Fertilizer and Oil Palm in Indonesia

An overview of the industry and challenges for small-scale oil palm farmer applications

May 2013

Prepared for Solidaridad Network

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Summary

The palm oil industry has enjoyed tremendous recent success in agricultural development in many countries, including Indonesia, where it has proved to be effective agent of development in remote rural areas. Development of oil palm plantations has occurred quickly in Indonesia in the past quarter century, from approximately 261 thousand hectares in 1979 to about 8.5 million hectares in 2012, of which approximately 40 percent is owned by smallholder farmers.

Although the potential for palm oil production could reach nine tons of crude palm oil (CPO)/hectare/year, the average national productivity level is still low at approximately 3.4 tons/hectares/year. Small scale plantations run by smallholders have even lower productivity. The low productivity is caused by a variety of factors, often regional and smallholder contingent, and include the use of fake seeds and poor application of fertilizer, or no fertilization at all. Fertilization is the most important factor in maintenance of oil palm plantations, with almost 60 percent of plantation maintenance cost being the fertilizer component.

Given that many leading oil palm plantations have to manage significant fertilization problems, and especially so in peat land developments, this aspect of plantation cultivation is particularly difficult for independent small scale cultivation. In general, smallholders[1] have poor knowledge and skills relating to oil palm cultivation (good agriculture practices or GAP), have challenges in accessing quality fertilizer, and face high fertilizer prices. These issues are compounded by overall poor farmer cash flow management at the plot level and the rampant issues of counterfeit and fake fertilizer.

The Indonesian government has tried to help smallholders by providing subsidized fertilizer. However, this program has experienced challenges in the planning, distribution, take-up, and monitoring aspects of its delivery to the plot level. Various cases are found in the field, including (a) delay of fertilizer delivery based on the 'Definitive Plan of the Farmer Group Needs' (DPGN) report, which is required for fertilizer distribution to farmer's groups; (b) fertilizer sales that at a higher price than the recommended retail price (HRP); (c) competition for fertilizer usage and leakage to/with other crops; and (d) the leakage of subsidized fertilizer from the system throughout the supply chain away from smallholders.

Recommendations for how to overcome these challenges are discussed at the end of this paper. One of the main suggestions is to increase efforts to establish and strengthen the group management of local community oil palm farmers. Farmers in a formally defined farmer's group have easier access to technology packages and will be able to avail themselves of the facilities and benefits of government programs, including access to subsidized fertilizers. Strengthening the farmer's group is considereds especially urgent because about 1.5 million hectares of small scale oil palm plantations will, in the near

[1] The report will use the phrase small farmer to describe smallholders with plots of less than 25 hectares.

future, be ready for replanting, which is essential in order to avoid repeating old mistakes (e.g. low quality seeds) in the second and third cycle (*sirclus*) of oil palm cultivation. In addition - and further complicating matters in terms of cultivation - the development of oil palm plantations have more recently been on more marginal land, less, or not as suitable for oil palm cultivation which has added to small farmer cultivation challenges.[2] These issues are critical to better livelihood outcomes for independent smallholder farmers in Indonesia.

The paper is structured in the following manner. The introduction highlights the importance of oil palm industry to Indonesia and the fast growing involvement of small farmers. The palm's need for fertilizer is then elaborated for the establishment of the plantation (known as the immature stage) and then the impact of fertilizer at the mature or fruiting stage is discussed. Here, fertilizer recommendations for dosage and type is developed using leaf analysis and agronomical information from the field. Both of these are important to ensure the efficiency of nutrient uptake and impacts, yet independent smallholders are not often able to avail themselves of this process. The use of oil palm empty fruit bunches (EFB) and compost is also discussed in line with the possibility to reduce the need for synthetic fertilizers for smallholders and the challenges smallholders face in obtaining EFB.

Other problems faced by smallholders are then discussed in more detail, including the lack of understanding of the farmers in GAP and poor access of farmers to fertilizers. Three cases studies are presented which evaluate and describe the challenges faced with the fertilizer subsidy system for smallholders in the field. The case studies discuss the government subsidized fertilizer program, its implementation on the ground, and why this program has had such mixed results.

The paper concludes by emphasizing the importance of fertilizer application to obtain maximum yielding oil palm results, and that smallholders need assistance from multiple stakeholders to fully benefit from this wonder crop. In the quest for low carbon, high yielding oil palm development in Indonesia, a failure to address some of the salient points and explanations about smallholder oil palm fertilizer challenges in this paper means that it will be increasingly difficult for Indonesia to reach its low emissions, pro-growth national government development outcomes.

[2] The authors acknowledge that fertiliser producers who have developed fertiliser specifically for peat, and other horticultural researchers, may disagree with this statement; other suggest that yields are able to reach 27 t/Ha/yr in peatland oil palm development. See 'Lahan Gambut untuk Kesejahteraan Rakyat', *Hortus*, 8 (5), 26-29; 'Potensi Sawit di Lahan Gambut, *Hortus* 8(5), 28-35.

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1. Introduction[3]

Seen from various perspectives, the oil palm (*Elaeis guineensis*) is a critical commodity and industry for Indonesia. It is a significant source of national income; a major provider of employment (particularly in rural areas where poverty and isolation are common); as a provider of people's basic needs such as cooking oil; and as an industry growth driver that supports a myriad of other businesses in rural areas. The palm oil industry plays a critical strategic role in equitable rural development because about 40 percent of the total 8.5 million hectares of oil palm plantations are owned by smallholders in various guises and plantation schemes.[4]

Smallholder plantations have continued to increase since the 1980s as the positive impact of the Nucleus Estate Scheme (NES) introduced by the government and the increasing number of successful farmers of palm oil began to be seen by other farmers. This has resulted in increasing numbers of motivated farmers switching to cultivating oil palm in an independent smallholder fashion. In 1979, only about 1 percent of oil palm plantations were owned by smallholders out of a total of 261 thousand hectares (Director General of Plantations, 2006), while by 2012 this number is estimated to have reached about 40 percent of the total approximately 8.5 million hectares. However, about 1.5 million hectares of the small farmer's oil palm plantations now have to be rejuvenated and replanted, which will require a new pattern of development using new seed technology and the application of best cultivation techniques so that yields can be increased (Kartasasmita, quoted in Media Perkebunan magazine, February 2013). It is a significant challenge for smallholders both those linked directly to plantations (*plasma*) and independent smallholders (*swadaya*).

This paper is intended to review some of the main fertilizing challenges and problems experienced by small scale oil palm farmers on the ground both from technical aspects as well as in regards to access to quality fertilizer. From this discussion, the paper will offer suggestions for input in policy making or preparation of development programs so that small scale farmers can increase their knowledge and awareness of the importance of fertilizers and also provide some potential avenues for addressing the complex issue of fertilizer availability in rural areas. The discussion here focuses primarily on independent

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[4] Smallholders in this context are those farmers managing less than 25 hectares per household (HH), with most smallholders having a cumulative total of approximately 2 hectares (ha) per household (HH). Variety is endemic. For more information on plantation schemes see Badrun (2010); McCarthy, Gillespie and Zen (2011).

smallholders as they face more complex problems given they are not formally affiliated to a plantation company and mill. *Plasma* smallholder farmers are *relatively* more fortunate because they have the ease of access to technology through its proximity to the company plantation.

2. Fertilizer and Oil Palm in Indonesia: An Overview

2.1 Use of Conventional Fertilizer

Crop productivity in oil palm is largely influenced by effective fertilization, and fertilization is the most important component to oil palm plantation upkeep. It is costly however; up to 60 percent of total maintenance cost of a plot is related to fertilizer application aspects, and this cost increases with the increase of fertilizer prices and associated transportation and labor costs. Fertilizer demand per unit area also increases in line with the cultivation cycle in some areas of Indonesia, which are now up to the fourth generation of planting. Although changes in the soil structure and chemical fertility occur slowly, the depletion of soil fertility is a growing related concern in Indonesian oil palm development, in particular relating to potassium (K) and the toxicity of aluminum (Al). These issues become more profound on marginal lands with hilly topography and peatlands, which are often areas used by independent small farmer for areas of cultivation. Attention to fertilization to meet specific location conditions has become increasingly important in recent years as plantations have been planted on marginal land with low fertility rates.

Fertilization is critically important in the cultivation of oil palm for the maximum realization of the potential crop production. It is essential for providing required plant mineral nutrients in sufficient quantity, availability, and in creating the appropriate balanced composition for plant growth and development. For the nursery phase and during the phase of immaturity before the fruit is harvesting, fertilization is required to enable the palm tree to grow and develop to form the requisite structure and biomass that will support the harvesting phase for years to come. Negligent fertilization in the immature phase will slow plant growth and development considerably, so that the phase of immaturity prior to harvesting is longer than the typical three years.

To maximize the benefits of fertilization on oil palm, a well known Indonesian plantation adage is the “6 Rights” principles. This relates to the right quality, the right dosage (amount), the right type, the right time, the right target, and the right price. Fertilizer

requirements for oil palm plantations are usually divided into the specific phases of plant growth and development in the field: in the nursery, at the stage of immature plantations (IP) and then at the mature stage (fruiting phase). In order to meet the demand for nutrients in the mature stage, fertilizer requirements (types and dosages) are determined based on agronomic recommendations made by considering various factors such as soil conditions (soil analysis), the levels of nutrients in the leaves (laboratory analysis), planting conditions, the fertilization history, the age of the plant and the production targets. Although not ideal, in the absence of fertilizer recommendations for specific locations, the general fertilizer dosage guidelines below for Indonesian oil palm plantations can be used (Table 1 and 2 below).

Table 1 Standard fertilizer dosage for oil palm in a main nursery

Age (week)	Type and Fertilizer Dosage (g)		
	NPKMg 15:15:6:4	NPKMg 12:12:17:2	Kieserit
14-15	2.5	-	-
16-17	5.0	-	-
18-20	7.5	-	-
22-24	10.0	-	-
26	-	10	-
28	-	10	5
30	-	10	-
32	-	10	5
34	-	15	-
36	-	15	7.5
38	-	15	-
40	-	15	7.5
42	-	20	-
44	-	20	10
46	-	20	-
48	-	20	10
50	-	25	-
52	-	25	10

Table 2

Standard Fertilizer for immature stage

Age (month)*	Fertilizer Dosage (g/palm)					
	ZA	TSP	RP	MOP	Kiserit	HGF-B
Hole	-	-	500	-	-	-
1	100	-	-	-	-	-
3	250	100	-	150	100	-
5	250	100	-	150	100	-
8	250	200	-	350	250	20
12	500	200	-	350	250	-
16	500	200	-	500	500	30
20	500	200	-	500	500	-
24	500	200	-	750	500	50
28	750	300	-	750	750	-
32	750	300	-	1,000	750	-
Total	**4,350**	**1,800**	**500**	**4,500**	**3,700**	**100**

*Explanation : * After planting in the field*

Standard Fertilizser for mature stage

Age Groups (Year)*	Fertilizer Dosage **(kg/palm/year)**				
	Urea	TSP-36	MOP	Kiserit	Jumlah
3 – 8	2.00	1.50	1.50	1.00	6.00
9 – 13	2.75	2.25	2.25	1.50	8.75
14 – 20	2.50	2.00	2.00	1.50	8.00
21 – 25	1.75	1.25	1.25	1.00	5.25

*dosages of fertilizer for immature and mature palm need to be adapted to the soil conditions. Source: Indonesian Oil Palm Research Institute, Medan

The tables above demonstrates how the nutrient composition and the type of fertilizer are important factors in ongoing plant development. For oil palm seedlings, the compound fertilizer NPK-Mg is desirable because smaller amounts of fertilizer are required and application is easier. Further, the effects of some slow release fertilizers such as NPK-Mg within the compound is found to be beneficial to plants to supply nutrients and seedlings in a way that results in further increases in growth.

The application of fertilizer in the immature phase of the palm is mostly undertaken across Indonesia using common dosages, but to maximize output it is recommended to adjust the dose to the prevailing soil and land conditions. Leading plantation companies in Indonesia undertake specific adjustments based upon location specifics. In addition, to maximize yields, it is necessary for the fertilization of legume cover crops surrounding the plants as well until the age of 1.5 years as per the general dosage requirements outlined in Table 3 below. Such a process is rarely undertaken by independent smallholders.

Table 3. General dose (standard) for legume cover crop

Age (month)	Type and Fertilizer Dosage (g)		
	Dolomite	Urea	TSP
Before Planting	400	-	-
1		15	30
6		-	60
12		-	120
18	-		120
Total	**400**	**15**	**330**

Source: Indonesian Oil Palm Research Institute, Medan.

Unlike the immature palms, the dynamic factors of plant growth, soil type, and nutrient status become more important in mature palms. In this case the recommendations are usually made for each year by taking into account the condition of the soil, leaf analysis results, the realization of previous fertilization attempts and results, and the age of the plant. Thus the standard doses shown in Table 1 are a general guide. From this recommendation, it demonstrates that fertilizer requirements for oil palm plantations are high, ranging from 6 to 9 kg/tree/year. With an average number of 143 palms per hectare average, the need reaches 858 to 1,287 kg/ha/year. It is clear from the numbers and the process of measurement that the ability to undertake professional recording and documentation storing is a critical part of good plantation management.

Besides the actual amount of fertilizer as described above, the type of fertilizer used is also important. Generally, the type of fertilizer used on oil palm plantations are inorganic synthetic fertilizers. For immature and mature palms, fertilizer provision is via a single fertilizer, while compound fertilizers are more often applied in the nursery. To meet the needs of critical nutrients, such as nitrogen (N), the type of fertilizer that can be selected is Urea (U) or ZA (ammonium sulfate). Sulfate is also included in the ZA fertilizer and this is considered necessary for the soil or for the circumstances under which the acidity is a relatively alkaline (where the pH is relatively high), so that a reduction in pH is required. Likewise, for a relatively acidic soil, the use of rock phosphate (RP) is expected to benefit the crop development because the fertilizer also contains calcium (CaO) in addition to Phosporus (P). Calcium can raise the soil pH. Moreover, the RP is preferred due to it being relatively cheaper than TSP (triple super phosphate), another common fertilizer of phosphate source. Understanding these principles is important in good plantation management, and often beyond the understanding of the majority of independent smallholders. It underlines the need for good extension services for independent

smallholders by either the local district government or the plantation and mill that accepts the fresh fruit bunches (FFB) from the independent smallholders.

Another factor to consider in application is the timing of fertilizer application. This includes when to apply fertilizer and with what frequency. These factors are determined primarily by rainfall, physical soil properties, the availability of fertilizers and antagonism properties, or fertilizer synergies with other chemicals. For example, usually the fertilizer P is given earlier than N (urea or ZA) because the element of P is slower in releasing into the soil (especially if applied in the form RP) rather than the elements associated with N. Giving P earlier also increases the cation exchange coefficient (CEC) of the soil, so that the soil absorption against the elements K and Mg is then further increased. In general, the order of application of fertilizer is: Dolomite-TSP-Urea-MoP.[5]

Viewed from the influence of local climactic conditions, especially relating to rainfall, optimum fertilizing efficiency is obtained when fertilizer is applied when the soil is quite moist, which is rainfall between 100 and 200 mm/month. In dry conditions, with rainfall less than 60 mm/month, it is advisable not to apply fertilizer; and if rainfall is above 300 mm/month there is a high possibility that mineral nutrients will be lost due to leaching and erosion.

The frequency of fertilization on oil palm especially in mature palms is still an ongoing science for both experts and practitioners. The frequency of fertilizer use is also linked to the considerations of nutrient availability and labor. For rapid soluble fertilizers such as urea and those that are vulnerable to leaching, for example Muriate of Potash (MoP), it is advisable to apply fertilizer twice a year. Such a process becomes even more important in sandy soil, soil that independent smallholders increasingly use to plant. More slowly soluble fertilizers such as RP, TSP, Kieserit and Dolomite can be given once. However, matters of frequency of fertilizer depend heavily on both access to fertilizer and access to workers who are able to apply fertilizer correctly, which links back directly to competent training programs. The sowing of fertilizer in the field needs to have professional oversight so it is on target to get the optimum benefits from the application. It is also linked to specific conditions on the ground, such as the weed circle that surrounds each individual tree. In principle, the weeds in the circle must be controlled, not only for ease of harvest, but also for the application of fertilizer. For controlled weed conditions, fertilizer is sprinkled evenly via a circular approach around the tree starting from 30cm from the base of the trunk to the outer limits of the circle. RP and MoP fertilizers can then be sown in a 'dead row' where the pruned palm fronds are stacked.

[5] Dolomite, a source of calcium, serves to stimulate root growth and aids in fixing the properties of soil chemistry, which is the pH and neutralizes the high level of Aluminium (Al) which may be toxic to the palm.

2.2 The use of organic fertilizer in oil palm

Recently, the use of organic material as fertilizer has been receiving increasing attention in the palm oil industry. This practice is not new to the business side of the industry. A common practice is to stack the pruned fronds on the ground to decompose. In addition, when replanting the old palms, the trunks are used as organic material by letting them decompose naturally or by chopping them and dispersing the remains. The recent practice of the application of empty fruit palm bunches (EFB), either via direct application or in the form of compost, provides additional plantation benefits. Even the ash of empty bunches can also serve as a valuable source of nutrients, especially via the infusion of potassium (K). However, the use of EFB ash has more recently become unpopular because of the national prohibition of burning EFB due to greenhouse gas pollution concerns. This has cost ramifications for companies and cuts down on the number of effective options tied *plasma* and independent smallholders have the effective preparation and fertilizing of their land. Efforts to use palm oil mill effluent (POME) as a direct fertilizer is also gaining attention as an organic fertilizer, although again. This is also a practice that leading companies have been incorporating into plantation practices for many years. POME can be applied as a liquid or when mixed with EFB for composting. Increases in production of up to 20 percent have been reported with the application of POME (Satyoso et al. 2005). Organic material functions thus not only as a source of nutrients, but also as material to improve soil quality, especially in regards to physical nature (texture) and biological fertility.

EFBs are an organic substance containing nutrients of great potential fertilizer use for a plantation and smallholder. Each ton of EFB contains nutrients equivalent to 3 kg urea, 0.6 kg RP, 12 kg MoP and 2 kg Kieserit (Loong et al 1987). However, the application of EFB or EPB compost is not recommended to completely substitute total inorganic fertilizer needs. In general, EFB application of up to as much as 40 tons EPB per hectare still needs to be combined with the application of inorganic fertilizers by as much as 60 percent of the recommended normal dose (Rahutomo et al, 2007). In many cases, the application of EFB compost is preferred to save transportation costs. Hence, 40 tons of EFB is equivalent to 10 tons of EFB compost.

The benefits of applying organic fertilizers in oil palm are well understood and the materials are largely available in the plantations as trunks, fronds, EFB and POME. Smallholder farmers, however, have little or no access to EFB and POME as these are the waste from palm oil mill extraction processes. In some cases the farmers may be able to purchase the EFB or EFB compost which is mixed with POME, but in general they are competing against the demand of the plantations owning the mills for organic fertilizers.

3. Fertilizer use in Indonesia: Relevant legal aspects of the fertilizer subsidy policy

As part of the national development objectives to improve agriculture and alleviate poverty largely within rural areas, the Government of Indonesia has introduced a fertilizer subsidy policy. The fertilizers are available for smallholders farming various commodities, including food crops, horticulture, and plantation crops like oil palm. Fertilizer allocation and distribution is a 'closed system' to ensure that the fertilizers will reach the right users. This section outlines the main government regulations related to the fertilizer subsidy system, including its allocation, monitoring, pricing, and distribution.

3.1 The allocation of the fertilizer subsidy policy

The most important policy relating to the annual subsidy of fertilizers is set out in the State Budget bill and specifically outlined in the legislation that contains the basic implementation of the fertilizer subsidy. The fertilizer subsidy policy settings in 2012 is outlined through Law no.4 Year 2012/Amendment of Law no.22 in 2011/ regarding the Budget and the Income and Expenditure in 2012. Article 10 of Law no. 4/2012 outlines that:

(1) The fertilizer subsidy in the Budget year 2012 is estimated at IDR.13,958,590,000,000.

(2) The Government is obligated to prioritize a sufficient supply of gas needed by domestic fertilizer producer companies in order to ensure food security while optimizing revenues from the gas sales themselves.

(3) In order to reduce the burden of agricultural subsidies, especially fertilizer in the future, the Government guarantees the price of gas to meet domestic fertilizer producer's needs with domestic prices.

(4) The local Government is given the authority for overseeing the distribution of subsidized fertilizers through the mechanism of the Definitive Plan of Farmer's Group Needs (DPGN).

As part of the implementation of this policy, the fertilizer subsidy policy involves several ministries, including the Ministry of Agriculture, Ministry of Finance, Ministry of Commerce, and the Ministry of State-Owned Enterprises (SOEs), all under the umbrella of the

Coordinating Minister for the Economy. It also involves the Food and Drug Monitoring Agency (FDM), and perhaps most critically in terms of implementation, local governments. Each institution has different functions and roles that are designed to be mutually supportive. To ensure the successful distribution of subsidized fertilizer to where it is most needed in rural areas and to ensure that the use and pricing of subsidized fertilizer is appropriate, the Supervisory Commission for Fertilizers and Pesticides (SCFP) was established to monitor and supervise the program in accordance with the relevant areas of supervision (provincial/district/city) as well as to prepare monitoring reports to be submitted to the Regent/Governor/Minister. To facilitate the implementation of its tasks, the SCFP is also assisted by agricultural extension workers.

The allocation and price of subsidized fertilizer is annually updated using the Regulation of Ministry of Agriculture. For example, the Minister recently issued Regulation No.69/2012 to regulate the fertilizer subsidy for 2013. The calculation of the allocation of subsidized fertilizer is adjusted to the recommendation of a site-specific balanced fertilization approach by considering the province's needs and research that is undertaken and then proposed by the Provincial Government for the consequent fertilizer subsidy allocation. The national subsidized fertilizer allocation is broken down by province, type, amount, sub-sectors, and the monthly distribution, and then further broken down further by district or city (determined by a Governor's regulation no later than the beginning of March in each year) and then by the sub-districts (defined by a regent/Mayor's regulation no later than the end of March in each year). Some of the variables to calculate the fertilizer subsidy allocation include:

(a) the amount of fertilizer, which is calculated based on the planting area and the recommended dose of a balanced fertilizer,

(b) type of fertilizer,

(c) highest retail price (HET), and

(d) the total cost of fertilizer goods sold (total cost of production plus the sales cost).

In the event of an allocation shortfall of subsidized fertilizer needs in the province and the regency or city, shortfalls can be met through a reallocation across regions and subsectors in the following manner:

(a) Reallocation between provinces is arranged by the Ministry of Agriculture. Reallocation between the regencies and cities are to be specified by the Governor, and the reallocation of the subsidized fertilizer between sub-districts is to be established by the Regent/Mayor. In order to meet the needs of farmers, reallocation

can be implemented first before the decision by the Governor and/or the Regent/Mayor on the recommendation of the local Department of Agriculture, and:

(b) If the allocated amount of subsidized fertilizer in a Province, regency/city, or sub-district in a given month is not sufficient, producers can re-distribute subsidized fertilizer for those within the immediate vicinity of the rest of the allocation of the ensuing months, and/or the allocation of the following months, provided the amount does not exceed the allocation set aside for that area within one (1) year.

The system provides regional bureaucrats and government departments with considerable scope to move subsidized fertilizer from district to district. The official distribution process of subsidized fertilizer begins with a proposal from farmer groups, which outlines the farmer's members' fertilizer needs in their Definitive Plan of Group's Need (DPGN). The DPGN is then sent to a Dealer (*Kiosk*) or a farmers group that is acting as an authorized retailer (Line-IV, see below), and then an assessment of the proposal is sent to the distributor (Line-III). This assessment of the fertilizer needs from the distributor is then sent to the Agency of Agriculture Regency/city, and then in stages, it is delegated and signed off internally by the Provincial Agency of Agriculture, and then by the Ministry of Agriculture. The process is bureaucratic and time consuming, and involves many different partners as part of the process.

3.2 Fertilizer and Supervision: The Decree of the Governor and Regent concerning Subsidized Fertilizer Use and Monitoring

In regards to the implementation and supervision of subsidized fertilizer in the field, the monitoring of the distribution, usage and pricing of subsidized fertilizer is officially undertaken by the Supervisory Commission for Fertilizers and Pesticides (SCFP). The SCFP at the Provincial and Regency level is a cross-sector coordination agency established by the Decree of the Governor or Regency to supervise the distribution, usage, and pricing of subsidized fertilizer in the relevant province or district. Additionally, the producers themselves often undertake monitoring for the supply and distribution of subsidized fertilizer at the local district level, as outlined from line I to line IV in figure two (page 16) below. Supervised distribution of subsidized fertilizer to farmer dealers in line IV is further undertaken by supervisors appointed as one of the Fertilizer and Pesticide Control Commission members (KP3) at the district level.

The Fertilizer and Pesticide Control Commission at the provincial and regency city conducts monitoring and surveillance of the distribution, usage, and pricing of subsidized fertilizer in

the region. Because of the shortage of available staff, the fertilizer and pesticide control commission of the regency and the cities are supported by external staff in implementing their duties. In this way, some of the supervisory responsibility in measuring the effectiveness of the program is seconded to outside workers from the Department of Weed Control and the Observation Team of Pests and Diseases in the Ministry of Agriculture.

As part of the monitoring of the fertilizer distribution, the Fertilizer and Pesticide Control Commission in the regency/city are required to submit reports regarding monitoring and supervision of subsidized fertilizer in their area to the Regency government level. The Regency in turn submits the report of the results to the Governor. The Fertilizer and Pesticide Control Commission in the province must then submit a report on the results of monitoring and supervision of subsidized fertilizer to the Governor. Finally, the Governor submits the report to the Minister of Agriculture. The regulations and levels on which the fertilizer subsidy is based is extensive and involves a number of governmental agencies. These make the delivery of fertilizer to the smallholder a long process, beginning from submitting the request made by the farmers group through to the central government, and then from the distribution of the fertilizers, to the producers, back to the farmers, through a long chain and series of portals.

4. Fertilizer distribution in Indonesia: How does fertilizer get from the fertilizer company to the independent smallholder in the field?

4.1. The Ministry of Trade Regulation concerning subsidized fertilizer distribution

The distribution channels of subsidized government fertilizer is complex and convoluted. The government policy on the distribution of subsidized fertilizer uses a 'closed pattern' distribution system. The system was implemented in January 2009 and aims to avoid shortages of fertilizer and fertilizer distribution irregularities. The procurement and distribution of subsidized fertilizer are determined by the closed distribution pattern and by the Definitive Plan of Farmers Group Needs (DPGN) within the specific regions.

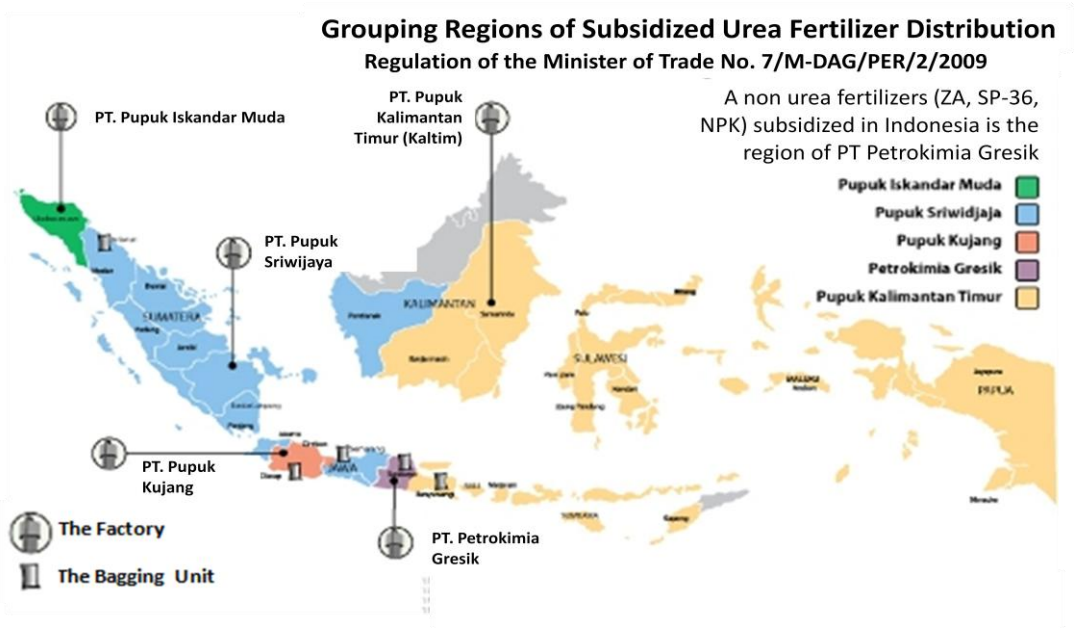
The distribution chain of subsidized fertilizer from the producer to end farmers is outlined in the Ministry of Trade Regulation No.07/M-DAG/PER/2/2009. As can be seen in figure two

below, the fertilizer moves from the Producer (Line-I/II) to the Distributor (Line-III), then onto the Suppliers (Line-IV), and then to the Farmer Group, and eventually to the individual farmer.

4.2 Distribution actors in the Supply Chain

Distribution actors involved in the supply chain include producers, distributors, retailers, and farmers. **Producers** are companies that produce inorganic fertilizers; i.e. urea, SP-36 (Superphosphate), ZA, NPK and domestic organic fertilizers. Producers are differentiated according to the type of subsidized fertilizer they produce. For example, urea is produced by PT. Pupuk Iskandar Muda (PIM), PT. Pupuk Sriwijaya, PT. Pupuk Kujang, PT. Pupuk Petrokimia Gresik and PT. Pupuk Kaltim; (ii) SP-36, Superphos and ZA is produced by PT. Pupuk Petrokimia Gresik; (iii) NPK Phonska is produced by PT. Pupuk Petrokimia Gresik; (iv) NPK Pelangi is produced by PT. Pupuk Kaltim; (iv) NPK Kujang is produced by PT. Kujang; and (v) organic fertilizers are produced by PT. Pupuk Iskandar Muda (PIM), PT. Pupuk Sriwijaya, PT. Pupuk Kujang, PT. Pupuk Petrokimia Gresik and PT. Pupuk Kaltim (Mantau and Faisal, 2009). The following diagram outlines the distribution areas for subsidized fertilizer - in this case - urea – demonstrating how specific companies are responsible for specific regions, for example, the Province of North Sumatra is the responsibility of PT. Pusri, and parts of Central Java are the responsibility of PT. Pupuk Kaltim.

Figure 1 Zoning Distribution of subsidized urea fertilizer based on Ministry of Trade Regulation No.07/M-DAG/PER/2/2009[6]

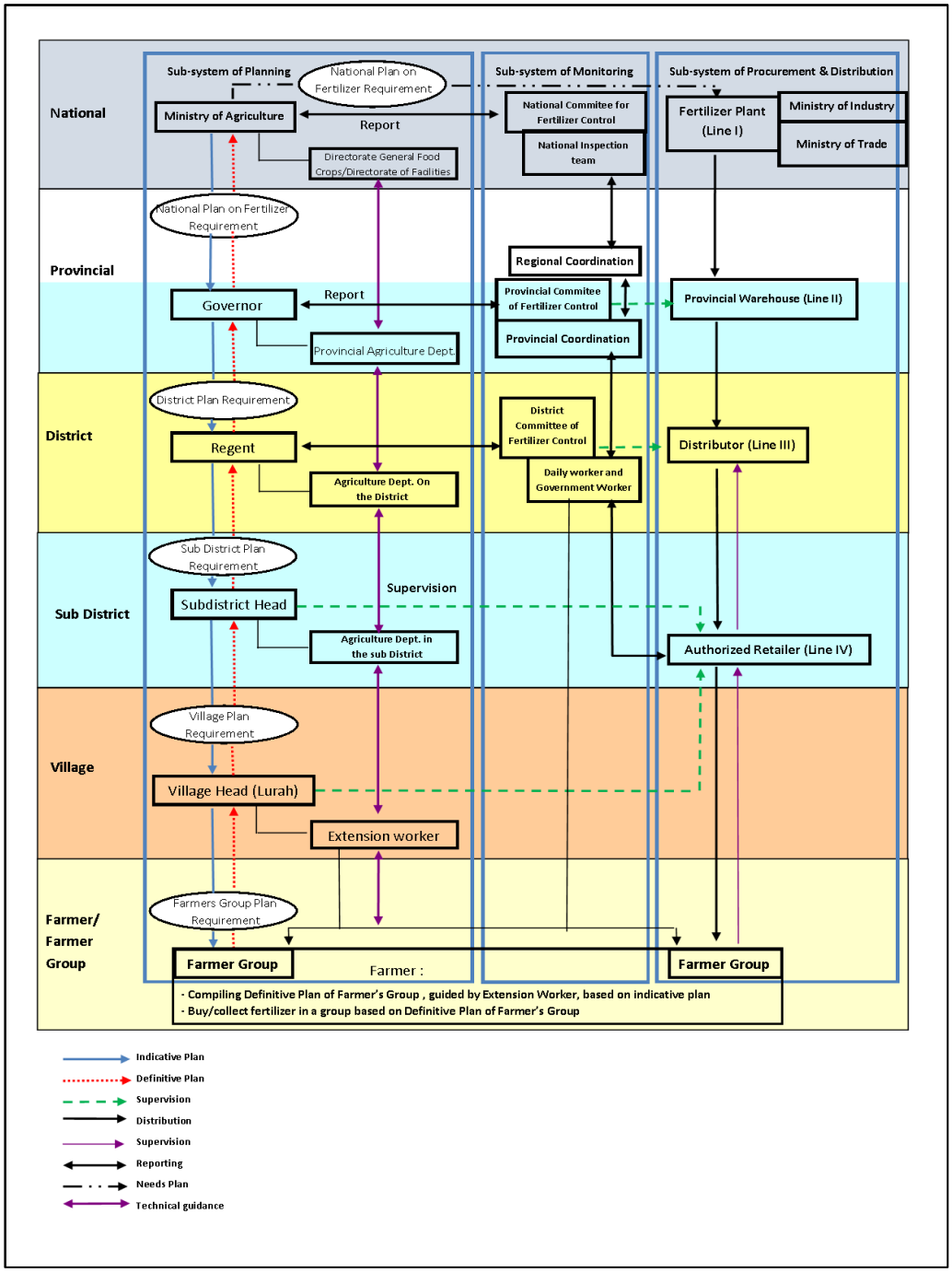


Other distribution actors include the **distributor** who is an individual company or business entity appointed by the producer to work on the purchase, storage, distribution and use of subsidized fertilizer in bulk within an area of responsibility, which is then to be sold to farmers and/or Farmers Groups through a designated retailer. The **retailer** is an individual, farmers group, or business entity domiciled in the sub-district and/or the village, that is appointed by the Distributor to sell the subsidized fertilizer to farmers and/or the farmer's groups.

A critical part of the distribution supply chain is at the end with the farmer's groups themselves. The **farmer's group** is a collection of farmers that work together on the basis of common interest in utilizing agricultural resources and working together to improve farm productivity and the welfare of its members. This group has to be formally registered by the local Regency. The **farmer** is defined an individual who works the land for the cultivation of food crops or horticulture, including farmers who work the land in a smallholder plantation, as well as farmers who do not have a formal business permission or license. Diagram two below outlines the subsidized fertilizer supply chain. It is a complex supply chain, with the fertilizer moving from the Producer (Line-I/II) to the Distributor (Line-III), then onto the Suppliers (Line-IV), and then to the Farmer Group, and eventually to the individual farmer.

[6] The policy is periodically updated.

Figure 2 Structure and distribution of subsidized fertilizer in the agriculture sector
(Source: Ministry of Agriculture, 2008)



In the complex subsidized fertilizer distribution supply chain just described, the responsibility for distribution by producers and distributors is conducted at specific phases and areas. This means that:

(i) Producers should carry out the distribution of subsidized fertilizer from line I to line III within their geographic area of responsibility (see figure one above);

(ii) The distributors should carry out the distribution of subsidized fertilizers from Line III to line IV within their geographic area of responsibility (figure two);

(iii) The retailers should carry out the distribution of subsidized fertilizer to farmers and/or farmer groups in line IV in their area of responsibility based on the Definitive Plan of Group's Need (DPGN), with the specified amount according to the relevant Regulation of the Governor and Regency.

Line I corresponds to a fertilizer warehouse located at the plant of the respective producer or in the port of destination for imported fertilizer. Line II is the location of the producer's warehouse in the provincial capital and fertilizer packing Unit (FPU) nearby to the port area. Line III is the location of the producer's warehouse and/or distributor in the Regency/City designated or established directly by the producer. Line IV is the location of the warehouse or retailer kiosk in the sub-district or the village designated or established by the Distributor.

In the event that distribution of subsidized fertilizer by distributors and/or retailers does not proceed well, producers are required to redirect distribution to the farmers or the farmer's groups corresponding to line IV. This is done in coordination with the local Regency. In many cases, this is done through the Head of Services in charge of agriculture at the district level. If the retailer is not able to distribute the subsidized fertilizer, the distributor can then coordinate with the Head of the Regency in charge of local agriculture, who can undertake a re-distribution of subsidized fertilizer directly to the Farmer's Group for a price not exceeding the Highest Retail Price (HRP).[7] Given such a convoluted process involving many bureaucrats and officials during the fertilizer distribution, the potential for 'add-ons' and additional charges down the lines is significant. It is the farmer's groups, and ultimately the farmers, who often bear additional costs during the redistribution process.

[7] HRP is the highest retail price set by the Minister of Agriculture for the cash sale of inorganic fertilizer i.e. urea, Superphosphorous, ZK, NPK and organic fertilizers in packs of 50 kg, 40 kg, or 20 kg by Retailers line IV to farmers and / or Farmer Groups. Subsidized fertilizer packaging must be labeled red with a label that reads "Government Subsidized Fertilizer - Goods in Supervision". The highest retail price (HRP) of subsidized fertilizer is outlined annually.

5. Challenges and bottlenecks in the subsidized fertilizer procurement and distribution system

5.1 Structural challenges

Because the subsidized fertilizer distribution system outlined above is a closed system, subsidized fertilizer can only be distributed by the official distributors and retailers and can only be distributed to farmers and/or farmer groups that have been officially registered in individual districts. The closed system nature of subsidized fertilizer distribution remains at high risk of fertilizer leakage because of the continual presence in the field by illegal retailers close to the distribution areas. These retailers typically operate when the plants are ready to be fertilized and when demand for the subsidized fertilizer is at its highest. Equally, during the main fertilizer period, the increased demand often means that local supplies do not match the demand, as subsidized fertilizer requirements listed in DPGN are often lower than the actual real requirement. Consequently, there are shortages of fertilizer and the retail price exceeds the stipulated HRP.

In such a situation, the independent smallholder is in a difficult position if she or he wants to fertilize correctly. The smallholder has limited options, which boil down to essentially two choices: if she or he wants to fertilize properly then he or she must pay higher inflated prices (which is no guarantee of high quality fertilizer without testing), or if she or he instead will need to cut back on fertilizer, thus reducing yield.

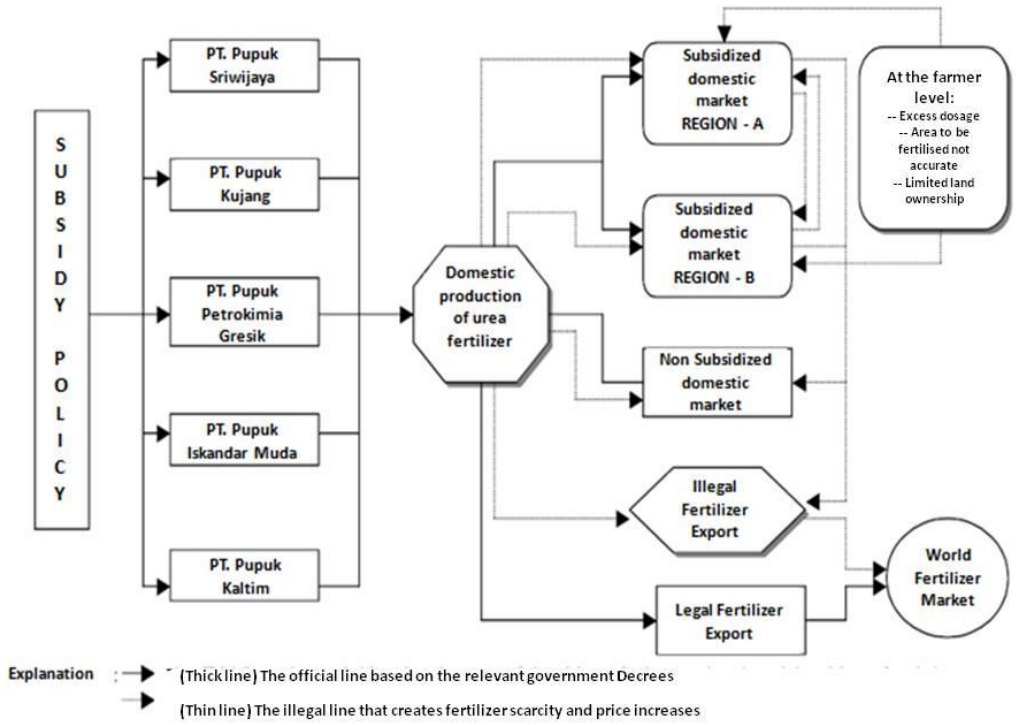
For many farmers, this situation is further complicated by plantation fertilizer being used for other crops close to the plantation. This can cause over-ordering of fertilizer in certain areas. If the fertilizer requirements listed in the DPGN are higher than the real demand, there will be an imbalance between the regions in terms of possible excess of subsidized fertilizer in one area while other areas may experience shortages of subsidized fertilizer. Scarcity issues within and across regions can be avoided if the plans of subsidized fertilizer needs listed in DPGN are properly based on the recommendations regarding balanced fertilization per area. However, the Ministry of Agriculture has not specifically set the recommendations for fertilization. Existing settings in the regulation explain that "subsidized fertilizer allocation (is) calculated in accordance with the recommendation of location-specific balanced fertilization and takes into account the proposals of needs submitted by the provincial government, and the budget allocation of the fertilizer subsidy in 2009." This means that having professional farmer’s groups that instruct and mentor their smallholder

members so they apply fertilizer correctly to their plantation is thus extremely difficult as they do not have access to the knowledge required to use fertilizer properly. Further compounding the lack of knowledge and the 'leakage' issue is that the government extension agents in the rural areas where smallholder plantations exist, are often under resourced and without incentives.

In areas where there is a scarcity of fertilizer brought about by over ordering in other district areas, this can mean that farmers are forced to buy subsidized fertilizer above the HRP if they want to fertilize properly. This phenomenon is a common occurrence today. In a study on the evaluation of *Urea Fertilizer Distribution System Policy in Indonesia: The Case of West Java Province* (Kariyasa and Yusdja, 2005) the authors concluded that the fertilizer distribution system which aims to stabilize the price of urea fertilizer at the farm level in West Java simply does not work. This is evidenced by the supply and demand reality which causes the price to 'bounce' regularly at the farm level. Besides the deviation of fertilizer to the non-subsidized market, or to where it is 'exported' illegally, there are several other factors that contribute to why the policy is not able to secure a stable price at the smallholder farm level.

Firstly, many distributors are not able to function properly: they do not have a fleet of trucks, creating irregular distribution. Secondly, the transportation costs which are designed to be charged to the distributor are often charged directly to farmers. Thirdly, there are not enough authorized retailers, so many unofficial retailers appear charging fees above the HRP. Fourthly, at the level of farmers' groups, there is poor technical training, which leads to farmers using fertililization doses well above or below the recommended subsidized dose. Fifthly, there is a concern that farmers are 'greedy' or 'undisciplined' in determining the proper cropping pattern. Finally, there is an absence of precision in calculating extensive cropping and the addition of many non-functioning farmer groups in helping the farmers get fertilizers, as well as the frequent occurrence of "phantom farmer groups" who often buy fertilizer in bulk to be resold at the time when fertilizer is scarce. This further exacerbates the inefficiencies and waste within the subsidized fertilizer distribution system policy. The following figure demonstrates the interplay of price irregularity and the under supply of subsidized fertilizer (Kariyasa and Yusdja, 2005).

Figure 3 Mechanisms of price irregularity and scarcity of subsidized fertilizer supply
(Kariyasa and Yusdja, 2005)



Rachman's (2009) research is also important in understanding both the issue of fertilizer scarcity caused by distribution problems and price irregularity for smallholders. Rachman believes that the subsidized fertilizer distribution system requires a far more direct and open linkage between the Regulation of the Minister of Trade, the Minister of Agriculture, and the Regulation of the Governor and Regent/Mayor. There is a need also to make the DPGN clearer and act more as a tool which controls the amount of fertilizer going to specific areas. Unfortunately, in the Regulation by the Minister of Trade on subsided fertilizer, the DPGN is only mentioned in regards to the general amount, which is "the amount of subsidized fertilizer referred to in accordance with the Regulations to the Governor and Regent." Neither the Governor or Regional regulations explain how to effectively and accurately determine regional fertilizer needs. This can make the DPGN appear inconsistent with the regulation issued by the local government. In order for the procurement and distribution of fertilizer regulation to be more effective, the DPGN needs to function more as a tool for planning the procurement and distribution of subsidized fertilizer at the district and sub-district level.

5.2 Additional fertilizer challenges for independent oil palm farmers

Earlier the paper outlined the importance of the '6 Rights' in oil palm fertilizer application, which relate to the right dose, type, quality, time, purpose, and price. As with other crops, oil palm maintenance requires a consistent commitment from seedling until replanting to get the highest production potential. Large oil palm plantations have a larger capacity and ability than smallholders to professionally implement a fertilizer program. This does not mean, however, that large plantations are free from fertilization problems, which in turn often affect nearby smallholders themselves. Some of these problems encountered are described below and are divided into problems relating to internal (embedded or within the control of farmers) and external (outside the control of farmers) factors.

5.2.1 Internal Problems

Across Indonesia, independent smallholders are interested in oil palm plantation because the farming is seen as profitable and relatively easy to maintain. However, many hundreds of thousands of farmers have rapidly converted their previous crops into oil palm without proper planning and without a sound understanding of oil palm cultivation. The poor planning and rapid establishment of oil palm plantation has resulted in low productivity from the beginning, and the farmers continue to lose income every month as a result. The level of smallholder farmer education is low and access to technological developments is difficult, especially in the development of remote areas, and farmers are not aware of some of the challenges related to oil palm farming when they begin.

Unlike *plasma* smallholders who receive technical support from the nucleus plantation company, theoretically enabling better access to technology and fertilizers, small independent farmers have other problems in relation to the production and maintenance of their oil palm plot. Fertilization problems for independent oil palm smallholders relate to a poor understanding of good agriculture practices (GAP) in oil palm plantation. Additionally, the palm's response to fertilizer varies greatly depending on the type and condition of seedlings that are used and the type of weed control used. Independent farmers are often trapped in the vicious cycle of fake seed use (seedlings purchased from an illegitimate dealer or seeds that are not original) or seeds that have been taken from the seedlings grown from the loose fruits in oil palm plantations ('sweep' seeds). These types of planting material are far less responsive to fertilizer than legitimate seeds, yet it is estimated that more than 70 percent of independent smallholders use these fake seeds or 'sweep' seeds.

Thus, although the farmers may apply fertilizer, increases in yields are still not as they should be compared to legitimate seeds.

In addition, planting practices that do not apply proper agronomy, for example planting on slopes without proper soil conservation (terracing), will cause the fertilizer to be easily leached by rain. This situation is a regular and common tragic occurrence amongst smallholders in Indonesia, and is exacerbated if farmers do not understand the requirement that when fertilizing, rainfall must remain at between 100-200 mm per month for best results. If there is higher rainfall, fertilization may then often be in vain because of the results of leaching.

To maximize fertilizer efficiency, laboratory services are required for the analysis of soil and leaves that cannot be done by the farmers themselves because of their technical limitations and the cost incurred. Leaf sampling (using a leaf structure unit, or LSU) is recommended for every 20-40 hectares, and the process of sampling and drying leaves requires skill and time. In practical and economic terms, LSU activity is not suitable for smallholders who generally only have about two hectares of planted oil palm land, unless they undertake planting in groups or cooperatives. This again underlines the importance of farmer Cooperative training. Such limitations of technical understanding can be overcome with good training and extension service programs. However, the service in the plantation sub-sector is still very limited. Meanwhile, the development of oil palm by smallholders is increasingly being pushed onto marginal lands because prime land is very limited and has often been acquired by large plantation companies.

If independent smallholders lack understanding and basic skills in relation to GAP, the consequences could be that they fertilize arbitrarily or excessively, or they fertilize in an unproductive way. All of these practices lead to lower and reduced productivity. From observations in the field, these are very commonly seen as symptoms of nutrient deficiency in independent smallholder plantations. It results in poor yields and poor overall land use.

Besides the limitations of understanding the basic skills of oil palm farming, smallholder oil palm farmers also have the added difficulty of managing cash flow and particularly as it relates to obtaining quality fertilizer. As the paper has outlined, subsidized fertilizer is very limited (and often difficult to obtain a timely and correct amount), and so most often independent smallholder farmers are forced to buy non-subsidized fertilizers which they pay for in cash. Limitations of cash flow often mean the farmers limit and refrain from purchasing fertilizer when prices fluctuate or real life cash pressure impinge on a family, such as a sick child or housing repairs. If farmers decide to fertilize, then they are also vulnerable to middlemen or money lenders who are willing to provide fertilizer with a

payment system that allows them to pay after harvesting. Sometimes this can be beneficial, but can also see them enter into a debt cycle where the majority of their income is then used to pay back the expensive fertilizer supplied by middlemen.[8]

Complicating this matter is the fact that the positive effect of fertilizers on the production yield of oil palm is not directly experienced in the current year and it usually takes at least two years after application to see any beneficial results. This is a disincentive for farmers to fertilize their oil palm crop when the Fresh Fruit Bunch (FFB) price is low. However, farmers will lose their chance to enjoy a higher income if FFB prices then consequently rise in the future, because it takes approximately two years for the oil palm tree to recover from the effects of not continuously fertilizing, resulting in crops that have a latent or chronic deficiency. Consistency is required to maintain the stability of a productive fertilizing program and good cash flow management is needed to address the inherent instability in the FFB price.

5.2.2 External Problems

The distribution of poor quality and fake fertilizer is a significant external challenge for independent smallholder farmers. Smallholders in rural areas face the continual circulation of fake fertilizer and blended fertilizer in the local district market. Unlike the large oil palm companies that perform fertilizer sampling analysis using high quality laboratory services, an independent smallholder's testing is limited only to a visual assessment of the purchased fertilizer. In addition to the inability of the farmer's to access laboratory services, farmers resoundingly remain attracted to the idea of buying fertilizer discounted at low rates, which exacerbate farmers vulnerability to scams such as fake fertilizers and blended fertilizer. This is a mindset issue that will take ongoing and expensive communication and education campaigns to address.

As outlined above, smallholder independent farmers often have limited or no access to fertilizers at the right time. In Indonesia, this problem occurs not only with oil palm, but with other crops as well. However, the problems faced by oil palm growers can be more serious, especially for those in remote areas far from licensed fertilizer distributors or retailers. One smallholder trainer in Sumatra notes that smallholder farmers also have an uncanny ability to not properly pre-order or store fertilizers in a storage facility, so the fertilizing itself is often done at urgent notice and consequently is not programmed nor measured properly.

[8] Due to space constraints, this paper will not discuss the effect of middlemen of FFB income but it is a related complexity for many independent smallholders in the field.

Ideally, the use of oil palm empty fruit bunches (EFB) and EFB compost for fertilizing palm oil should be a partial alternative to the scarcity of fertilizer in rural areas. In addition, organic materials can also improve physical and biological soil fertility. However, here independent smallholder farmers have obstacles getting EFB or EFB compost because of the transportation costs from the oil palm mill (POM) to the farmer's plantations, which are often at a considerable distance away from the mill. Unfortunately, very few POMs are willing to give or even sell EFB to outsiders because the company itself is also applying EFB for internal plantation needs. As a result, independent farmers do not have access to the required amounts of EFB.

Another external problem faced by the smallholders is the limitation of the government's ability to overcome many of the fertilizing problems mentioned above. It needs to be acknowledged that the government has tried a number of approaches in attempt to solve some of the problems outlined above, including using extension services, partnering with big companies, undertaking legal action where there are cases of fertilizer dilution, mixing and fraud, and the provision of subsidized fertilizer. But there remain many cases of fraud occurring, and these often occur in some of the areas with the most longstanding experience with oil palm, that of north Sumatra, Riau, and Jambi. This suggests that much more needs to be done with a more innovative and far reaching program to increase effectiveness.

One approach is to strengthen the associations of independent smallholders who cultivate oil palm. Despite the success of some farmer groups, the implementation of a small farmer organization development programs in general remains weak in Indonesia. One experienced oil palm observer and researcher in Indonesia suggests the attitude of a partial 'addiction to aid', which creates a consequence of 'spoiling' the farmers with previous government programs, such as rice intensification programs. This causes the farmer or village unit cooperatives (VUC) to have weak foundations and not work independently if there is no immediate financial assistance from the government.

6. Reality on the ground: Consequences of the subsidized fertilizer policies at the smallholder level

As discussed, the subsidized fertilizer program is also intended for other plantations, including rubber, coconut, cashew nuts, cloves, pepper, coffee, cocoa, sugar cane, cotton and some other crops. The Directorate General of Plantations has consistently outlined the need for subsidized fertilizer in both general farmer agriculture and plantations, but the

planning and implementation of the subsidized fertilizer project has not always generated the desired results. The varied results of the subsidized fertilizer policy in 2009, can also be seen from research conducted by the Research and Development Agency of the Ministry of Agriculture (2009). Based on case analysis from 2009, the research shows that the results of subsidized fertilizer distribution to meet the needs of small plantation farmers across commodities and the wider agricultural sector has been limited, except for the fertilizer compound ZA.

Table 4. Planning v Reality: Distribution figures of subsidized fertilizer for smallholder plantation, January to August 2009 (tons)

Fertilizer Type	Agriculture (whole)			Smallholder Plantation		
	Planned	Realization	%	Planned	Realization	%
Urea	5,500,000	2,751.844	52.92	1,147,319	607,161	57.68
SP-18	1,000,000	442,664	44.27	301,156	159,372	38.94
ZA	923,000	523,921	56.76	367,872	194,678	97.14
NPK	1,500,000	848,611	60.62	383,211	202,795	40.77
Organic	450,000	129,978	28.83	0	0	0

Source : Directorate General of Plantations (2009)

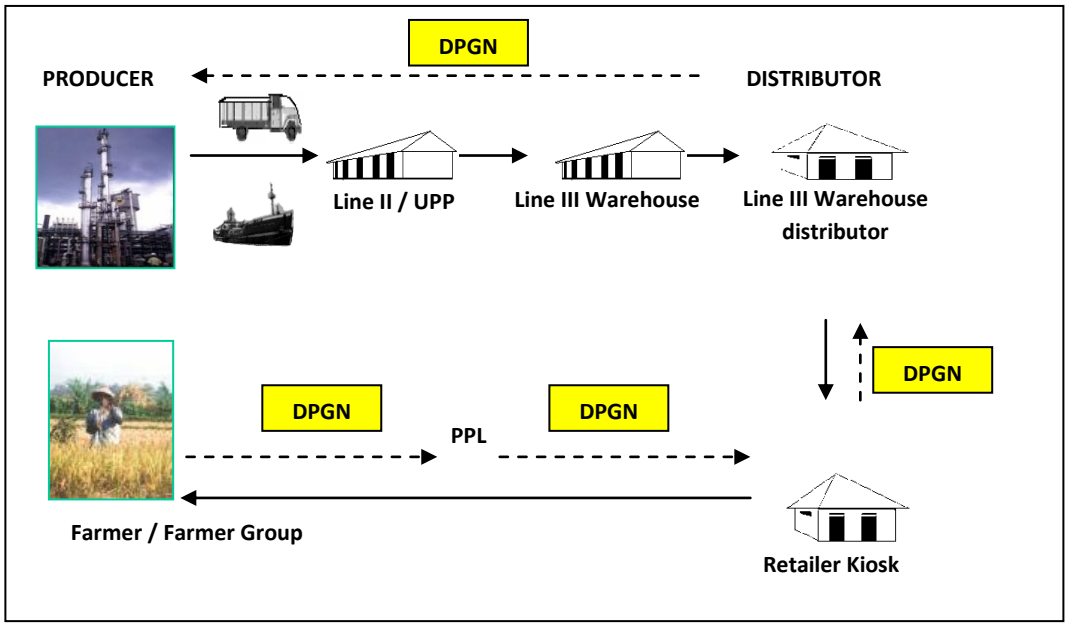
Both the data in Table 4 above and Rachman's research in the previous section (Rachman 2009) demonstrate the difficulty in distribution and in controlling the price of smallholder subsidized fertilizer by the time that it gets to the farmers. Because fertilizer application at the right time is very important, demand rises and prices are squeezed higher during the fertilizer season. Linked with this is the common situation where the estimation of the fertilizer needs exceeds the real needs, but the availability of subsidized fertilizer for crops is actually *lower* than the requirement. Such a situation is self perpetuating. The following section outlines some specific research on upstream subsided fertilizer distribution for independent smallholders in three Indonesian oil palm sites.

6.1 Analysis of subsidized palm oil subsidized fertilizer flow in Indragiri Hilir, Landak and North Mamuju districts

In 2009, the Agricultural Research and Development Agency assessed how subsidized fertilizers get to independent smallholder farmers in some selected oil palm plantations. The study was conducted at smallholder plantations in Indragiri Hilir Regency (Riau), Landak Regency (West Kalimantan), and North Mamuju (West Sulawesi province). Site selection was based on factors including diversity, number of farmers, and geographical distribution.

The flow of fertilizer distribution begins from the fertilizer producers that supply fertilizer to the warehouse line II/UPP via shipping. From the warehouse line II, it then travels to the warehouse line III, the distributors, who then pass it on to the district retailer kiosks. From there, the fertilizer is distributed to the farmers or farmer groups. The amount distributed is in accordance with the Definitive Plan of Group's Need (DPGN) submitted by farmer groups to the retailer which then sends the plan to the distributor. The distribution flow is summarized in Figure 4.

Figure 4 Flow of subsidized fertilizer from fertilizer producer to farmers



Explanation: - - -▶ : DPGN Application Flow ——▶: Subsidized Fertilizer Distribution Flow

Payment for the fertilizer is made through the flow similar to that of the DPGN which starts from farmers or farmer groups and then goes to retailers, distributors, and finally, to

producers. The transaction system at the farmers or farmer groups level are generally made on credit terms and paid at the time of harvest. Payments made by the subsequent actors in the chain are given in cash.

6.2 Performance evaluation of subsidized fertilizer distribution

An assessment of the performance of the subsidized fertilizer distribution chain in Indragiri Hilir Regency, Landak and North Mamuju can be seen in the table below.

Table 5 Performance assessment of subsidized fertilizer distribution chain in Indragiri Hilir Regency

CHAIN STRUCTURE	6 RIGHT MEASUREMENT					
	Type (%)	Quality (%)	Price (Rp)	Amount (Ratio)	Time (weeks)	Location/Target
Indragiri Hilir Regency						
Producer-Distributor	100	100	< HRP	Sesuai DPGN (Gov. Regul.)	< 1	DPGN Suitable
Distributor-Retailer	<100	100	< HRP	< DPGN	< 2	DPGN misallocation* (some were not redeemed)
Retailer - Farmer Group	100	100	> HRP	< DPGN	> 2	Misallocation
Farmer Group – Farmer	100	100	> HRP	< DPGN	> 3	DPGN Suitable
Landak Regency						
Producer-Distributor	100	100	< HRP	DPGN Suitable(Pergub)	< 1	DPGN Suitable
Distributor-Retailer	<100	100	< HRP	< DPGN	< 2	DPGN misallocation* (some were not redeemed)
Retailer - Farmer Group	100	100	> HRP	< DPGN	> 2	Mis-allocation (few cases)
Farmer Group – Farmer	100	100	> HRP	< DPGN	> 3	DPGN Suitable

CHAIN STRUCTURE	6 RIGHT MEASUREMENT					
	Type (%)	Quality (%)	Price (Rp)	Amount (Ratio)	Time (weeks)	Location/Target
Mamuju Utara Regency						
Producer-Distributor	100	100	< HRP	Sesuai DPGN (Pergub)	< 1	DPGN Suitable
Distributor-Retailer	100	100	< HRP	< DPGN	< 1	DPGN Suitable
Retailer - Farmer Group	100	100	> HRP	< DPGN	< 1	DPGN Suitable
Farmer Group – Farmer	100	100	> HRP	< DPGN	< 1	DPGN Suitable

Sources: Subsidized Fertilizer Policy Research Team (2009)

The survey results presented in Table 5 show that farmers believe that retailers have distributed the right kind of fertilizer and quality, but not in the right quantity, price, place, or time. The reoccurrence of shortages of subsidized fertilizer (which reflects the inaccuracy of quality, time and place) and the fact that farmers are paying higher than HRP prices shows that the distribution system is not running effectively for smallholders. Part of the problem is the inaccurate estimation of quantity of fertilizer needed, the distribution of the subsidized fertilizer, and the poor supervision of fertilizer transportation throughout the supply chain. The great disparity in prices of subsidized and non-subsidized fertilizer also creates problems in the distribution, and as a result the subsidized fertilizers are often sold to the non-target farmers. This then results in the problem of scarcity of fertilizer and the price exceeding the HRP during the time of fertilizer application when it is most needed.

6.3 Identification of constraints

As a recap, the following constraints have been identified and divided into the relevant players involved along the smallholder fertilizer supply chain.

6.3.1 Constraints faced by producers

1) Inaccuracy of data of farmers' need for subsized fertilizers
2) Subsidized fertilizer allocation particularly in the planning of production because the process of DPGN is long and bureaucratic
3) Incorrect dosage of fertilizing by farmers, leading to insufficient cover

4) Ineffectiveness of fertilizer distribution supervision

6.3.2 Constraints faced by distributors

1) Bureaucratic constraints
2) Existing rampant 'illegal fees' that cause high costs
3) Long delivery delays from fertilizer factories due to poor road conditions and the number of fertilizer hub and transfer points along the supply chain
4) Location of warehouses are often far from farmers, increasing the fertilizer transfer points
5) The DPGN and fertilizer allocation often provide excess fertilizer in one area, creating deficiencies in other areas.
6) The distribution of subsidized fertilizer experiences trouble and involvement with particular authorities (e.g. the police) and NGOs which complicates, not alleviates, supply chain challenges.

6.3.3 Constraints faced by retailers

1) The DPGN process: fertilizer that has been distributed by the distributor are not redeemed and picked up by the proper farmers.
2) Related to the DPGN, the retailers must redeem and pay for the fertilizer to distributors in the beginning, while farmers buy fertilizer to retailers on credit or pay after the harvest. The retailers are often faced with delayed payment and must frequently contact the farmers.
3) Illegal fees from people claiming to be officials in charge for inspection, but are actually not officials. They scrutinize the retailers and expect bribes.
4) The existence of demand for fertilizer from farmers but not through the DPGN mechanism.
5) The long lead time between the request submission for fertilizer until it arrives at the farmers groups.
6) The allocation scheduling creates constraints to farmer groups because the large demand is not proportional to the availability of fertilizers obtained from distributors for the oil palm sector

7) The sales difficulty for ruined/spoiled fertilizers or those with broken packs (can be often up to 5 to 10 packs broken in one truck) during transportation. This is then paid for by smallholders with higher prices for the unbroken packs

6.3.4 Constraints faced by Farmers' Groups

1) The misallocation of fertilizer distribution, for example fertilizer that was supposed to be assigned to one sub-district is instead delivered to a nearby sub-district. This increase costs and pressures for all involved, but it is often undertaken with the involvement of the local farmer Cooperative head.

2) Consistent lack of fertilizer availability in specific rural areas.

3) The amount of fertilizer stated in the DPGN is not correct. Other times the amount in the DPGN may be correct but the figure does not match that outlined in the regulation issued by the District Head. This causes inevitable delays and problems in the disbursement process of the fertilizer.

4) The allocation of fertilizer to farmers is not adequate.

6.3.5 Constraints faced by farmers

1) Lack of financial capacity to purchase fertilizer consistently.

2) Many farmers have not joined a farmers group, which means they are not entitled to subsidized fertilizers as purchases must go through the farm group leader, field extension officer, and village heads as part of the DPGN.

3) Distribution of fertilizer is not properly targeted according to the DPGN.

4) There are many unofficial DPGN requests from 'phantom' farmers groups.

5) Bureaucratic challenges in submitting a DPGN submission means they are not submitted.

7. Conclusions and Suggestions

7.1 Conclusions

This research concludes with a series of points. These include:

1. Proper fertilization is critical in oil palm cultivation to obtain high maximum yields.

2. Application of fertilizer needs to be done consistently from the beginning in the nursery, through the immature phase, and regularly in the mature phase by following the appropriate fertilization recommendations. In this case, fertilization is based on the 6R principles, which are the right dose, right type, right quality, right time, right target, and the right price.

3. Site specific fertilizing recommendations is increasingly necessary because the development of oil palm plantations more recently occurs on marginal land with low fertility rates. This compounds challenges for independent smallholders.

4. Smallholder oil palm farmers face various fertilizing problems such as a lack of understanding about the cultivation of oil palm (good agriculture practices), fertilizer use, they are often unable to interpret and follow fertilizing recommendations, they have difficulty accessing fertilizer, fertilizer prices are inflated in rural areas, smallholders have poor cash flow management skills which affect fertilizer implementation, and there is rampant counterfeit fertilizer within the district and sub district market.

5. Smallholders are also faced with the problems of the poor response of their oil palm crops to fertilizing because they use fake seeds with low overall production potential.

6. Oil palm empty fruit bunches (EFB) can be used as a partial alternative to difficult availability of inorganic fertilizer, but smallholdershave limited access to such organic material from palm oil mills.

7. Smallholder oil palm farmers can avail themselves of subsidized fertilizer via the government program through the national law on subsidized fertilizer. The procurement policy and the distribution of subsidized fertilizer is set by a Minister of Trade Regulation and the needs and subsidized fertilizer price (HRP) for the agricultural sector is regulated by a Minister of Agriculture Regulation. Other settings relating to supervision of distribution, usage and pricing of subsidized fertilizer are determined by the Governor and the district Regent.

8. The subsidized fertilizer program from procurement to distribution to oil palm farmers follows a complex, closed pattern distribution system; subsidized fertilizer can only be distributed by the Distributor and Retailer; and subsidized fertilizer can only be distributed to farmers and/or farmer groups that have been identified. Such a closed pattern is problematic in terms of independent smallholder outcomes because some of supply chain members are not carrying out their functions properly. This is compounded by the use of fertilizers by farmers who are either exceeding and on-selling, or vastly underproviding with regard to the appropriate fertilizer dosage.

9. The DPGN system, whilst a logical approach to ascertaining local sub-district farmer needs, does not function effectively as a way to synergize the relationships between the different levels at the Minister of Trade, Minister of Agriculture, the Governor, the district, and farmers groups and farmers. It does not yet serve as a functioning overall tool for planning the procurement and distribution of subsidized fertilizer for smallholders.

10. The reality in the field, coupled with the research studies outlined in this research suggest that the procurement and distribution of subsidized fertilizer to the agricultural sector, and the requirements and pricing of subsidized fertilizer for oil palm smallholders is far from optimal.

7.2. Suggestions

1. The establishment and strengthening of small independent oil palm farmer groups are very important and focus on this needs to be intensified, not only as a way to improve knowledge and skills of oil palm cultivation for smallholders overall but as a means to draft the DPGN through mentoring by plantation instructors and in simplifying the operational procedures of the DPGN submission to obtain subsidized fertilizer. Empowering the farmer groups will also protect them from the distribution of fake fertilizers. Strengthening farmer groups are increasingly important given the approximately 1.5 million hectares of smallholder oil palm plantations that already need to be rejuvenated and who need access to modern planting technology.

2. To realize the suggestions above, farmers needs to made aware that the establishment and strengthening of the group should prioritize self-reliance so that the group will be able to function without aid and help from the outside. This may be a gradual process, involving seed money, but it needs to be the goal of any form of direct or indirect external assistance and support: how to make the farmers group self sustaining.

3. A greater harmonization of the Minister of Trade regulations concerning procurement and distribution of subsidized fertilizer to the agricultural sector with the Minister of Agriculture regulations about the needs and subsidized fertilizer price is needed. The allocation and planning of subsidized fertilizer needs based on the DPGN plan also needs to be more closely aligned and followed by the distribution based on the DPGN itself.

4. Governments, particularly the supervisory body SCFP, needs to properly evaluate the effectiveness of the distributors in the supply chain and the implementation of procurement and distribution of subsidized fertilizer according to the current regulations. Clear action must be taken to gradually 'clean up' and improve the distribution process.

5. To make the process potentially more efficient in terms of time and costs, and as a way to enhance the performance of the distribution chain, the District government could consider empowering leading farmer organizations (farmer groups/farmer group unions/cooperatives) as retailers themselves. This could be supported by the Ministry of Cooperatives and local NGOs.

6. The determination of the pricing HRP policy should pay attention to the specific conditions of the region, such as the distance travelled and the condition of infrastructure. Failing to take this into account will result in reduced distribution effectiveness.

7. Strengthening of the SCFP oversight process would support the Regency budget, and outlining the fiscal requirements for this task in district expenditure could assist with the monitoring and supervision functions and create better oversight.

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