 185 | - | - | 618 | 93 | 93 | 0,09 | 0,09 | 0,06 | 0,04 |
| PULANG PISAU | 38.585 | 67.348 | 105.934 | 11.183 | 16.267 | 27.450 | 31.065 | 5.592 | 54.222 | 8.133 | 13.725 | 14 | 14 | 9 | 5 |
| SERUYAN | 9.232 | 314.992 | 324.224 | 2.676 | 76.080 | 78.756 | 7.433 | 1.338 | 253.600 | 38.040 | 39.378 | 39 | 40 | 25 | 15 |
| SUKAMARA | 1.588 | 113.287 | 114.875 | 460 | 27.362 | 27.823 | 1.278 | 230 | 91.208 | 13.681 | 13.911 | 14 | 14 | 9 | 5 |
| **Total** | **158.307** | **1.652.216** | **1.810.523** | **45.883** | **399.060** | **444.943** | **127.453** | **22.942** | **1.330.199** | **232.831** | **255.773** | **189** | **193** | **122** | **71** |
| **Corporate Total Area** | **80,51%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C2.4. East Kalimantan Province** | | | | | | | | | | | | | | | |
| BERAU | 81 | 193.737 | 193.818 | 23 | 46.817 | 46.840 | 65 | 12 | 156.056 | 23.408 | 23.420 | 23 | 24 | 15 | 9 |
| KOTA SAMARINDA | | 113 | 113 | - | 27 | 27 | - | - | 91 | 14 | 14 | 0,01 | 0,01 | 0,01 | 0,01 |
| KUTAI BARAT | | 130.316 | 130.316 | - | 31.491 | 31.491 | - | - | 104.969 | 15.745 | 15.745 | 16 | 16 | 10 | 6 |
| KUTAI KARTANEGARA | 16.430 | 244.580 | 261.010 | 4.765 | 59.103 | 63.867 | 13.235 | 2.382 | 197.009 | 29.551 | 31.934 | 32 | 33 | 21 | 12 |
| KUTAI TIMUR | | 529.119 | 529.119 | - | 127.862 | 127.862 | - | - | 426.205 | 63.931 | 63.931 | 64 | 65 | 41 | 24 |
| MAHAKAM HULU | | 20.048 | 20.048 | - | 4.845 | 4.845 | - | - | 16.149 | 2.422 | 2.422 | 2 | 2 | 2 | 1 |
| PASER | | 244.062 | 244.062 | - | 58.978 | 58.978 | - | - | 196.592 | 29.489 | 29.489 | 29 | 30 | 19 | 11 |
| PENAJAM PASER UTARA | | 66.662 | 66.662 | - | 16.109 | 16.109 | - | - | 53.697 | 8.054 | 8.054 | 8 | 8 | 5 | 3 |
| **Total** | **16.511** | **1.428.637** | **1.445.149** | **4.788** | **345.230** | **350.018** | **13.300** | **2.394** | **1.150.767** | **172.615** | **175.009** | **175** | **179** | **113** | **66** |
| **Corporate Total Area** | **80,55%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.5. North Kalimantan Province** | | | | | | | | | | | | | | | |
| BULUNGAN | 2.273 | 100.012 | 102.285 | 619 | 22.686 | 23.304 | 1.719 | 309 | 75.619 | 11.343 | 11.652 | 12 | 12 | 7 | 4 |
| MALINAU | | 1.077 | 1.077 | - | 244 | 244 | - | - | 815 | 122 | 122 | 0,12 | 0,12 | 0,08 | 0,05 |
| NUNUKAN | 4.322 | 168.612 | 172.934 | 1.176 | 38.246 | 39.423 | 3.268 | 588 | 127.488 | 19.123 | 19.711 | 20 | 20 | 13 | 7 |
| TANA TIDUNG | 22.855 | 7.993 | 30.847 | 6.221 | 1.813 | 8.034 | 17.280 | 3.110 | 6.043 | 906 | 4.017 | 4 | 4 | 3 | 2 |
| **Total** | **29.450** | **277.694** | **307.144** | **8.016** | **62.989** | **71.005** | **22.267** | **4.008** | **209.964** | **31.495** | **35.503** | **36** | **36** | **23** | **13** |
| **Corporate Total Area** | **75,61%** | | | | | | | | | | | | | | |
| | | **Total Area, Kalimantan ha** | **6.035.000** | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.6. Riau Province** | | | | | | | | | | | | | | | |
| BENGKALIS | 160.738 | 198.485 | 359.222 | 22.082 | 22.723 | 44.804 | 61.338 | 11.041 | 75.742 | 11.361 | 22.402 | 22 | 23 | 14 | 8 |
| INDRAGIRI HILIR | 559.539 | 119.747 | 679.287 | 76.867 | 13.709 | 90.576 | 213.520 | 38.434 | 45.696 | 6.854 | 45.288 | 45 | 46 | 29 | 17 |
| INDRAGIRI HULU | 69.149 | 345.613 | 414.762 | 9.499 | 39.566 | 49.065 | 26.387 | 4.750 | 131.886 | 19.783 | 24.533 | 25 | 25 | 16 | 9 |
| KAMPAR | 123.052 | 465.575 | 588.627 | 16.904 | 53.299 | 70.203 | 46.957 | 8.452 | 177.664 | 26.650 | 35.102 | 35 | 36 | 23 | 13 |
| KEPULAUAN MERANTI | 28.038 | 46 | 28.084 | 3.852 | 5 | 3.857 | 10.699 | 1.926 | 18 | 3 | 1.929 | 2 | 2 | 1 | 1 |
| KOTA DUMAI | 105.651 | 60.544 | 166.194 | 14.514 | 6.931 | 21.445 | 40.316 | 7.257 | 23.103 | 3.466 | 10.722 | 11 | 11 | 7 | 4 |
| KOTA PEKANBARU | 4.237 | 30.371 | 34.608 | 582 | 3.477 | 4.059 | 1.617 | 291 | 11.590 | 1.738 | 2.029 | 2 | 2 | 1 | 1 |
| KUANTAN SINGINGI | | 225.301 | 225.301 | - | 25.792 | 25.792 | - | - | 85.975 | 12.896 | 12.896 | 13 | 13 | 8 | 5 |
| PELALAWAN | 124.841 | 343.520 | 468.360 | 17.150 | 39.326 | 56.476 | 47.639 | 8.575 | 131.087 | 19.663 | 28.238 | 28 | 29 | 18 | 11 |
| ROKAN HILIR | 240.892 | 390.439 | 631.330 | 33.093 | 44.697 | 77.790 | 91.924 | 16.546 | 148.991 | 22.349 | 38.895 | 39 | 40 | 25 | 15 |
| ROKAN HULU | 47.189 | 416.334 | 463.522 | 6.483 | 47.662 | 54.144 | 18.007 | 3.241 | 158.873 | 23.831 | 27.072 | 27 | 28 | 17 | 10 |
| SIAK | 157.817 | 263.687 | 421.504 | 21.680 | 30.187 | 51.867 | 60.223 | 10.840 | 100.623 | 15.093 | 25.934 | 26 | 26 | 17 | 10 |
| **Total** | **1.621.142** | **2.859.660** | **4.480.803** | **222.706** | **327.374** | **550.080** | **618.628** | **111.353** | **1.091.246** | **163.687** | **275.040** | **275** | **281** | **177** | **104** |
| **Smallholder Total Area** | **61,84%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.7. West Sumatera Province** | | | | | | | | | | | | | | | |
| AGAM | 10.579 | 51.316 | 61.895 | 1.643 | 6.643 | 8.286 | 4.565 | 822 | 22.143 | 3.321 | 4.143 | 4 | 4 | 3 | 2 |
| DHARMASRAYA | | 129.349 | 129.349 | - | 16.744 | 16.744 | - | - | 55.814 | 8.372 | 8.372 | 8 | 9 | 5 | 3 |
| KEPULAUAN MENTAWAI | | 15 | 15 | - | 2 | 2 | - | - | 7 | 1 | 1 | 0 | 0 | 0 | 0 |
| KOTA PADANG | | 1 | 1 | - | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOTA SAWAHLUNTO | | 369 | 369 | - | 48 | 48 | - | - | 159 | 24 | 24 | 0 | 0 | 0 | 0 |
| LIMA PULUH KOTA | | 3.549 | 3.549 | - | 459 | 459 | - | - | 1.532 | 230 | 230 | 0 | 0 | 0 | 0 |
| PADANG PARIAMAN | | 2.471 | 2.471 | - | 320 | 320 | - | - | 1.066 | 160 | 160 | 0 | 0 | 0 | 0 |
| PASAMAN | | 13.196 | 13.196 | - | 1.708 | 1.708 | - | - | 5.694 | 854 | 854 | 1 | 1 | 1 | 0 |
| PASAMAN BARAT | 13.307 | 206.694 | 220.001 | 2.067 | 26.757 | 28.824 | 5.742 | 1.034 | 89.188 | 13.378 | 14.412 | 14 | 15 | 9 | 5 |
| PESISIR SELATAN | 64.519 | 43.269 | 107.789 | 10.022 | 5.601 | 15.624 | 27.840 | 5.011 | 18.671 | 2.801 | 7.812 | 8 | 8 | 5 | 3 |
| SIJUNJUNG | | 27.922 | 27.922 | - | 3.614 | 3.614 | - | - | 12.048 | 1.807 | 1.807 | 2 | 2 | 1 | 1 |
| SOLOK SELATAN | | 75.028 | 75.028 | - | 9.712 | 9.712 | - | - | 32.374 | 4.856 | 4.856 | 5 | 5 | 3 | 2 |
| **Total** | **88.406** | **553.180** | **641.585** | **13.733** | **71.609** | **85.342** | **38.147** | **6.866** | **238.697** | **35.805** | **42.671** | **43** | **44** | **27** | **16** |
| **Smallholder Total Area** | **56,85%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C2.8. North Sumatera Province** | | | | | | | | | | | | | | | |
| ASAHAN | 24.363 | 221.370 | 245.733 | 5.814 | 44.024 | 49.838 | 16.150 | 2.907 | 146.746 | 22.012 | 24.919 | 25 | 25 | 16 | 9 |
| BATU BARA | | 55.319 | 55.319 | - | 11.001 | 11.001 | - | - | 36.671 | 5.501 | 5.501 | 6 | 6 | 4 | 2 |
| DAIRI | | 7.358 | 7.358 | - | 1.463 | 1.463 | - | - | 4.877 | 732 | 732 | 1 | 1 | 0 | 0 |
| DANAU TOBA | | 19 | 19 | - | 4 | 4 | - | - | 13 | 2 | 2 | 0 | 0 | 0 | 0 |
| DELI SERDANG | | 93.764 | 93.764 | - | 18.647 | 18.647 | - | - | 62.156 | 9.323 | 9.323 | 9 | 10 | 6 | 4 |
| HUMBANG HASUNDUTAN | | 154 | 154 | - | 31 | 31 | - | - | 102 | 15 | 15 | 0 | 0 | 0 | 0 |
| KARO | | 26.931 | 26.931 | - | 5.356 | 5.356 | - | - | 17.853 | 2.678 | 2.678 | 3 | 3 | 2 | 1 |
| KOTA BINJAI | | 2.173 | 2.173 | - | 432 | 432 | - | - | 1.441 | 216 | 216 | 0 | 0 | 0 | 0 |
| KOTA MEDAN | | 146 | 146 | - | 29 | 29 | - | - | 97 | 15 | 15 | 0 | 0 | 0 | 0 |
| KOTA PADANG SIDEMPUAN | | 682 | 682 | - | 136 | 136 | - | - | 452 | 68 | 68 | 0 | 0 | 0 | 0 |
| KOTA PEMATANG SIANTAR | | 686 | 686 | - | 136 | 136 | - | - | 455 | 68 | 68 | 0 | 0 | 0 | 0 |
| KOTA TANJUNG BALAI | | 3.105 | 3.105 | - | 618 | 618 | - | - | 2.059 | 309 | 309 | 0 | 0 | 0 | 0 |
| KOTA TEBING TINGGI | | 1.067 | 1.067 | - | 212 | 212 | - | - | 708 | 106 | 106 | 0 | 0 | 0 | 0 |
| LABUHAN BATU | 94.382 | 112.930 | 207.312 | 22.524 | 22.458 | 44.982 | 62.566 | 11.262 | 74.861 | 11.229 | 22.491 | 22 | 23 | 14 | 8 |
| LABUHAN BATU SELATAN | 38.420 | 192.685 | 231.105 | 9.169 | 38.319 | 47.488 | 25.468 | 4.584 | 127.731 | 19.160 | 23.744 | 24 | 24 | 15 | 9 |
| LABUHAN BATU UTARA | 59.899 | 138.757 | 198.656 | 14.295 | 27.595 | 41.889 | 39.707 | 7.147 | 91.982 | 13.797 | 20.945 | 21 | 21 | 13 | 8 |
| LANGKAT | | 218.376 | 218.376 | - | 43.428 | 43.428 | - | - | 144.762 | 21.714 | 21.714 | 22 | 22 | 14 | 8 |
| MANDAILING NATAL | 11.524 | 73.073 | 84.597 | 2.750 | 14.532 | 17.282 | 7.639 | 1.375 | 48.440 | 7.266 | 8.641 | 9 | 9 | 6 | 3 |
| PADANG LAWAS | | 140.999 | 140.999 | - | 28.040 | 28.040 | - | - | 93.468 | 14.020 | 14.020 | 14 | 14 | 9 | 5 |
| PADANG LAWAS UTARA | | 180.677 | 180.677 | - | 35.931 | 35.931 | - | - | 119.771 | 17.966 | 17.966 | 18 | 18 | 12 | 7 |
| PAKPAK BHARAT | | 2.431 | 2.431 | - | 483 | 483 | - | - | 1.611 | 242 | 242 | 0 | 0 | 0 | 0 |
| SAMOSIR | | 1.569 | 1.569 | - | 312 | 312 | - | - | 1.040 | 156 | 156 | 0 | 0 | 0 | 0 |
| SERDANG BEDAGAI | | 105.287 | 105.287 | - | 20.938 | 20.938 | - | - | 69.795 | 10.469 | 10.469 | 10 | 11 | 7 | 4 |
| SIMALUNGUN | | 162.064 | 162.064 | - | 32.230 | 32.230 | - | - | 107.432 | 16.115 | 16.115 | 16 | 16 | 10 | 6 |
| TAPANULI SELATAN | 9.954 | 25.922 | 35.876 | 2.376 | 5.155 | 7.531 | 6.599 | 1.188 | 17.184 | 2.578 | 3.765 | 4 | 4 | 2 | 1 |
| TAPANULI TENGAH | 6.662 | 28.436 | 35.098 | 1.590 | 5.655 | 7.245 | 4.416 | 795 | 18.850 | 2.828 | 3.622 | 4 | 4 | 2 | 1 |
| TAPANULI UTARA | | 324 | 324 | - | 64 | 64 | - | - | 215 | 32 | 32 | 0 | 0 | 0 | 0 |
| TOBA SAMOSIR | | 5.033 | 5.033 | - | 1.001 | 1.001 | - | - | 3.336 | 500 | 500 | 1 | 1 | 0 | 0 |
| **Total** | **245.204** | **1.801.338** | **2.046.542** | **58.516** | **358.232** | **416.749** | **162.546** | **29.258** | **1.194.107** | **179.116** | **208.374** | **208** | **213** | **134** | **79** |
| **Smallholder Total Area** | **33,71%** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **C2.9. South Sumatera Province** | | | | | | | | | | | | | | | |
| BANYUASIN | 2.999 | 252.016 | 255.015 | 495 | 34.650 | 35.145 | 1.374 | 247 | 115.499 | 17.325 | 17.572 | 18 | 18 | 11 | 7 |
| EMPAT LAWANG | | 11.011 | 11.011 | - | 1.514 | 1.514 | - | - | 5.047 | 757 | 757 | 1 | 1 | 0 | 0 |
| KOTA LUBUKLINGGAU | | 1.051 | 1.051 | - | 145 | 145 | - | - | 482 | 72 | 72 | 0 | 0 | 0 | 0 |
| KOTA PAGAR ALAM | | 41 | 41 | - | 6 | 6 | - | - | 19 | 3 | 3 | 0 | 0 | 0 | 0 |
| KOTA PALEMBANG | 46 | 566 | 612 | 8 | 78 | 85 | 21 | 4 | 259 | 39 | 43 | 0 | 0 | 0 | 0 |
| KOTA PRABUMULIH | | 2.332 | 2.332 | - | 321 | 321 | - | - | 1.069 | 160 | 160 | 0 | 0 | 0 | 0 |
| LAHAT | | 56.108 | 56.108 | - | 7.714 | 7.714 | - | - | 25.714 | 3.857 | 3.857 | 4 | 4 | 2 | 1 |
| MUARA ENIM | 6.844 | 67.768 | 74.612 | 1.129 | 9.317 | 10.447 | 3.137 | 565 | 31.058 | 4.659 | 5.223 | 5 | 5 | 3 | 2 |
| MUSI BANYUASIN | 109.534 | 452.017 | 561.551 | 18.072 | 62.148 | 80.220 | 50.199 | 9.036 | 207.159 | 31.074 | 40.110 | 40 | 41 | 26 | 15 |
| MUSI RAWAS | 2.066 | 100.173 | 102.239 | 341 | 13.773 | 14.114 | 947 | 170 | 45.909 | 6.886 | 7.057 | 7 | 7 | 5 | 3 |
| MUSI RAWAS UTARA | 22.612 | 66.945 | 89.557 | 3.731 | 9.204 | 12.935 | 10.363 | 1.865 | 30.681 | 4.602 | 6.467 | 6 | 7 | 4 | 2 |
| OGAN ILIR | 553 | 25.245 | 25.798 | 91 | 3.471 | 3.562 | 254 | 46 | 11.570 | 1.735 | 1.781 | 2 | 2 | 1 | 1 |
| OGAN KOMERING ILIR | 87.528 | 170.647 | 258.175 | 14.441 | 23.462 | 37.903 | 40.114 | 7.221 | 78.207 | 11.731 | 18.952 | 19 | 19 | 12 | 7 |
| OGAN KOMERING ULU | | 44.156 | 44.156 | - | 6.071 | 6.071 | - | - | 20.237 | 3.036 | 3.036 | 3 | 3 | 2 | 1 |
| OGAN KOMERING ULU SELATAN | | 19.848 | 19.848 | - | 2.729 | 2.729 | - | - | 9.096 | 1.364 | 1.364 | 1 | 1 | 1 | 1 |
| OGAN KOMERING ULU TIMUR | | 20.104 | 20.104 | - | 2.764 | 2.764 | - | - | 9.214 | 1.382 | 1.382 | 1 | 1 | 1 | 1 |
| PENUKAL ABAB LEMATANG ILIR | 21.000 | 8.455 | 29.456 | 3.465 | 1.163 | 4.627 | 9.624 | 1.732 | 3.875 | 581 | 2.314 | 2 | 2 | 1 | 1 |
| **Total** | **253.183** | **1.298.485** | **1.551.668** | **41.772** | **178.529** | **220.301** | **116.034** | **20.886** | **595.096** | **89.264** | **110.150** | **110** | **112** | **71** | **42** |
| **Smallholder Total Area** | **54,17%** | | | | | | | | | | | | | | |

## C2. Oil Palm Plantation-Corporate (Continued)

| Identified Areas 1) | | | | TAM 2) | | | Reducing Factors 3) | | | | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Peat Area | Mineral Area | Total Area | Peat Area | Amount | Mineral Area | Amount | Total | Amount | Amount | Amount | Amount of Zn |
| | ha | ha | ha | kg Zn/year | kg Zn/year | kg Zn/year | ha | kg Zn/year | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **C2.10. Jambi Province** | | | | | | | | | | | | | | | |
| BATANG HARI | | 132.882 | 132.882 | - | 15.252 | 15.252 | - | - | 50.841 | 7.626 | 7.626 | 8 | 8 | 5 | 3 |
| BUNGO | | 102.657 | 102.657 | - | 11.783 | 11.783 | - | - | 39.277 | 5.891 | 5.891 | 6 | 6 | 4 | 2 |
| KERINCI | | 189 | 189 | - | 22 | 22 | - | - | 72 | 11 | 11 | 0 | 0 | 0 | 0 |
| KOTA JAMBI | 1 | 474 | 474 | 0 | 54 | 54 | 0 | 0 | 181 | 27 | 27 | 0 | 0 | 0 | 0 |
| MERANGIN | | 76.855 | 76.855 | - | 8.821 | 8.821 | - | - | 29.405 | 4.411 | 4.411 | 4 | 5 | 3 | 2 |
| MUARO JAMBI | 88.358 | 108.890 | 197.248 | 12.170 | 12.498 | 24.668 | 33.806 | 6.085 | 41.661 | 6.249 | 12.334 | 12 | 13 | 8 | 5 |
| SAROLANGUN | 23.745 | 68.742 | 92.488 | 3.271 | 7.890 | 11.161 | 9.085 | 1.635 | 26.301 | 3.945 | 5.580 | 6 | 6 | 4 | 2 |
| TANJUNG JABUNG BARAT | 47.346 | 213.318 | 260.663 | 6.521 | 24.485 | 31.006 | 18.114 | 3.261 | 81.615 | 12.242 | 15.503 | 16 | 16 | 10 | 6 |
| TANJUNG JABUNG TIMUR | 56.612 | 181.211 | 237.824 | 7.798 | 20.799 | 28.597 | 21.660 | 3.899 | 69.332 | 10.400 | 14.298 | 14 | 15 | 9 | 5 |
| TEBO | | 158.673 | 158.673 | - | 18.212 | 18.212 | - | - | 60.708 | 9.106 | 9.106 | 9 | 9 | 6 | 3 |
| **Total** | **216.062** | **1.043.890** | **1.259.952** | **29.759** | **119.818** | **149.577** | **82.665** | **14.880** | **399.392** | **59.909** | **74.789** | **75** | **76** | **48** | **28** |
| **Smallholder Total Area** | **61,74%** | | | | | | | | | | | | | | |
| | | **Total Area, Sumatera ha** | **9.980.550** | | | | | | | | | **Total Market Potential for Sumatera & Kalimantan, Oil Palm Plantation, Corporate** | | | **531** |
| | | | | | | | | | | | | **Ton Zn/year** | | | |
| | | | | | | | | | | | | **TAM, Ton Zn/year** | | | **2.848** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 75%
7) Market Potential = PD - PCMS

**Table C3-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C3. Industrial Forest

| Identified Areas 1) | | | | TAM 2) | Reducing Factors 3) | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Total Area | Total Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Cu/year | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **Indonesia** | | | | | | | | | |
| Indonesia | - | - | 500.000 | 417.000 | 173.889 | 243 | 248 | 156 | 92 |
| **Total** | | | 500.000 | 417.000 | 173.889 | 243 | 248 | 156 | 92 |

| | |
|---|---|
| **Total Market Potential for Industrial Forest** | **92** |
| **Ton Cu/year** | |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 75%
7) Market Potential = PD - PCMS

***Assumption:**

20% user of recommended dosage for each land type

Macrofertilizer Market serviced by Pupuk Indonesia Holding: 63%

Recommended dosage for Cu application on Industrial Forest (CuEDTA): (5 g/ year)

**Table C3-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## C3. Industrial Forest

| Identified Areas 1) | | | | TAM 2) | Reducing Factors 3) | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Peat Area | Mineral Area | Total Area | Total Area | Total Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | ha | ha | kg Zn/year | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **Indonesia** | | | | | | | | | |
| Indonesia | - | - | 500.000 | 278.000 | 77.284 | 201 | 205 | 129 | 76 |
| **Total** | | | 500.000 | 278.000 | 77.284 | 201 | 205 | 129 | 76 |

| | | |
|---|---|---|
| **Total Market Potential for Industrial Forest** | | **76** |
| | **Ton Zn/year** | |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 75%
7) Market Potential = PD - PCMS

***Assumption:**

20% user of recommended dosage for each land type

Macrofertilizer Market serviced by Pupuk Indonesia Holding: 63%

Recommended dosage for Zn application on Industrial Forest (ZnEDTA): (5 g/ year)

**Table D1.A-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

**D1. Rice Field-Tide Affected**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Total Area | Total Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | kg Cu/year | ha | kg Cu/year | ton Cu/year | ton Cu/year | ton Cu/year | ton Cu/year |
| **D1.1. South Sumatera Province** | | | | | | | | |
| Banyuasin | 148.705 | 1.115.285 | 148.705 | 0 | 1.115 | 1.139 | 717 | 421 |
| Musi Banyuasin | 16.228 | 121.710 | 16.228 | 0 | 122 | 124 | 78 | 46 |
| Ogan Komering Ilir | 36.392 | 272.943 | 36.392 | 0 | 273 | 279 | 176 | 103 |
| **Total** | **201.325** | **1.509.938** | | - | **1.510** | **1.542** | **971** | **570** |
| | | | | | | | | |
| **D1.2. Lampung Province** | | | | | | | | |
| Lampung Timur | 4.592 | 34.441 | 4.592 | 0 | 34 | 35 | 22 | 13 |
| Mesuji | 5.225 | 39.185 | 5.225 | 940 | 38 | 39 | 25 | 14 |
| Tulangbawang | 29.284 | 219.631 | 29.284 | 2.636 | 217 | 222 | 140 | 82 |
| **Total** | **39.101** | **293.257** | **39.101** | **3.576** | **290** | **296** | **186** | **109** |
| | | | | | | | | |
| **D1.3. Aceh Province** | | | | | | | | |
| Aceh Jaya | 3.466 | 25.995 | 3.466 | 312 | 26 | 26 | 17 | 10 |
| Aceh Timur | 9.578 | 71.833 | 9.578 | 862 | 71 | 72 | 46 | 27 |
| Aceh Utara | 10.626 | 79.695 | 10.626 | 956 | 79 | 80 | 51 | 30 |
| Bireuen | 7.315 | 54.863 | 7.315 | 658 | 54 | 55 | 35 | 20 |
| Pidie Jaya | 3.308 | 24.811 | 3.308 | 298 | 25 | 25 | 16 | 9 |
| **Total** | **34.293** | **257.196** | **34.293** | **3.086** | **254** | **259** | **163** | **96** |
| | | | | | | | | |
| **D1.4. Riau Province** | | | | | | | | |
| Bengkalis | 2.593 | 19.446 | 2.593 | 233 | 19 | 20 | 12 | 7 |
| Indragiri Hilir | 17.221 | 129.157 | 17.221 | 1.550 | 128 | 130 | 82 | 48 |
| Pelalawan | 4.822 | 36.166 | 4.822 | 434 | 36 | 36 | 23 | 13 |
| Rokan Hilir | 8.407 | 63.051 | 8.407 | 757 | 62 | 64 | 40 | 24 |
| Siak | 3.280 | 24.597 | 3.280 | 295 | 24 | 25 | 16 | 9 |
| **Total** | **36.322** | **272.417** | **36.322** | **3.269** | **269** | **275** | **173** | **102** |
| | | | | | | | | |

**D1. Rice Field-Tide Affected (Continued)**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| **Province; Regency/Sub-District** | **Total Area** | **Total Area** | **Total Area** | **Amount** | **Amount** | **Amount** | **Amount** | **Amount of Cu** |
| | **ha** | **kg Cu/year** | **ha** | **kg Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** |
| **D1.5. North Sumatera Province** | | | | | | | | |
| Deliserdang | 15.759 | 118.196 | 15.759 | 1.418 | 117 | 119 | 75 | 44 |
| Labuhanbatu | 5.314 | 39.851 | 5.314 | 478 | 39 | 40 | 25 | 15 |
| Labuhanbatu Utara | 9.340 | 70.053 | 9.340 | 841 | 69 | 71 | 45 | 26 |
| Langkat | 10.376 | 77.822 | 10.376 | 934 | 77 | 79 | 49 | 29 |
| Serdang Bedagai | 5.807 | 43.552 | 5.807 | 523 | 43 | 44 | 28 | 16 |
| **Total** | **46.596** | **349.473** | **46.596** | **4.194** | **345** | **353** | **222** | **130** |
| | | | | | | | | |
| **D1.6. Central Kalimantan Province** | | | | | | | | |
| Kapuas | 42.995 | 389.102 | 42.995 | 3.870 | 385 | 393 | 248 | 146 |
| Katingan | 5.589 | 41.914 | 5.589 | 503 | 41 | 42 | 27 | 16 |
| Kotawaringin Barat | 1.125 | 8.434 | 1.125 | 101 | 8 | 9 | 5 | 3 |
| Kotawaringin Timur | 5.038 | 37.788 | 5.038 | 453 | 37 | 38 | 24 | 14 |
| Pulangpisau | 18.352 | 137.641 | 18.352 | 1.652 | 136 | 139 | 87 | 51 |
| Seruyan | 1.959 | 14.690 | 1.959 | 176 | 15 | 15 | 9 | 5 |
| **Total** | **75.057** | **629.569** | **75.057** | **6.755** | **623** | **636** | **401** | **235** |
| | | | | | | | | |
| **D1.7. South Kalimantan Province** | | | | | | | | |
| Banjar | 21.304 | 159.777 | 21.304 | 1.917 | 158 | 161 | 102 | 60 |
| Barito Kuala | 56.622 | 424.666 | 56.622 | 5.096 | 420 | 428 | 270 | 159 |
| Kota Banjarmasin | 2.034 | 15.255 | 2.034 | 183 | 15 | 15 | 10 | 6 |
| Kotabaru | 2.372 | 17.786 | 2.372 | 213 | 18 | 18 | 11 | 7 |
| Tanahbumbu | 3.806 | 28.542 | 3.806 | 343 | 28 | 29 | 18 | 11 |
| Tanahlaut | 9.098 | 68.233 | 9.098 | 819 | 67 | 69 | 43 | 25 |
| **Total** | **95.234** | **714.258** | **95.234** | **8.571** | **706** | **721** | **454** | **267** |

**D1. Rice Field-Tide Affected (Continued)**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| **Province; Regency/Sub-District** | **Total Area** | **Total Area** | **Total Area** | **Amount** | **Amount** | **Amount** | **Amount** | **Amount of Cu** |
| | **ha** | **kg Cu/year** | **ha** | **kg Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** | **ton Cu/year** |
| **D1.8. West Kalimantan Province** | | | | | | | | |
| Kayong Utara | 11.091 | 83.183 | 11.091 | 998 | 82 | 84 | 53 | 31 |
| Ketapang | 23.851 | 178.881 | 23.851 | 2.147 | 177 | 180 | 114 | 67 |
| Kuburaya | 21.764 | 163.233 | 21.764 | 1.959 | 161 | 165 | 104 | 61 |
| Mempawah | 6.400 | 48.002 | 6.400 | 576 | 47 | 48 | 31 | 18 |
| Sambas | 40.685 | 305.140 | 40.685 | 3.662 | 301 | 308 | 194 | 114 |
| **Total** | **103.792** | **778.439** | **103.792** | **9.341** | **769** | **785** | **495** | **291** |

| | | | |
|---|---|---|---|
| **Total Area, Indonesia ha** | **631.721** | **Total Market Potential for Sumatera & Kalimantan, Tide Affected Rice Field** | **1.800** |
| | | **Ton Cu/year** | |
| | | **TAM, Ton Cu/year** | **4.805** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS

**Assumption:**

| | | |
|---|---|---|
| Pure Cu recommended dosage | 5 | kg/ha/tahun |
| Macrofertilizer Market serviced by Pupuk Indonesia Holding | 63% | |

**Table D1.A-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

**D1.A. Rice Field-Tide Affected**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Total Area | Total Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **D1.1. South Sumatera Province** | | | | | | | | |
| Banyuasin | 148.705 | 1.115.285 | 148.705 | 0 | 1.115 | 1.139 | 717 | 421 |
| Musi Banyuasin | 16.228 | 121.710 | 16.228 | 0 | 122 | 124 | 78 | 46 |
| Ogan Komering Ilir | 36.392 | 272.943 | 36.392 | 0 | 273 | 279 | 176 | 103 |
| **Total** | **201.325** | **1.509.938** | **201.325** | - | **1.510** | **1.542** | **971** | **570** |
| | | | | | | | | |
| **D1.2. Lampung Province** | | | | | | | | |
| Lampung Timur | 4.592 | 34.441 | 4.592 | 0 | 34 | 35 | 22 | 13 |
| Mesuji | 5.225 | 39.185 | 5.225 | 627 | 39 | 39 | 25 | 15 |
| Tulangbawang | 29.284 | 219.631 | 29.284 | 1.757 | 218 | 222 | 140 | 82 |
| **Total** | **39.101** | **293.257** | **39.101** | **2.384** | **291** | **297** | **187** | **110** |
| | | | | | | | | |
| **D1.3. Aceh Province** | | | | | | | | |
| Aceh Jaya | 3.466 | 25.995 | 3.466 | 208 | 26 | 26 | 17 | 10 |
| Aceh Timur | 9.578 | 71.833 | 9.578 | 575 | 71 | 73 | 46 | 27 |
| Aceh Utara | 10.626 | 79.695 | 10.626 | 638 | 79 | 81 | 51 | 30 |
| Bireuen | 7.315 | 54.863 | 7.315 | 439 | 54 | 56 | 35 | 21 |
| Pidie Jaya | 3.308 | 24.811 | 3.308 | 198 | 25 | 25 | 16 | 9 |
| **Total** | **34.293** | **257.196** | **34.293** | **2.058** | **255** | **260** | **164** | **96** |
| | | | | | | | | |
| **D1.4. Riau Province** | | | | | | | | |
| Bengkalis | 2.593 | 19.446 | 2.593 | 156 | 19 | 20 | 12 | 7 |
| Indragiri Hilir | 17.221 | 129.157 | 17.221 | 1.033 | 128 | 131 | 82 | 48 |
| Pelalawan | 4.822 | 36.166 | 4.822 | 289 | 36 | 37 | 23 | 14 |
| Rokan Hilir | 8.407 | 63.051 | 8.407 | 504 | 63 | 64 | 40 | 24 |
| Siak | 3.280 | 24.597 | 3.280 | 197 | 24 | 25 | 16 | 9 |
| **Total** | **36.322** | **272.417** | **36.322** | **2.179** | **270** | **276** | **174** | **102** |
| | | | | | | | | |

**D1.A. Rice Field-Tide Affected (Continued)**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Total Area | Total Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **D1.5. North Sumatera Province** | | | | | | | | |
| Deliserdang | 15.759 | 118.196 | 15.759 | 946 | 117 | 120 | 75 | 44 |
| Labuhanbatu | 5.314 | 39.851 | 5.314 | 319 | 40 | 40 | 25 | 15 |
| Labuhanbatu Utara | 9.340 | 70.053 | 9.340 | 560 | 69 | 71 | 45 | 26 |
| Langkat | 10.376 | 77.822 | 10.376 | 623 | 77 | 79 | 50 | 29 |
| Serdang Bedagai | 5.807 | 43.552 | 5.807 | 348 | 43 | 44 | 28 | 16 |
| **Total** | **46.596** | **349.473** | **46.596** | **2.796** | **347** | **354** | **223** | **131** |
| | | | | | | | | |
| **D1.6. Central Kalimantan Province** | | | | | | | | |
| Kapuas | 42.995 | 389.102 | 42.995 | 2.580 | 387 | 395 | 249 | 146 |
| Katingan | 5.589 | 41.914 | 5.589 | 335 | 42 | 42 | 27 | 16 |
| Kotawaringin Barat | 1.125 | 8.434 | 1.125 | 67 | 8 | 9 | 5 | 3 |
| Kotawaringin Timur | 5.038 | 37.788 | 5.038 | 302 | 37 | 38 | 24 | 14 |
| Pulangpisau | 18.352 | 137.641 | 18.352 | 1.101 | 137 | 139 | 88 | 52 |
| Seruyan | 1.959 | 14.690 | 1.959 | 118 | 15 | 15 | 9 | 6 |
| **Total** | **75.057** | **629.569** | **75.057** | **4.503** | **625** | **638** | **402** | **236** |
| | | | | | | | | |
| **D1.7. South Kalimantan Province** | | | | | | | | |
| Banjar | 21.304 | 159.777 | 21.304 | 1.278 | 158 | 162 | 102 | 60 |
| Barito Kuala | 56.622 | 424.666 | 56.622 | 3.397 | 421 | 430 | 271 | 159 |
| Kota Banjarmasin | 2.034 | 15.255 | 2.034 | 122 | 15 | 15 | 10 | 6 |
| Kotabaru | 2.372 | 17.786 | 2.372 | 142 | 18 | 18 | 11 | 7 |
| Tanahbumbu | 3.806 | 28.542 | 3.806 | 228 | 28 | 29 | 18 | 11 |
| Tanahlaut | 9.098 | 68.233 | 9.098 | 546 | 68 | 69 | 44 | 26 |
| **Total** | **95.234** | **714.258** | **95.234** | **5.714** | **709** | **723** | **456** | **268** |

**D1.A. Rice Field-Tide Affected (Continued)**

| Identified Areas 1) | TAM 2) | | Reducing Factors 3) | | AD 4) | PD 5) | PCMS 6) | Market Potential for PT MCG 7) |
|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Total Area | Total Area | Amount | Amount | Amount | Amount | Amount of Cu |
| | ha | kg Zn/year | ha | kg Zn/year | ton Zn/year | ton Zn/year | ton Zn/year | ton Zn/year |
| **D1.8. West Kalimantan Province** | | | | | | | | |
| Kayong Utara | 11.091 | 83.183 | 11.091 | 665 | 83 | 84 | 53 | 31 |
| Ketapang | 23.851 | 178.881 | 23.851 | 1.431 | 177 | 181 | 114 | 67 |
| Kuburaya | 21.764 | 163.233 | 21.764 | 1.306 | 162 | 165 | 104 | 61 |
| Mempawah | 6.400 | 48.002 | 6.400 | 384 | 48 | 49 | 31 | 18 |
| Sambas | 40.685 | 305.140 | 40.685 | 2.441 | 303 | 309 | 195 | 114 |
| **Total** | **103.792** | **778.439** | **103.792** | **6.228** | **772** | **788** | **497** | **292** |

| | | | |
|---|---|---|---|
| **Total Area, Indonesia, ha** | **631.721** | **Total Market Potential for Sumatera & Kalimantan, Tide Affected Rice Field** | **1.805** |
| | | **Ton Zn/year** | |
| | | **TAM, Ton Zn/year** | **4.805** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63%
7) Market Potential = PD - PCMS

**Assumption:**

| | | |
|---|---|---|
| Pure Zn recommended dosage | 5 | kg/ha/tahun |
| Macrofertilizer Market serviced by Pupuk Indonesia Holding | 63% | |

**Table D1.B-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## D1.B. Rice Field-Seawater Intrused

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year |
| **West Java Province** | | | | | | | | | | | | | | | | |
| CIREBON | 7.013 | 7.013 | 4.675.322 | 4.675.322 | 52.597 | 52.597 | 7.013 | 7.013 | - | - | - | - | 4.675 | 4.675 | 53 | 53 |
| INDRAMAYU | 13.699 | 13.699 | 9.132.404 | 9.132.404 | 102.740 | 102.740 | 13.699 | 13.699 | - | - | - | - | 9.132 | 9.132 | 103 | 103 |
| KARAWANG | 12.081 | 12.081 | 8.054.262 | 8.054.262 | 90.610 | 90.610 | 12.081 | 12.081 | - | - | - | - | 8.054 | 8.054 | 91 | 91 |
| KOTA CIREBON | 65 | 65 | 43.104 | 43.104 | 485 | 485 | 65 | 65 | - | - | - | - | 43 | 43 | 0 | 0 |
| SUBANG | 11.074 | 11.074 | 7.382.765 | 7.382.765 | 83.056 | 83.056 | 11.074 | 11.074 | - | - | - | - | 7.383 | 7.383 | 83 | 83 |
| **Total** | **43.932** | **43.932** | **29.287.858** | **29.287.858** | **329.488** | **329.488** | **43.932** | **43.932** | **-** | **-** | **-** | **-** | **29.288** | **29.288** | **329** | **329** |
| | | | | | | | | | | | | | | | | |
| **Central Java Province** | | | | | | | | | | | | | | | | |
| BATANG | 4.907 | 4.907 | 3.271.389 | 3.271.389 | 36.803 | 36.803 | 4.907 | 4.907 | - | - | - | - | 3.271 | 3.271 | 37 | 37 |
| BREBES | 6.339 | 741 | 4.226.050 | 494.174 | 47.543 | 5.559 | 6.339 | 741 | - | - | - | - | 4.226 | 494 | 48 | 6 |
| DEMAK | 13.409 | 13.369 | 8.939.593 | 8.912.655 | 100.570 | 100.267 | 13.409 | 13.369 | - | - | - | - | 8.940 | 8.913 | 101 | 100 |
| JEPARA | 2.084 | 2.084 | 1.389.196 | 1.389.196 | 15.628 | 15.628 | 2.084 | 2.084 | - | - | - | - | 1.389 | 1.389 | 16 | 16 |
| KENDAL | 4.660 | 4.660 | 3.106.515 | 3.106.515 | 34.948 | 34.948 | 4.660 | 4.660 | - | - | - | - | 3.107 | 3.107 | 35 | 35 |
| KOTA PEKALONGAN | 819 | 819 | 546.125 | 546.125 | 6.144 | 6.144 | 819 | 819 | - | - | - | - | 546 | 546 | 6 | 6 |
| KOTA SEMARANG | 544 | 544 | 362.891 | 362.891 | 4.083 | 4.083 | 544 | 544 | - | - | - | - | 363 | 363 | 4 | 4 |
| KOTA TEGAL | 471 | 471 | 314.270 | 314.270 | 3.536 | 3.536 | 471 | 471 | - | - | - | - | 314 | 314 | 4 | 4 |
| PEKALONGAN | 1.645 | 1.645 | 1.096.754 | 1.096.754 | 12.338 | 12.338 | 1.645 | 1.645 | - | - | - | - | 1.097 | 1.097 | 12 | 12 |
| PEMALANG | 5.976 | 5.976 | 3.984.019 | 3.984.019 | 44.820 | 44.820 | 5.976 | 5.976 | - | - | - | - | 3.984 | 3.984 | 45 | 45 |
| REMBANG | 4.348 | 4.312 | 2.898.769 | 2.874.538 | 32.611 | 32.339 | 4.348 | 4.312 | - | - | - | - | 2.899 | 2.875 | 33 | 32 |
| TEGAL | 4.258 | 4.257 | 2.838.446 | 2.838.232 | 31.933 | 31.930 | 4.258 | 4.257 | - | - | - | - | 2.838 | 2.838 | 32 | 32 |
| **Total** | **49.461** | **43.786** | **32.974.017** | **29.190.758** | **370.958** | **328.396** | **49.461** | **43.786** | **-** | **-** | **-** | **-** | **32.974** | **29.191** | **371** | **328** |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Cu |
| | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton/year | ton Cu/year |
| **West Java Province** | | | | | | | | | | | | | | |
| CIREBON | 4.774 | 4.774 | 54 | 54 | 119 | 119 | 34 | 34 | 4.654 | 4.654 | 20 | 20 | 21 | 33 |
| INDRAMAYU | 9.324 | 9.324 | 105 | 105 | 233 | 233 | 66 | 66 | 9.091 | 9.091 | 39 | 39 | 41 | 64 |
| KARAWANG | 8.223 | 8.223 | 93 | 93 | 206 | 206 | 58 | 58 | 8.018 | 8.018 | 34 | 34 | 36 | 56 |
| KOTA CIREBON | 44 | 44 | 0 | 0 | 1 | 1 | 0 | 0 | 43 | 43 | 0 | 0 | 0 | 0 |
| SUBANG | 7.538 | 7.538 | 85 | 85 | 188 | 188 | 53 | 53 | 7.349 | 7.349 | 31 | 31 | 33 | 52 |
| **Total** | **29.903** | **29.903** | **336** | **336** | **748** | **748** | **212** | **212** | **29.155** | **29.155** | **124** | **124** | **133** | **205** |
| | | | | | | | | | | | | | | |
| **Central Java Province** | | | | | | | | | | | | | | |
| BATANG | 3.340 | 3.340 | 38 | 38 | 84 | 84 | 24 | 24 | 3.257 | 3.257 | 14 | 14 | 15 | 23 |
| BREBES | 4.315 | 505 | 49 | 6 | 108 | 13 | 31 | 4 | 4.207 | 492 | 18 | 2 | 2 | 3 |
| DEMAK | 9.127 | 9.100 | 103 | 102 | 228 | 227 | 65 | 64 | 8.899 | 8.872 | 38 | 38 | 40 | 62 |
| JEPARA | 1.418 | 1.418 | 16 | 16 | 35 | 35 | 10 | 10 | 1.383 | 1.383 | 6 | 6 | 6 | 10 |
| KENDAL | 3.172 | 3.172 | 36 | 36 | 79 | 79 | 22 | 22 | 3.092 | 3.092 | 13 | 13 | 14 | 22 |
| KOTA PEKALONGAN | 558 | 558 | 6 | 6 | 14 | 14 | 4 | 4 | 544 | 544 | 2 | 2 | 2 | 4 |
| KOTA SEMARANG | 371 | 371 | 4 | 4 | 9 | 9 | 3 | 3 | 361 | 361 | 2 | 2 | 2 | 3 |
| KOTA TEGAL | 321 | 321 | 4 | 4 | 8 | 8 | 2 | 2 | 313 | 313 | 1 | 1 | 1 | 2 |
| PEKALONGAN | 1.120 | 1.120 | 13 | 13 | 28 | 28 | 8 | 8 | 1.092 | 1.092 | 5 | 5 | 5 | 8 |
| PEMALANG | 4.068 | 4.068 | 46 | 46 | 102 | 102 | 29 | 29 | 3.966 | 3.966 | 17 | 17 | 18 | 28 |
| REMBANG | 2.960 | 2.935 | 33 | 33 | 74 | 73 | 21 | 21 | 2.886 | 2.862 | 12 | 12 | 13 | 20 |
| TEGAL | 2.898 | 2.898 | 33 | 33 | 72 | 72 | 21 | 21 | 2.826 | 2.825 | 12 | 12 | 13 | 20 |
| **Total** | **33.666** | **29.804** | **379** | **335** | **842** | **745** | **239** | **211** | **32.825** | **29.059** | **140** | **124** | **132** | **204** |

## D1.B. Rice Field-Seawater Intrused (Continued)

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year |
| **East Java Province** | | | | | | | | | | | | | | | | |
| GRESIK | 2.412 | 2.412 | 1.607.860 | 1.607.860 | 18.088 | 18.088 | 2.412 | 2.412 | - | - | - | - | 1.608 | 1.608 | 18 | 18 |
| KOTA PASURUAN | 140 | 140 | 93.343 | 93.343 | 1.050 | 1.050 | 140 | 140 | - | - | - | - | 93 | 93 | 1 | 1 |
| LAMONGAN | 296 | 296 | 197.069 | 197.069 | 2.217 | 2.217 | 296 | 296 | - | - | - | - | 197 | 197 | 2 | 2 |
| PASURUAN | 388 | 388 | 258.945 | 258.945 | 2.913 | 2.913 | 388 | 388 | - | - | - | - | 259 | 259 | 3 | 3 |
| SIDOARJO | 1.668 | 1.668 | 1.112.186 | 1.112.186 | 12.512 | 12.512 | 1.668 | 1.668 | - | - | - | - | 1.112 | 1.112 | 13 | 13 |
| TUBAN | 6.262 | 6.262 | 4.174.886 | 4.174.886 | 46.967 | 46.967 | 6.262 | 6.262 | - | - | - | - | 4.175 | 4.175 | 47 | 47 |
| **Total** | **11.166** | **11.166** | **7.444.290** | **7.444.290** | **83.748** | **83.748** | **11.166** | **11.166** | **-** | **-** | **-** | **-** | **7.444** | **7.444** | **84** | **84** |

| Updated Total Area, Indonesia ha | 98.884 |
|---|---|

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Cu |
| | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton/year | ton Cu/year |
| **East Java Province** | | | | | | | | | | | | | | |
| GRESIK | 1.642 | 1.642 | 18 | 18 | 41 | 41 | 12 | 12 | 1.601 | 1.601 | 7 | 7 | 7 | 11 |
| KOTA PASURUAN | 95 | 95 | 1 | 1 | 2 | 2 | 1 | 1 | 93 | 93 | 0 | 0 | 0 | 1 |
| LAMONGAN | 201 | 201 | 2 | 2 | 5 | 5 | 1 | 1 | 196 | 196 | 1 | 1 | 1 | 1 |
| PASURUAN | 264 | 264 | 3 | 3 | 7 | 7 | 2 | 2 | 258 | 258 | 1 | 1 | 1 | 2 |
| SIDOARJO | 1.136 | 1.136 | 13 | 13 | 28 | 28 | 8 | 8 | 1.107 | 1.107 | 5 | 5 | 5 | 8 |
| TUBAN | 4.263 | 4.263 | 48 | 48 | 107 | 107 | 30 | 30 | 4.156 | 4.156 | 18 | 18 | 19 | 29 |
| **Total** | **7.601** | **7.601** | **86** | **86** | **190** | **190** | **54** | **54** | **7.411** | **7.411** | **32** | **32** | **34** | **52** |

| Updated Total Market Potential for Java, Seawater Intrusion-affected Rice Field | | |
|---|---|---|
| Ton Cu/Year | | 280 |
| TAM Cu, Ton/Year | | 742 |
| Ton Gypsum/Year | | 65.625 |
| TAM Gypsum, Ton/Year | | 65.923 |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63% for Cu, 2,48% for Gypsum
7) Market Potential = PD - PCMS

***Assumptions:**

20% of users already applied Cu to their operations in each region

IP: 1,5 when 2 T/3 years dosage of Gypsum is applied

Gypsum recommended dosage 2 T/3 years

Pure Cu recommended dosage 5 kg/season/ha

**Table D1.B-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## D1.B. Rice Field-Seawater Intrused

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year |
| **West Java Province** | | | | | | | | | | | | | | | | |
| CIREBON | 7.013 | 7.013 | 4.675.322 | 4.675.322 | 52.597 | 52.597 | 7.013 | 7.013 | - | - | - | - | 4.675 | 4.675 | 53 | 53 |
| INDRAMAYU | 13.699 | 13.699 | 9.132.404 | 9.132.404 | 102.740 | 102.740 | 13.699 | 13.699 | - | - | - | - | 9.132 | 9.132 | 103 | 103 |
| KARAWANG | 12.081 | 12.081 | 8.054.262 | 8.054.262 | 90.610 | 90.610 | 12.081 | 12.081 | - | - | - | - | 8.054 | 8.054 | 91 | 91 |
| KOTA CIREBON | 65 | 65 | 43.104 | 43.104 | 485 | 485 | 65 | 65 | - | - | - | - | 43 | 43 | 0 | 0 |
| SUBANG | 11.074 | 11.074 | 7.382.765 | 7.382.765 | 83.056 | 83.056 | 11.074 | 11.074 | - | - | - | - | 7.383 | 7.383 | 83 | 83 |
| **Total** | **43.932** | **43.932** | **29.287.858** | **29.287.858** | **329.488** | **329.488** | **43.932** | **43.932** | **-** | **-** | **-** | **-** | **29.288** | **29.288** | **329** | **329** |
| | | | | | | | | | | | | | | | | |
| **Central Java Province** | | | | | | | | | | | | | | | | |
| BATANG | 4.907 | 4.907 | 3.271.389 | 3.271.389 | 36.803 | 36.803 | 4.907 | 4.907 | - | - | - | - | 3.271 | 3.271 | 37 | 37 |
| BREBES | 6.339 | 741 | 4.226.050 | 494.174 | 47.543 | 5.559 | 6.339 | 741 | - | - | - | - | 4.226 | 494 | 48 | 6 |
| DEMAK | 13.409 | 13.369 | 8.939.593 | 8.912.655 | 100.570 | 100.267 | 13.409 | 13.369 | - | - | - | - | 8.940 | 8.913 | 101 | 100 |
| JEPARA | 2.084 | 2.084 | 1.389.196 | 1.389.196 | 15.628 | 15.628 | 2.084 | 2.084 | - | - | - | - | 1.389 | 1.389 | 16 | 16 |
| KENDAL | 4.660 | 4.660 | 3.106.515 | 3.106.515 | 34.948 | 34.948 | 4.660 | 4.660 | - | - | - | - | 3.107 | 3.107 | 35 | 35 |
| KOTA PEKALONGAN | 819 | 819 | 546.125 | 546.125 | 6.144 | 6.144 | 819 | 819 | - | - | - | - | 546 | 546 | 6 | 6 |
| KOTA SEMARANG | 544 | 544 | 362.891 | 362.891 | 4.083 | 4.083 | 544 | 544 | - | - | - | - | 363 | 363 | 4 | 4 |
| KOTA TEGAL | 471 | 471 | 314.270 | 314.270 | 3.536 | 3.536 | 471 | 471 | - | - | - | - | 314 | 314 | 4 | 4 |
| PEKALONGAN | 1.645 | 1.645 | 1.096.754 | 1.096.754 | 12.338 | 12.338 | 1.645 | 1.645 | - | - | - | - | 1.097 | 1.097 | 12 | 12 |
| PEMALANG | 5.976 | 5.976 | 3.984.019 | 3.984.019 | 44.820 | 44.820 | 5.976 | 5.976 | - | - | - | - | 3.984 | 3.984 | 45 | 45 |
| REMBANG | 4.348 | 4.312 | 2.898.769 | 2.874.538 | 32.611 | 32.339 | 4.348 | 4.312 | - | - | - | - | 2.899 | 2.875 | 33 | 32 |
| TEGAL | 4.258 | 4.257 | 2.838.446 | 2.838.232 | 31.933 | 31.930 | 4.258 | 4.257 | - | - | - | - | 2.838 | 2.838 | 32 | 32 |
| **Total** | **49.461** | **43.786** | **32.974.017** | **29.190.758** | **370.958** | **328.396** | **49.461** | **43.786** | **-** | **-** | **-** | **-** | **32.974** | **29.191** | **371** | **328** |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Zn |
| | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton/year | ton Zn/year |
| **West Java Province** | | | | | | | | | | | | | | |
| CIREBON | 4.774 | 4.774 | 54 | 54 | 119 | 119 | 34 | 34 | 4.654 | 4.654 | 20 | 20 | 21 | 33 |
| INDRAMAYU | 9.324 | 9.324 | 105 | 105 | 233 | 233 | 66 | 66 | 9.091 | 9.091 | 39 | 39 | 41 | 64 |
| KARAWANG | 8.223 | 8.223 | 93 | 93 | 206 | 206 | 58 | 58 | 8.018 | 8.018 | 34 | 34 | 36 | 56 |
| KOTA CIREBON | 44 | 44 | 0 | 0 | 1 | 1 | 0 | 0 | 43 | 43 | 0 | 0 | 0 | 0 |
| SUBANG | 7.538 | 7.538 | 85 | 85 | 188 | 188 | 53 | 53 | 7.349 | 7.349 | 31 | 31 | 33 | 52 |
| **Total** | **29.903** | **29.903** | **336** | **336** | **748** | **748** | **212** | **212** | **29.155** | **29.155** | **124** | **124** | **133** | **205** |
| | | | | | | | | | | | | | | |
| **Central Java Province** | | | | | | | | | | | | | | |
| BATANG | 3.340 | 3.340 | 38 | 38 | 84 | 84 | 24 | 24 | 3.257 | 3.257 | 14 | 14 | 15 | 23 |
| BREBES | 4.315 | 505 | 49 | 6 | 108 | 13 | 31 | 4 | 4.207 | 492 | 18 | 2 | 2 | 3 |
| DEMAK | 9.127 | 9.100 | 103 | 102 | 228 | 227 | 65 | 64 | 8.899 | 8.872 | 38 | 38 | 40 | 62 |
| JEPARA | 1.418 | 1.418 | 16 | 16 | 35 | 35 | 10 | 10 | 1.383 | 1.383 | 6 | 6 | 6 | 10 |
| KENDAL | 3.172 | 3.172 | 36 | 36 | 79 | 79 | 22 | 22 | 3.092 | 3.092 | 13 | 13 | 14 | 22 |
| KOTA PEKALONGAN | 558 | 558 | 6 | 6 | 14 | 14 | 4 | 4 | 544 | 544 | 2 | 2 | 2 | 4 |
| KOTA SEMARANG | 371 | 371 | 4 | 4 | 9 | 9 | 3 | 3 | 361 | 361 | 2 | 2 | 2 | 3 |
| KOTA TEGAL | 321 | 321 | 4 | 4 | 8 | 8 | 2 | 2 | 313 | 313 | 1 | 1 | 1 | 2 |
| PEKALONGAN | 1.120 | 1.120 | 13 | 13 | 28 | 28 | 8 | 8 | 1.092 | 1.092 | 5 | 5 | 5 | 8 |
| PEMALANG | 4.068 | 4.068 | 46 | 46 | 102 | 102 | 29 | 29 | 3.966 | 3.966 | 17 | 17 | 18 | 28 |
| REMBANG | 2.960 | 2.935 | 33 | 33 | 74 | 73 | 21 | 21 | 2.886 | 2.862 | 12 | 12 | 13 | 20 |
| TEGAL | 2.898 | 2.898 | 33 | 33 | 72 | 72 | 21 | 21 | 2.826 | 2.825 | 12 | 12 | 13 | 20 |
| **Total** | **33.666** | **29.804** | **379** | **335** | **842** | **745** | **239** | **211** | **32.825** | **29.059** | **140** | **124** | **132** | **204** |

## D1.B. Rice Field-Seawater Intrused (Continued)

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year |
| **East Java Province** | | | | | | | | | | | | | | | | |
| GRESIK | 2.412 | 2.412 | 1.607.860 | 1.607.860 | 18.088 | 18.088 | 450 | 450 | - | - | 169 | 169 | 1.608 | 1.608 | 18 | 18 |
| KOTA PASURUAN | 140 | 140 | 93.343 | 93.343 | 1.050 | 1.050 | 140 | 450 | - | - | 53 | 169 | 93 | 93 | 1 | 1 |
| LAMONGAN | 296 | 296 | 197.069 | 197.069 | 2.217 | 2.217 | 296 | 450 | - | - | 111 | 169 | 197 | 197 | 2 | 2 |
| PASURUAN | 388 | 388 | 258.945 | 258.945 | 2.913 | 2.913 | 388 | 450 | - | - | 146 | 169 | 259 | 259 | 3 | 3 |
| SIDOARJO | 1.668 | 1.668 | 1.112.186 | 1.112.186 | 12.512 | 12.512 | 1.668 | 450 | - | - | 626 | 169 | 1.112 | 1.112 | 12 | 12 |
| TUBAN | 6.262 | 6.262 | 4.174.886 | 4.174.886 | 46.967 | 46.967 | 6.262 | 450 | - | - | 2.348 | 169 | 4.175 | 4.175 | 45 | 47 |
| **Total** | **11.166** | **11.166** | **7.444.290** | **7.444.290** | **83.748** | **83.748** | **9.205** | **2.700** | **-** | **-** | **3.452** | **1.013** | **7.444** | **7.444** | **80** | **83** |
| **Total Area, Indonesia, ha** | **98.884** | | | | | | | | | | | | | | | |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Zn |
| | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton/year | ton Zn/year |
| **East Java Province** | | | | | | | | | | | | | | |
| GRESIK | 1.642 | 1.642 | 18 | 18 | 41 | 41 | 12 | 12 | 1.601 | 1.601 | 7 | 7 | 7 | 11 |
| KOTA PASURUAN | 95 | 95 | 1 | 1 | 2 | 2 | 1 | 1 | 93 | 93 | 0 | 0 | 0 | 1 |
| LAMONGAN | 201 | 201 | 2 | 2 | 5 | 5 | 1 | 1 | 196 | 196 | 1 | 1 | 1 | 1 |
| PASURUAN | 264 | 264 | 3 | 3 | 7 | 7 | 2 | 2 | 258 | 258 | 1 | 1 | 1 | 2 |
| SIDOARJO | 1.136 | 1.136 | 12 | 13 | 28 | 28 | 8 | 8 | 1.107 | 1.107 | 4 | 5 | 5 | 8 |
| TUBAN | 4.263 | 4.263 | 46 | 48 | 107 | 107 | 29 | 30 | 4.156 | 4.156 | 17 | 18 | 19 | 29 |
| **Total** | **7.601** | **7.601** | **82** | **84** | **190** | **190** | **52** | **53** | **7.411** | **7.411** | **30** | **31** | **34** | **52** |

| Updated Total Market Potential for Java, Seawater Intrusion-affected Rice Field | | |
|---|---|---|
| Ton Zn/Year | | 280 |
| TAM Zn, Ton/Year | | 742 |
| Ton Gypsum/Year | | 65.625 |
| TAM Gypsum, Ton/Year | | 65.923 |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63% for Cu, 2,48% for Gypsum
7) Market Potential = PD - PCMS

***Assumptions:**

20% of users already applied Cu to their operations in each region

| | | |
|---|---|---|
| IP: | 1,5 | when 2 T/3 years dosage of Gypsum is applied |
| Gypsum recommended dosage | 2 T/3 years | |
| Pure Zn recommended dosage | 5 kg/season/ha | |

**Table E1-Cu. Market Potential of Cu Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## E1. Rice Field-High pH

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ton Gypsum/year | kg Gypsum/year | ton Cu/year | kg Cu/year |
| **Central Java Province** | | | | | | | | | | | | | | | | |
| GROBOGAN | 55.275 | 55.275 | 36.849.770 | 36.849.770 | 1.381.866 | 1.381.866 | 55.275 | 55.275 | - | - | 276.373 | 276.373 | 36.850 | 36.850 | 1.105 | 1.105 |
| BLORA | 32.038 | 32.038 | 21.358.352 | 21.358.352 | 800.938 | 800.938 | 32.038 | 32.038 | - | - | 160.188 | 160.188 | 21.358 | 21.358 | 641 | 641 |
| WONOGIRI | 6.721 | 6.721 | 4.480.916 | 4.480.916 | 168.034 | 168.034 | 6.721 | 6.721 | - | - | 33.607 | 33.607 | 4.481 | 4.481 | 134 | 134 |
| TEGAL | 494 | 494 | 329.643 | 329.643 | 12.362 | 12.362 | 494 | 494 | - | - | 2.472 | 2.472 | 330 | 330 | 10 | 10 |
| REMBANG | 418 | 418 | 278.551 | 278.551 | 10.446 | 10.446 | 418 | 418 | - | - | 2.089 | 2.089 | 279 | 279 | 8 | 8 |
| BREBES | 5 | 5 | 3.229 | 3.229 | 121 | 121 | 5 | 5 | - | - | 24 | 24 | 3 | 3 | 0 | 0 |
| KOTA TEGAL | 1 | 1 | 866 | 866 | 32 | 32 | 1 | 1 | - | - | 6 | 6 | 1 | 1 | 0 | 0 |
| **Total** | **94.952** | **94.952** | **63.301.328** | **63.301.328** | **2.373.800** | **2.373.800** | **94.952** | **94.952** | **-** | **-** | **474.760** | **474.760** | **63.301** | **63.301** | **1.899** | **1.899** |
| **East Java Province** | | | | | | | | | | | | | | | | |
| NGAWI | 10.085 | 13.640 | 6.723.023 | 9.093.516 | 252.113 | 341.007 | 10.085 | 13.640 | - | - | 50.423 | 68.201 | 6.723 | 9.094 | 202 | 273 |
| MOJOKERTO | 8.742 | 8.742 | 5.828.237 | 5.828.237 | 218.559 | 218.559 | 8.742 | 8.742 | - | - | 43.712 | 43.712 | 5.828 | 5.828 | 175 | 175 |
| JOMBANG | 2.098 | 2.098 | 1.398.734 | 1.398.734 | 52.453 | 52.453 | 2.098 | 2.098 | - | - | 10.491 | 10.491 | 1.399 | 1.399 | 42 | 42 |
| GRESIK | 2.011 | 2.011 | 1.340.832 | 1.340.832 | 50.281 | 50.281 | 2.011 | 2.011 | - | - | 10.056 | 10.056 | 1.341 | 1.341 | 40 | 40 |
| BANYUWANGI | 1.851 | 1.851 | 1.233.796 | 1.233.796 | 46.267 | 46.267 | 1.851 | 1.851 | - | - | 9.253 | 9.253 | 1.234 | 1.234 | 37 | 37 |
| MALANG | 1.688 | 1.688 | 1.125.169 | 1.125.169 | 42.194 | 42.194 | 1.688 | 1.688 | - | - | 8.439 | 8.439 | 1.125 | 1.125 | 34 | 34 |
| PACITAN | 603 | 603 | 402.104 | 402.104 | 15.079 | 15.079 | 603 | 603 | - | - | 3.016 | 3.016 | 402 | 402 | 12 | 12 |
| TULUNGAGUNG | 391 | 391 | 260.904 | 260.904 | 9.784 | 9.784 | 391 | 391 | - | - | 1.957 | 1.957 | 261 | 261 | 8 | 8 |
| BLITAR | 326 | 326 | 217.332 | 217.332 | 8.150 | 8.150 | 326 | 326 | - | - | 1.630 | 1.630 | 217 | 217 | 7 | 7 |
| PROBOLINGGO | 253 | 253 | 168.831 | 168.831 | 6.331 | 6.331 | 253 | 253 | - | - | 1.266 | 1.266 | 169 | 169 | 5 | 5 |
| KOTA MOJOKERTO | 3 | 3 | 1.728 | 1.728 | 65 | 65 | 3 | 3 | - | - | 13 | 13 | 2 | 2 | 0,05 | 0 |
| **Total** | **28.051** | **31.607** | **18.700.691** | **21.071.184** | **701.276** | **790.169** | **28.051** | **31.607** | **-** | **-** | **140.255** | **158.034** | **18.701** | **21.071** | **561** | **632** |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Cu |
| | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | Ton Gypsum/year | ton Cu/year |
| **Central Java Province** | | | | | | | | | | | | | | |
| GROBOGAN | 37.624 | 37.624 | 1.129 | 1.129 | 941 | 941 | 711 | 711 | 36.683 | 36.683 | 418 | 418 | 167 | 964 |
| BLORA | 21.807 | 21.807 | 654 | 654 | 545 | 545 | 412 | 412 | 21.262 | 21.262 | 242 | 242 | 97 | 559 |
| WONOGIRI | 4.575 | 4.575 | 137 | 137 | 114 | 114 | 86 | 86 | 4.461 | 4.461 | 51 | 51 | 20 | 117 |
| TEGAL | 337 | 337 | 10 | 10 | 8 | 8 | 6 | 6 | 328 | 328 | 4 | 4 | 1 | 9 |
| REMBANG | 284 | 284 | 9 | 9 | 7 | 7 | 5 | 5 | 277 | 277 | 3 | 3 | 1 | 7 |
| BREBES | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 |
| KOTA TEGAL | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| **Total** | **64.631** | **64.631** | **1.939** | **1.939** | **1.616** | **1.616** | **1.222** | **1.222** | **63.015** | **63.015** | **717** | **717** | **286** | **1.656** |
| **East Java Province** | | | | | | | | | | | | | | |
| NGAWI | 6.864 | 9.284 | 206 | 279 | 172 | 232 | 130 | 175 | 6.693 | 9.052 | 76 | 103 | 41 | 238 |
| MOJOKERTO | 5.951 | 5.951 | 179 | 179 | 149 | 149 | 112 | 112 | 5.802 | 5.802 | 66 | 66 | 26 | 153 |
| JOMBANG | 1.428 | 1.428 | 43 | 43 | 36 | 36 | 27 | 27 | 1.392 | 1.392 | 16 | 16 | 6 | 37 |
| GRESIK | 1.369 | 1.369 | 41 | 41 | 34 | 34 | 26 | 26 | 1.335 | 1.335 | 15 | 15 | 6 | 35 |
| BANYUWANGI | 1.260 | 1.260 | 38 | 38 | 31 | 31 | 24 | 24 | 1.228 | 1.228 | 14 | 14 | 6 | 32 |
| MALANG | 1.149 | 1.149 | 34 | 34 | 29 | 29 | 22 | 22 | 1.120 | 1.120 | 13 | 13 | 5 | 29 |
| PACITAN | 411 | 411 | 12 | 12 | 10 | 10 | 8 | 8 | 400 | 400 | 5 | 5 | 2 | 11 |
| TULUNGAGUNG | 266 | 266 | 8 | 8 | 7 | 7 | 5 | 5 | 260 | 260 | 3 | 3 | 1 | 7 |
| BLITAR | 222 | 222 | 7 | 7 | 6 | 6 | 4 | 4 | 216 | 216 | 2 | 2 | 1 | 6 |
| PROBOLINGGO | 172 | 172 | 5 | 5 | 4 | 4 | 3 | 3 | 168 | 168 | 2 | 2 | 1 | 4 |
| KOTA MOJOKERTO | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| **Total** | **19.093** | **21.514** | **573** | **645** | **477** | **538** | **361** | **407** | **18.616** | **20.976** | **212** | **239** | **95** | **551** |

## E1. Rice Field-High pH (Continued)

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Cu/year | kg Cu/year | ton Gypsum/year | kg Gypsum/year | ton Cu/year | kg Cu/year |
| **Yogyakarta Special Region Province** | | | | | | | | | | | | | | | | |
| GUNUNG KIDUL | 3.629 | 3.629 | 2.419.080 | 2.419.080 | 90.715 | 90.715 | 3.629 | 3.629 | - | - | 18.143 | 18.143 | 2.419 | 2.419 | 73 | 73 |
| **Total** | **3.629** | **3.629** | **2.419.080** | **2.419.080** | **90.715** | **90.715** | **3.629** | **3.629** | **-** | **-** | **18.143** | **18.143** | **2.419** | **2.419** | **73** | **73** |
| | | | | | | | | | | | | | | | | |
| **East Nusa Tenggara Province** | | | | | | | | | | | | | | | | |
| MANGGARAI | 1.822 | 1.822 | 1.214.593 | 1.214.593 | 45.547 | 45.547 | 1.822 | 1.822 | - | - | 9.109 | 9.109 | 1.215 | 1.215 | 36 | 36 |
| MALAKA | 1.496 | 1.496 | 997.143 | 997.143 | 37.393 | 37.393 | 1.496 | 1.496 | - | - | 7.479 | 7.479 | 997 | 997 | 30 | 30 |
| NAGEKEO | 1.000 | 1.000 | 666.481 | 666.481 | 24.993 | 24.993 | 1.000 | 1.000 | - | - | 4.999 | 4.999 | 666 | 666 | 20 | 20 |
| MANGGARAI BARAT | 712 | 712 | 474.678 | 474.678 | 17.800 | 17.800 | 712 | 712 | - | - | 3.560 | 3.560 | 475 | 475 | 14 | 14 |
| NGADA | 705 | 705 | 470.071 | 470.071 | 17.628 | 17.628 | 705 | 705 | - | - | 3.526 | 3.526 | 470 | 470 | 14 | 14 |
| ROTE NDAO | 546 | 546 | 364.232 | 364.232 | 13.659 | 13.659 | 546 | 546 | - | - | 2.732 | 2.732 | 364 | 364 | 11 | 11 |
| ALOR | 97 | 97 | 64.431 | 64.431 | 2.416 | 2.416 | 97 | 97 | - | - | 483 | 483 | 64 | 64 | 2 | 2 |
| KUPANG | 51 | 51 | 33.839 | 33.839 | 1.269 | 1.269 | 51 | 51 | - | - | 254 | 254 | 34 | 34 | 1 | 1 |
| SUMBA TIMUR | 9 | 9 | 5.864 | 5.864 | 220 | 220 | 9 | 9 | - | - | 44 | 44 | 6 | 6 | 0 | 0 |
| **Total** | **6.437** | **6.437** | **4.291.332** | **4.291.332** | **160.925** | **160.925** | **6.437** | **6.437** | **-** | **-** | **32.185** | **32.185** | **4.291** | **4.291** | **129** | **129** |
| **Updated Total Area, Indonesia, ha** | **136.624** | | **88.712** | | **3.327** | | | | | | | | | | | |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Cu | Updated Amount | Amount of Gypsum | Amount of Cu |
| | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | ton Gypsum/year | ton Gypsum/year | ton Cu/year | ton Cu/year | Ton Gypsum/year | ton Cu/year |
| | | | | | | | | | | | | | | |
| | 2.470 | 2.470 | 74 | 74 | 62 | 62 | 47 | 47 | 2.408 | 2.408 | 27 | 27 | 11 | 63 |
| | **2.470** | **2.470** | **74** | **74** | **62** | **62** | **47** | **47** | **2.408** | **2.408** | **27** | **27** | **11** | **63** |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | 1.240 | 1.240 | 37 | 37 | 31 | 31 | 23 | 23 | 1.209 | 1.209 | 14 | 14 | 5 | 32 |
| | 1.018 | 1.018 | 31 | 31 | 25 | 25 | 19 | 19 | 993 | 993 | 11 | 11 | 5 | 26 |
| | 680 | 680 | 20 | 20 | 17 | 17 | 13 | 13 | 663 | 663 | 8 | 8 | 3 | 17 |
| | 485 | 485 | 15 | 15 | 12 | 12 | 9 | 9 | 473 | 473 | 5 | 5 | 2 | 12 |
| | 480 | 480 | 14 | 14 | 12 | 12 | 9 | 9 | 468 | 468 | 5 | 5 | 2 | 12 |
| | 372 | 372 | 11 | 11 | 9 | 9 | 7 | 7 | 363 | 363 | 4 | 4 | 2 | 10 |
| | 66 | 66 | 2 | 2 | 2 | 2 | 1 | 1 | 64 | 64 | 1 | 1 | 0 | 2 |
| | 35 | 35 | 1 | 1 | 1 | 1 | 1 | 1 | 34 | 34 | 0 | 0 | 0 | 1 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 0 |
| | **4.381** | **4.381** | **131** | **131** | **110** | **110** | **83** | **83** | **4.272** | **4.272** | **49** | **49** | **19** | **112** |

| Total Market Potential for Java & Nusa Tenggara, Rice Field with High pH | | |
|---|---|---|
| Ton Cu/Year | | 1.032 |
| TAM Cu, Ton/Year | | 3.416 |
| Ton Gypsum/Year | | 90.671 |
| TAM Gypsum, Ton/Year | | 91.083 |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63% for Cu, 2,48% for Gypsum
7) Market Potential = PD - PCMS

***Assumptions:**

20% of users already applied Cu to their operations in each region

| | | |
|---|---|---|
| IP: | 2,5 | when 2 T/3 years dosage of Gypsum is applied |
| Gypsum recommended dosage | 2 T/3 years | |
| Pure Cu recommended dosage | 10 kg/season/ha | |

**Table E1-Zn. Market Potential of Zn Fertilizer based on Total Addressable Market, Actual Demand, Projected Demand and Projected Competitor's Market Share in Indonesia distributed among Identified Areas most likely requiring the fertilizers**

## E1. Rice Field-High pH

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year |
| **Central Java Province** | | | | | | | | | | | | | | | | |
| GROBOGAN | 55.275 | 55.275 | 36.849.770 | 36.849.770 | 2.072.800 | 2.072.800 | 55.275 | 55.275 | - | - | 414.560 | 414.560 | 36.850 | 36.850 | 1.658 | 1.658 |
| BLORA | 32.038 | 32.038 | 21.358.352 | 21.358.352 | 1.201.407 | 1.201.407 | 32.038 | 32.038 | - | - | 34.601 | 34.601 | 21.358 | 21.358 | 1.167 | 1.167 |
| WONOGIRI | 6.721 | 6.721 | 4.480.916 | 4.480.916 | 252.052 | 252.052 | 6.721 | 6.721 | - | - | 50.410 | 50.410 | 4.481 | 4.481 | 202 | 202 |
| TEGAL | 494 | 494 | 329.643 | 329.643 | 18.542 | 18.542 | 494 | 494 | - | - | 3.708 | 3.708 | 330 | 330 | 15 | 15 |
| REMBANG | 418 | 418 | 278.551 | 278.551 | 15.668 | 15.668 | 418 | 418 | - | - | 3.134 | 3.134 | 279 | 279 | 13 | 13 |
| BREBES | 5 | 5 | 3.229 | 3.229 | 182 | 182 | 5 | 5 | - | - | 36 | 36 | 3 | 3 | 0 | 0 |
| KOTA TEGAL | 1 | 1 | 866 | 866 | 49 | 49 | 1 | 1 | - | - | 10 | 10 | 1 | 1 | 0 | 0 |
| **Total** | **94.952** | **94.952** | **63.301.328** | **63.301.328** | **3.560.700** | **3.560.700** | **94.952** | **94.952** | **-** | **-** | **506.459** | **506.459** | **63.301** | **63.301** | **3.054** | **3.054** |
| | | | | | | | | | | | | | | | | |
| **East Java Province** | | | | | | | | | | | | | | | | |
| NGAWI | 10.085 | 13.640 | 6.723.023 | 9.093.516 | 378.170 | 511.510 | 560 | 500 | - | - | 2.520 | 2.700 | 6.723 | 9.094 | 376 | 509 |
| MOJOKERTO | 8.742 | 8.742 | 5.828.237 | 5.828.237 | 327.838 | 327.838 | 8.742 | 8.742 | - | - | 39.341 | 39.341 | 5.828 | 5.828 | 288 | 288 |
| JOMBANG | 2.098 | 2.098 | 1.398.734 | 1.398.734 | 78.679 | 78.679 | 2.098 | 2.098 | - | - | 9.441 | 9.441 | 1.399 | 1.399 | 69 | 69 |
| GRESIK | 2.011 | 2.011 | 1.340.832 | 1.340.832 | 75.422 | 75.422 | 2.011 | 2.011 | - | - | 9.051 | 9.051 | 1.341 | 1.341 | 66 | 66 |
| BANYUWANGI | 1.851 | 1.851 | 1.233.796 | 1.233.796 | 69.401 | 69.401 | 1.851 | 1.851 | - | - | 8.328 | 8.328 | 1.234 | 1.234 | 61 | 61 |
| MALANG | 1.688 | 1.688 | 1.125.169 | 1.125.169 | 63.291 | 63.291 | 1.688 | 1.688 | - | - | 7.595 | 7.595 | 1.125 | 1.125 | 56 | 56 |
| PACITAN | 603 | 603 | 402.104 | 402.104 | 22.618 | 22.618 | 603 | 603 | - | - | 2.714 | 2.714 | 402 | 402 | 20 | 20 |
| TULUNGAGUNG | 391 | 391 | 260.904 | 260.904 | 14.676 | 14.676 | 391 | 391 | - | - | 1.761 | 1.761 | 261 | 261 | 13 | 13 |
| BLITAR | 326 | 326 | 217.332 | 217.332 | 12.225 | 12.225 | 326 | 326 | - | - | 1.467 | 1.467 | 217 | 217 | 11 | 11 |
| PROBOLINGGO | 253 | 253 | 168.831 | 168.831 | 9.497 | 9.497 | 253 | 253 | - | - | 1.140 | 1.140 | 169 | 169 | 8 | 8 |
| KOTA MOJOKERTO | 3 | 3 | 1.728 | 1.728 | 97 | 97 | 3 | 3 | - | - | 12 | 12 | 2 | 2 | 0,09 | 0 |
| **Total** | **28.051** | **31.607** | **18.700.691** | **21.071.184** | **1.051.914** | **1.185.254** | **18.527** | **18.467** | **-** | **-** | **83.369** | **83.549** | **18.701** | **21.071** | **969** | **1.102** |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Zn | Updated Amount | Amount of Gypsum | Amount of Zn |
| | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Zn/year |
| **Central Java Province** | | | | | | | | | | | | | | |
| GROBOGAN | 37.624 | 37.624 | 1.693 | 1.693 | 941 | 941 | 1.067 | 1.067 | 36.683 | 36.683 | 626 | 626 | 167 | 1.446 |
| BLORA | 21.807 | 21.807 | 1.191 | 1.191 | 545 | 545 | 751 | 751 | 21.262 | 21.262 | 441 | 441 | 97 | 761 |
| WONOGIRI | 4.575 | 4.575 | 206 | 206 | 114 | 114 | 130 | 130 | 4.461 | 4.461 | 76 | 76 | 20 | 176 |
| TEGAL | 337 | 337 | 15 | 15 | 8 | 8 | 10 | 10 | 328 | 328 | 6 | 6 | 1 | 13 |
| REMBANG | 284 | 284 | 13 | 13 | 7 | 7 | 8 | 8 | 277 | 277 | 5 | 5 | 1 | 11 |
| BREBES | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 |
| KOTA TEGAL | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| **Total** | **64.631** | **64.631** | **3.118** | **3.118** | **1.616** | **1.616** | **1.965** | **1.965** | **63.015** | **63.015** | **1.154** | **1.154** | **286** | **2.407** |
| | | | | | | | | | | | | | | |
| **East Java Province** | | | | | | | | | | | | | | |
| NGAWI | 6.864 | 9.284 | 384 | 519 | 172 | 232 | 242 | 327 | 6.693 | 9.052 | 142 | 192 | 41 | 319 |
| MOJOKERTO | 5.951 | 5.951 | 295 | 295 | 149 | 149 | 186 | 186 | 5.802 | 5.802 | 109 | 109 | 26 | 219 |
| JOMBANG | 1.428 | 1.428 | 71 | 71 | 36 | 36 | 45 | 45 | 1.392 | 1.392 | 26 | 26 | 6 | 53 |
| GRESIK | 1.369 | 1.369 | 68 | 68 | 34 | 34 | 43 | 43 | 1.335 | 1.335 | 25 | 25 | 6 | 50 |
| BANYUWANGI | 1.260 | 1.260 | 62 | 62 | 31 | 31 | 39 | 39 | 1.228 | 1.228 | 23 | 23 | 6 | 46 |
| MALANG | 1.149 | 1.149 | 57 | 57 | 29 | 29 | 36 | 36 | 1.120 | 1.120 | 21 | 21 | 5 | 42 |
| PACITAN | 411 | 411 | 20 | 20 | 10 | 10 | 13 | 13 | 400 | 400 | 8 | 8 | 2 | 15 |
| TULUNGAGUNG | 266 | 266 | 13 | 13 | 7 | 7 | 8 | 8 | 260 | 260 | 5 | 5 | 1 | 10 |
| BLITAR | 222 | 222 | 11 | 11 | 6 | 6 | 7 | 7 | 216 | 216 | 4 | 4 | 1 | 8 |
| PROBOLINGGO | 172 | 172 | 9 | 9 | 4 | 4 | 5 | 5 | 168 | 168 | 3 | 3 | 1 | 6 |
| KOTA MOJOKERTO | 2 | 2 | 0,09 | 0 | 0,04 | 0 | 0,06 | 0 | 2 | 2 | 0,03 | 0 | 0 | 0 |
| **Total** | **19.093** | **21.514** | **989** | **1.125** | **477** | **538** | **623** | **709** | **18.616** | **20.976** | **366** | **416** | **95** | **769** |

## E1. Rice Field-High pH (Continued)

| Identified Areas 1) | | | TAM 2) | | | | Reducing Factors 3) | | | | | | AD 4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Total Area | Updated Total Area | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount |
| | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ha | ha | kg Gypsum/year | kg Gypsum/year | kg Zn/year | kg Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year |
| **Yogyakarta Special Region Province** | | | | | | | | | | | | | | | | |
| GUNUNG KIDUL | 3.629 | 3.629 | 2.419.080 | 2.419.080 | 136.073 | 136.073 | 3.629 | 3.629 | - | - | 27.215 | 27.215 | 2.419 | 2.419 | 109 | 109 |
| **Total** | **3.629** | **3.629** | **2.419.080** | **2.419.080** | **136.073** | **136.073** | **3.629** | **3.629** | **-** | **-** | **27.215** | **27.215** | **2.419** | **2.419** | **109** | **109** |
| | | | | | | | | | | | | | | | | |
| **East Nusa Tenggara Province** | | | | | | | | | | | | | | | | |
| MANGGARAI | 1.822 | 1.822 | 1.214.593 | 1.214.593 | 68.321 | 68.321 | 1.822 | 1.822 | - | - | 13.664 | 13.664 | 1.215 | 1.215 | 55 | 55 |
| MALAKA | 1.496 | 1.496 | 997.143 | 997.143 | 56.089 | 56.089 | 1.496 | 1.496 | - | - | 11.218 | 11.218 | 997 | 997 | 45 | 45 |
| NAGEKEO | 1.000 | 1.000 | 666.481 | 666.481 | 37.490 | 37.490 | 1.000 | 1.000 | - | - | 7.498 | 7.498 | 666 | 666 | 30 | 30 |
| MANGGARAI BARAT | 712 | 712 | 474.678 | 474.678 | 26.701 | 26.701 | 712 | 712 | - | - | 5.340 | 5.340 | 475 | 475 | 21 | 21 |
| NGADA | 705 | 705 | 470.071 | 470.071 | 26.442 | 26.442 | 705 | 705 | - | - | 5.288 | 5.288 | 470 | 470 | 21 | 21 |
| ROTE NDAO | 546 | 546 | 364.232 | 364.232 | 20.488 | 20.488 | 546 | 546 | - | - | 4.098 | 4.098 | 364 | 364 | 16 | 16 |
| ALOR | 97 | 97 | 64.431 | 64.431 | 3.624 | 3.624 | 97 | 97 | - | - | 725 | 725 | 64 | 64 | 3 | 3 |
| KUPANG | 51 | 51 | 33.839 | 33.839 | 1.903 | 1.903 | 51 | 51 | - | - | 381 | 381 | 34 | 34 | 2 | 2 |
| SUMBA TIMUR | 9 | 9 | 5.864 | 5.864 | 330 | 330 | 9 | 9 | - | - | 66 | 66 | 6 | 6 | 0,26 | 0 |
| **Total** | **6.437** | **6.437** | **4.291.332** | **4.291.332** | **241.387** | **241.387** | **6.437** | **6.437** | **-** | **-** | **48.277** | **48.277** | **4.291** | **4.291** | **193** | **193** |
| | | | | | | | | | | | | | | | | |
| **Total Area, Indonesia, ha** | **133.069** | | **88.712** | | **4.990** | | | | | | | | | | | |

| Identified Areas 1) | PD 5) | | | | PCMS 6) | | | | Market Potential for PT MCG 7) | | | | Gap TAM - MP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province; Regency/Sub-District | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount | Updated Amount | Amount of Gypsum | Updated Amount | Amount of Zn | Updated Amount | Amount of Gypsum | Amount of Zn |
| | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Gypsum/year | ton Zn/year | ton Zn/year | ton Gypsum/year | ton Zn/year |
| **Yogyakarta Special Region Province** | | | | | | | | | | | | | | |
| GUNUNG KIDUL | 2.470 | 2.470 | 111 | 111 | 62 | 62 | 70 | 70 | 2.408 | 2.408 | 41 | 41 | 11 | 95 |
| **Total** | **2.470** | **2.470** | **111** | **111** | **62** | **62** | **70** | **70** | **2.408** | **2.408** | **41** | **41** | **11** | **95** |
| | | | | | | | | | | | | | | |
| **East Nusa Tenggara Province** | | | | | | | | | | | | | | |
| MANGGARAI | 1.240 | 1.240 | 56 | 56 | 31 | 31 | 35 | 35 | 1.209 | 1.209 | 21 | 21 | 5 | 48 |
| MALAKA | 1.018 | 1.018 | 46 | 46 | 25 | 25 | 29 | 29 | 993 | 993 | 17 | 17 | 5 | 39 |
| NAGEKEO | 680 | 680 | 31 | 31 | 17 | 17 | 19 | 19 | 663 | 663 | 11 | 11 | 3 | 26 |
| MANGGARAI BARAT | 485 | 485 | 22 | 22 | 12 | 12 | 14 | 14 | 473 | 473 | 8 | 8 | 2 | 19 |
| NGADA | 480 | 480 | 22 | 22 | 12 | 12 | 14 | 14 | 468 | 468 | 8 | 8 | 2 | 18 |
| ROTE NDAO | 372 | 372 | 17 | 17 | 9 | 9 | 11 | 11 | 363 | 363 | 6 | 6 | 2 | 14 |
| ALOR | 66 | 66 | 3 | 3 | 2 | 2 | 2 | 2 | 64 | 64 | 1 | 1 | 0 | 3 |
| KUPANG | 35 | 35 | 2 | 2 | 1 | 1 | 1 | 1 | 34 | 34 | 0,58 | 1 | 0 | 1 |
| SUMBA TIMUR | 6 | 6 | 0,27 | 0 | 0,15 | 0 | 0,17 | 0 | 6 | 6 | 0,10 | 0 | 0 | 0 |
| **Total** | **4.381** | **4.381** | **197** | **197** | **110** | **110** | **124** | **124** | **4.272** | **4.272** | **73** | **73** | **19** | **168** |

| Updated Total Market Potential for Java & Nusa Tenggara, Rice Field with High pH | | |
|---|---|---|
| Ton Zn/Year | | **1.684** |
| TAM Zn, Ton/Year | | **5.123** |
| Ton Gypsum/Year | | **90.671** |
| TAM Gypsum, Ton/Year | | **91.083** |

1) Based on digital soil mapping
2) Total Adressable Market = Identified Areas x Recommended dose
3) Risk preference, purchasing power, attitude toward innovation, etc derived from quessionaires
4) Actual Demand = TAM - Reducing Factors
5) Projected Demand = AD x Growt Rate; Growth rate was deducted from trend in import of the fertilizer raw materials
6) Projected Competitor's Market Share = assumed to be 63% for Cu, 2,48% for Gypsum
7) Market Potential = PD - PCMS

***Assumptions:**

20% of users already applied Cu to their operations in each region

| | | |
|---|---|---|
| IP: | 2,5 | when 2 T/3 years dosage of Gypsum is applied |
| Gypsum recommended dosage | 2 T/3 years | |
| Pure Zn recommended dosage | 15 kg/season/ha | |

## Recapitulation of Total Addressable Market and Potential Market of Cu & Zn Micronutrient Fertilizers and Gypsum Soil Enhancers in Indonesia In Pure and Commonly Distributed Form

| Pure Cu | | | Updated | | CuSO4 | | Cu-EDTA | |
|---|---|---|---|---|---|---|---|---|
| Commodity/Land Type or Classification | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market |
| | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year |
| **Ricefield** | | | | | | | | |
| Intensive Farming | 25.892 | 9.528 | 30.595 | 11.305 | 117.675 | 43.480 | 203.969 | 75.366 |
| High-pH Soil | 3.327 | 1.005 | 3.416 | 1.032 | 13.137 | 3.970 | 22.771 | 6.882 |
| Tide-affected Soil | 4.738 | 1.775 | 4.805 | 1.800 | 18.479 | 6.924 | 32.030 | 12.002 |
| Seawater Intrusion-affected Soil | 784 | 296 | 742 | 280 | 2.852 | 1.078 | 4.944 | 1.868 |
| Total | 34.741 | 12.605 | 39.557 | 14.418 | 152.143 | 55.453 | 263.714 | 96.118 |
| **Horticultural Commodity** | | | | | | | | |
| Red Onion/Shallot | 10 | 3 | 263 | 43 | 1.011 | 164 | 1.752 | 284 |
| Potato | 11 | 2 | 715 | 135 | 2.749 | 519 | 4.765 | 899 |
| Big Chili Pepper | 24 | 4 | 134 | 25 | 515 | 96 | 893 | 167 |
| Small Chili Pepper | 24 | 4 | | | | | | |
| Total | 69 | 14 | 1.112 | 202 | 4.275 | 779 | 7.410 | 1.350 |
| **Oil Palm Plantation** | | | | | | | | |
| Smallholder | 8.289 | 2.493 | 8.289 | 2.493 | 31.882 | 9.588 | 55.263 | 16.618 |
| Corporate | 4.273 | 797 | 4.273 | 797 | 16.435 | 3.065 | 28.487 | 5.313 |
| Total | 12.562 | 3.290 | 12.562 | 3.290 | 48.317 | 12.653 | 83.749 | 21.932 |
| **Industrial Forest** | 417 | 92 | 417 | 92 | 1.604 | 354 | 2.780 | 613 |
| **Ex-mined Land, Revegetation** | 0 | 0 | 0 | 0 | - | - | | |
| **Total Cu; Indonesia** | 47.789 | 16.000 | 53.648 | 18.002 | **206.339** | **69.238** | **357.654** | **120.013** |

| Pure Zn | | | Updated | | ZnSO4 | | Zn-EDTA | |
|---|---|---|---|---|---|---|---|---|
| Commodity/Land Type or Classification | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market |
| | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year |
| **Ricefield** | | | | | | | | |
| Intensive Farming | 38.837 | 14.088 | 45.893 | 16.719 | 127.481 | 46.442 | 458.931 | 167.190 |
| High-pH Soil | 4.765 | 1.471 | 5.123 | 1.684 | 14.232 | 4.678 | 51.234 | 16.841 |
| Tide-affected Soil | 3.159 | 1.183 | 4.805 | 1.805 | 13.346 | 5.015 | 48.045 | 18.052 |
| Seawater Intrusion-affected Soil | 784 | 295 | 742 | 280 | 2.060 | 777 | 7.416 | 2.798 |
| Total | 47.546 | 17.037 | 56.563 | 20.488 | 157.118 | 56.911 | 565.627 | 204.881 |
| **Horticultural Commodity** | | | | | | | | |
| Red Onion/Shallot | 25 | 8 | 657 | 130 | 1.825 | 361 | 6.571 | 1.301 |
| Potato | 34 | 6 | 1.072 | 203 | 2.978 | 563 | 10.720 | 2.026 |
| Big Chili Pepper | 50 | 9 | 201 | 38 | 558 | 106 | 2.010 | 380 |
| Small Chili Pepper | 45 | 8 | | | | | | |
| Total | 154 | 32 | 1.930 | 371 | 5.362 | 1.030 | 19.302 | 3.707 |
| **Oil Palm** | | | | | | | | |
| Smallholder | 11.148 | 4.189 | 11.148 | 4.189 | 30.967 | 11.636 | 111.480 | 41.890 |
| Corporate | 2.848 | 531 | 2.848 | 531 | 7.911 | 1.475 | 28.480 | 5.310 |
| Total | 13.996 | 4.720 | 13.996 | 4.720 | 38.878 | 13.111 | 139.960 | 47.200 |
| **Industrial Forest** | 278 | 76 | 278 | 76 | 772 | 211 | 2.780 | 760 |
| **Ex-mined Land, Revegetation** | 0 | 0 | 0 | 0 | - | - | - | - |
| **Total Zn; Indonesia** | 61.974 | 21.865 | 72.767 | 25.655 | **202.130** | **71.263** | **727.668** | **256.548** |

**Recapitulation of Total Addressable Market and Potential Market of Cu & Zn Micronutrient Fertilizers and Gypsum Soil Enhancers in Indonesia In Pure and Commonly Distributed Form (Continued)**

| Gypsum | | | Updated | |
|---|---|---|---|---|
| Commodity/Land Type or Classification | Total Addressable Market | Potential Market | Total Addressable Market | Potential Market |
| | Ton/year | Ton/year | Ton/year | Ton/year |
| **Ricefield** | | | | |
| High-pH Soil | 88.712 | 88.311 | 91.083 | 90.671 |
| Seawater Intrusion-affected Soil | 69.706 | 69.391 | 65.923 | 65.625 |
| **Total Gypsum; Indonesia** | 158.419 | 157.702 | 157.006 | 156.295 |

| Commonly Distributed Form | Mass in Commercial Form (kg) | In Pure Micronutrient (kg) | Conversion Factor |
|---|---|---|---|
| CuSO4 | 10 | 2,6 | 3,85 |
| ZnSO4 | 10 | 3,6 | 2,78 |
| CuEDTA | 10 | 1,5 | 6,67 |
| ZnEDTA | 10 | 1 | 10,00 |

# Appendix 4.

# Documentation of Field Verification Activities

**DOCUMENTATION OF FIELD VERIFICATION IN BOJONEGORO REGENCY-EAST JAVA PROVINCE**


**Condition of intensive rice field with CI >= 2, District Sumberrejo, Bojonegoro**


**Condition of intensive rice field with CI >= 3, District Kanor, Bojonegoro**


**Interview with farmer (Rusman), member of farmers group "Sido Makmur", District Kanor, Bojonegoro**


**Farmer's (Rusman) paddy condition, member of farmers group "Sido Makmur", District Kanor, Bojonegoro**

**DOCUMENTATION OF FIELD VERIFICATION IN TUBAN REGENCY-EAST JAVA PROVINCE**


**Condition of seawater intrusion affected rice field, District Palang, Tuban**


**Condition of seawater intrusion affected rice field, District Palang, Tuban**


**Interview w/ farmers and head of Dusun Caper (Sukalam), Cepokorejo village, District Palang, Tuban**


**Interview with farmer (Tamat), chief of farmers group "Trimulyo Tani", District Widang, Tuban**

**DOCUMENTATION OF FIELD VERIFICATION IN GRESIK REGENCY-EAST JAVA PROVINCE**


**Condition of seawater intrusion affected rice field, District Bungah, Gresik**


**Condition of seawater intrusion affected rice field, District Bungah, Gresik**


**Condition of high pH rice field, District Panceng, Gresik**


**Condition of high pH rice field, District Sidayu, Gresik**

**DOCUMENTATION OF FIELD VERIFICATION IN NGANJUK REGENCY-EAST JAVA PROVINCE (INTENSIVE RICEFIELD)**


**Condition of intensive rice field, District Prambon, Nganjuk**


**Condition of intensive rice field, District Prambon, Nganjuk**


**Condition of intensive rice field, District Ngronggot, Nganjuk**


**Condition of intensive rice field, District Ngronggot, Nganjuk**

**DOCUMENTATION OF FIELD VERIFICATION IN BREBES REGENCY-CENTRAL JAVA PROVINCE (HORTICULTURE)**


**Coordinaating site visit w/ Dept. of Agriculture & Food Security, Brebes**


**Surjan system applied by some red onion farmers at District Kedunguler, Brebes**


**Surjan system and yield product from red onion in Brebes**


**Visit to agricultural kiosk in Brebes**

**DOCUMENTATION OF FIELD VERIFICATION IN NGAWI REGENCY-EAST JAVA PROVINCE**


**Coordinaating site visit w/ Dept. of Agriculture & Food Security, Ngawi, attended by Dept. Head and staffs**


**Interview with Bapak Sutrisno, member of farmers group Tani Makmur, Bulang, District Kartoharjo, Ngawi**


**Ground check at Pak Sutrisno's high pH soil ricefield at Sukowiyono, District Padas, Ngawi**



**Fungal infection on Pak Supriyanto's (farmers group Tani Makmur) paddy,Sukowiyono, District Padas, Ngawi**

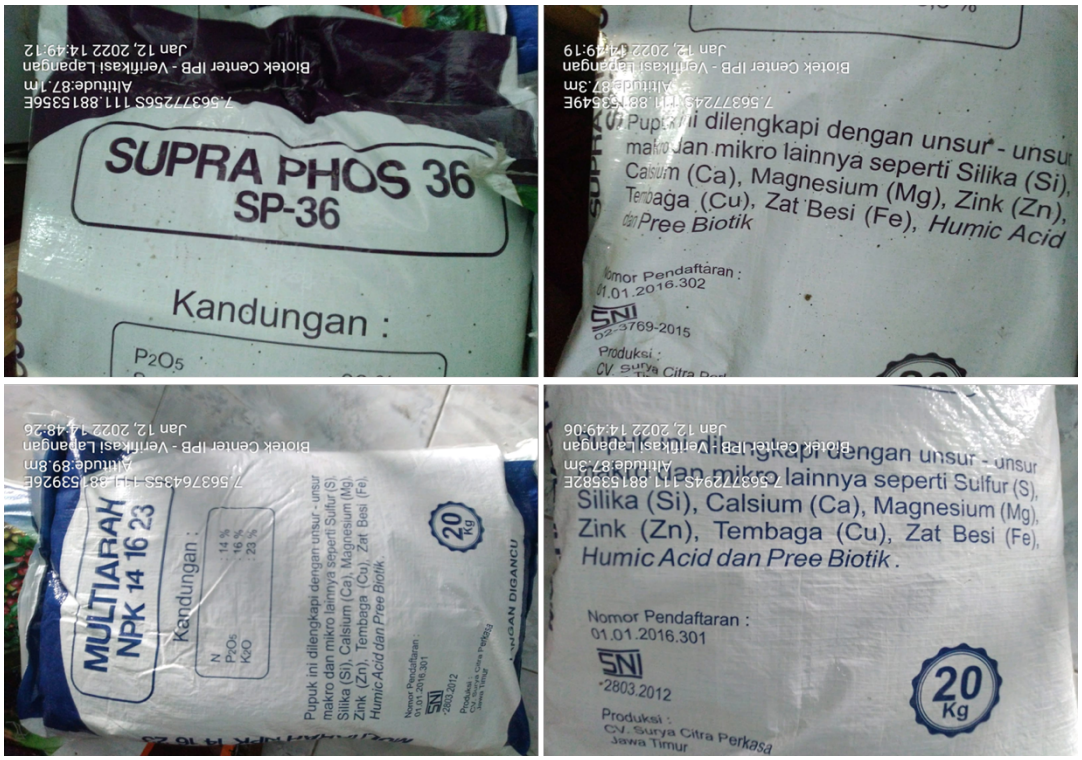

**Dr. Chendy explaining about problems related to high pH ricefields**

**DOCUMENTATION OF FIELD VERIFICATION IN NGANJUK REGENCY-EAST JAVA PROVINCE (HORTICULTURE)**


**Coordinaating site visit w/ Dept. of Agriculture & Food Security, Nganjuk, attended by Dept. Head and staffs**


**Interview w/ Bapak Akat (member of farmers group Luru Luhur), Sukorejo, District Rejoso, Nganjuk**


**Condition of red onions in District Rejoso, Nganjuk**




**Different types of fertilizers available at Pak Akat's warehouse (farmers group chief at District Rejoso, Nganjuk): NPK Fertilizer "Mutiara" has formulation of NPK+TE = 14:16:23+TE incl. Zn dan Cu**

**DOCUMENTATION OF FIELD VERIFICATION IN BATU CITY AND MALANG REGENCY-EAST JAVA PROVINCE**


**Coordinaating site visit w/ Dept. of Agriculture and Horticulture, Batu, attended by Dept. head and staffs**


**Interview w/ Bapak Joni (horticulture farmer) in Sumber Brantas, District Bumiaji, Kota Batu**


**Planted potatoes in District Bumiaji, Batu City**


**Planted potatoes of Pak Joni (chief of farmers group Sumber Brantas), District Bumiaji, Batu City**

## DOCUMENTATION OF FIELD VERIFICATION IN BATU CITY AND MALANG REGENCY-EAST JAVA PROVINCE (CONT.)


**Application of fungicide w/ aktif compound of Cu, forming sediment on potato field canal, District Bumiaji, Batu City**


**Interview results verification w/ Bapak Marsudi (horticulture farmer), farmers group Sumber Brantas**


**Horticultural crops in District Karang Ploso, Malang Regency**


**Horticultural crops in District Karang Ploso, Malang Regency**

## DOCUMENTATION OF FIELD VERIFICATION IN BREBES REGENCY-CENTRAL JAVA PROVINCE (SEAWATER INTRUSED RICEFIELD)

**Discussion w/ Dept. of Agriculture & Food Security, Brebes**


**Discussion w/ head of Badan Penyuluhan Pertanian, Dept. of Agriculture & Food Security, Brebes**


**Discussion w/ head of Badan Penyuluhan Pertanian (BPP), Dept. of Agriculture & Food Security, Brebes**


**Visit to BPP office, Dept. of Agriculture & Food Security, Brebes**

## DOCUMENTATION OF FIELD VERIFICATION IN DEMAK REGENCY-CENTRAL JAVA PROVINCE

**Discussion w/ Head and staffs of Dept. of Agriculture, Demak**

**Discussion w/ head of Food Crops Section, Dept. of Agriculture, Demak**


**Discussion w/ BP3K functionaries, District Kebonagung, Demak**

**Condition of ricefield in District Wonosalam, Demak**

**DOCUMENTATION OF FIELD VERIFICATION IN GROBOGAN REGENCY-CENTRAL JAVA PROVINCE**


**Discussion w/ Head of Dept. of Agriculture, Grobogan**


**Discussion w/ Dept. of Agriculture staffs and farmer, Dept. of Agriculture Office, Grobogan**

**Condition of ricefield in Grobogan**

**Condition of ricefields in District Godong, Grobogan**

## DOCUMENTATION OF FIELD VERIFICATION IN BLORA REGENCY-CENTRAL JAVA PROVINCE

**Discussion w/ Head of Dept. of Agriculture, Livestock and Fisheries, Blora**

**Discussion & verification w/ staffs of Dept. of Agriculture, Livestock and Fisheries, and farmer, Blora**


**Visit to Dept. of Agriculture, Livestock and Fisheries Office, Blora**

**Ground check and visit to farmer in District Kedungtuban, Blora**

## DOCUMENTATION OF FIELD VERIFICATION IN SIAK REGENCY-RIAU PROVINCE

**Discussion w/ Dept. of Agriculture and Plantation staffs, Siak**

**Discussion w/ Dept. of Agriculture and Plantation staffs, Siak**

**Interview w/ chief, administators, and members of farmers group "Manunggal Sakti", Siak**


**Visit to Dept. of Agriculture and Plantation office, Siak**


**Visit to farmers group "Manunggal Sakti" office, Siak**

## DOCUMENTATION OF FIELD VERIFICATION IN KAMPAR REGENCY-RIAU PROVINCE

**Discussion w/ Secretary and staffs of Dept. of Plantation, Livestock, and Animal Health, Kampar**

**Discussion w/ Secretary and staffs of Dept. of Plantation, Livestock, and Animal Health, Kampar**

**Visit to Dept. of Plantation, Livestock, and Animal Health office, Kampar**

**Ground check and site visit to plantation of Farmers Cooperation "Petapahan Maju Bersama", Kampar**

## DOCUMENTATION OF FIELD VERIFICATION IN PULANG PISAU REGENCY-CENTRAL KALIMANTAN PROVINCE


**Discussion w/ Section Head of Dept. of Agriculture, Pulang Pisau**


**Discussion w/ Head of Plantation Section, Dept. of Agriculture, Pulang Pisau**



**Discussion and site visit at PT Atas Sawit Perkasa plantation area, District Jabiren, Pulang Pisau**


**Discussion w/ R & D staffs of PT Kencana Mas, District Kanamit, Pulang Pisau**


**Discussion w/ chief of farmers group (Tani Karya Dadi) Pantik Village, District Pandih Batu, Pulang Pisau**


**Discussion w/ chief of farmers group (Mandiri Bersama) Belanti Siam Village, District Pandih Batu, Pulang Pisau**

## DOCUMENTATION OF FIELD VERIFICATION IN KAPUAS REGENCY-CENTRAL KALIMANTAN PROVINCE


**Discussion w/ Head of Plantation Production Section, Dept. of Agriculture, Kapuas**



**Bound to Mulya Channel using speedboat to discuss w/ farmers group "Mulya Tani" & BPP of District Bataguh, Kapuas**




**Condition of paddy rice on fields affected by swamp tides, of farmers group (Mulya Tani), at Terusan Mulya Village, District Bataguh, Kapuas**