ISBN 978 - 979 - 18768 - 3 - 4

Green Agro - Industry
Investment For Our Future

International Conference, Yogyakarta, Indonesia, November 12-14, 2013

Organized by:

Faculty of Agriculture,
Universitas Pembangunan Nasional "Veteran" Yogyakarta

and supported by:

Proceedings

International Conference on Green Agro-Industry
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UTILIZATION OF WASTE PALM OIL AS A SOURCE SOIL ORGANIC MATTER FOR SUPPORT GREEN AGROINDUSTRY

S. Setyo Wardoyo[1)]

[1)]Department of Agro-technology (Soil Science) UPN "Veteran" Yogyakarta.

Ring road street, Condongcatur Yogyakarta 55283 Telp/Fax. 274-486737.

Email: setyowdy@gmail.com

ABSTRACT

Indonesian climate conditions that have a high temperature and humidity, to support the rapid proliferation of soil microbes including cellulolytic microbes, so that decomposition of soil organic matter goes very fast. As a result of mineral soils in Indonesia are generally poor organic matter. While the abundance of oil palm waste, not fully utilized as raw material for downstream, and the waste created circumstances that disrupt the environment. As an alternative to resolve palm oil waste is utilized as a source of soil organic matter. Organic matter to improves soil physical, chemical and biological soil and healthy environment. Thus it can help support the creation of good green Agro-industry.

Key words: oil palm waste, soil organic matter, agro-industry

INTRODUCTION

Indonesia has a tropical area especially temperature and high humidity as a result of decomposition of soil organic matter goes very fast, so that the mineral lands in Indonesia generally contain low organic matter. As a result the physical, chemical and biological soil is not good, and easily eroded. More so with the loss of nutrients transported through harvest with no effort to bring it back.

Palm plants have waste, in the form of plant parts that are not past the stage of processing of oil palm empty fruit bunches example. Parts of this plant can be a waste because there is widespread use of waste treatment technologies in the oil palm farmers, lack of expert personnel and skilled workers as well as the lack of investor interest in the business in the processing of agricultural waste.

The expansion of oil palm plantations are also an abundance of agricultural waste has consequences. People have realized that the abundant waste will interfere with the environment or be a disposal problem. At the end of the 20th century, many experts began to researching on waste to be a by-product and the rest though again become useful materials such as organic fertilizer into the soil to be restored again, but not all of the palm oil industry utilizing these technologies. Agricultural waste is not only used for agriculture alone, but can be used for food industry, livestock feed, pharmaceuticals, cosmetics and construction. Many things once unimaginable is now becoming a reality. To the authors limit the waste as a source of soil organic matter, which is derived from plant oil palm.

A. Waste Oil Palm And Results Of Side

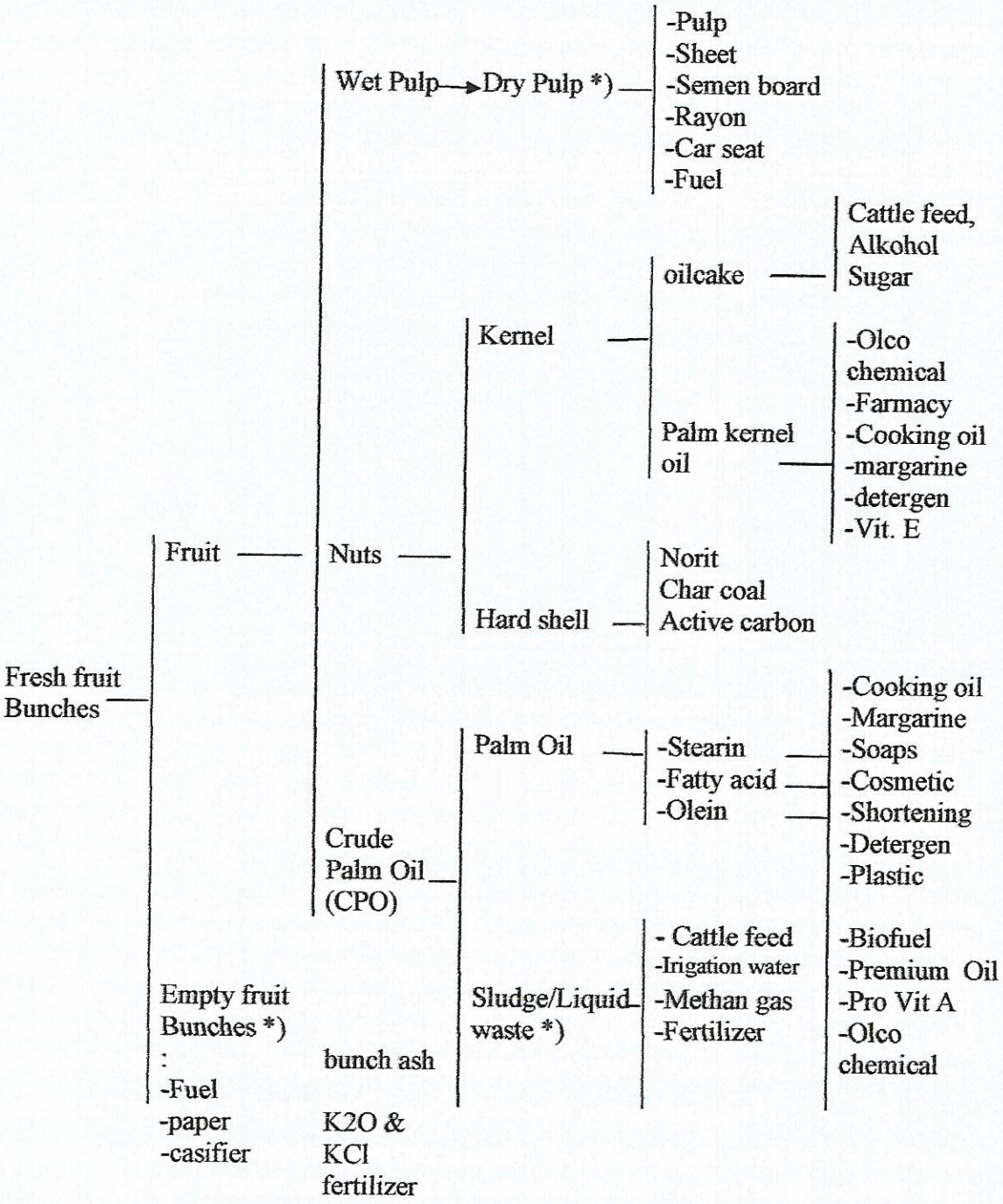
Terms of waste, just for a while before there is technology that can process them into useful material. Once available technology modifiers waste into useful products, the waste is turned into byproducts.

Harvested in the form of palm oil fresh fruit bunches (FFB). Separation of the fruit from FFB, will leave waste or slender bunches that in terms of plantation called "empty fruit bunches". The next process in the factory, the fruit will produce crude palm oil products and coir waste (wet / dry pulp) and leave nuts palm. Crude palm oil will result in major palm oil products and liquid wastes left which is called by Sludge. At a later stage the nuts will be separated again from its shell to the kernel. Shell can create byproducts activated carbon, charcoal and norit. While the kernel can produce palm kernel oil and oilcake which will also create a by-product of alcohol, vinegar, sugar and cattle feed (Naibaho, 1990).

In more developed countries, oil palm Agroindustry already utilize these wastes into by-product, in the form of organic fertilizer, cattle feed or as material of paper, pulp, cement board, etc. (Figure 1). Expected future all Indonesian oil palm agro-industry has been utilizing these wastes into by-product or other industrial raw materials.

1. Oil Palm Empty Fruit Bunches

Empty fruit bunches obtained from the separation of fresh fruit bunches (FFB) with fruit. Number of empty fruit bunches estimated 27% of FFB. Palm oil production on land Class II by 24 tonnes FFB / ha / yr. In 2012, the area of oil palm plantations in Indonesia covering an area of 9,074,621 ha (Ministry of Agriculture, 2013). Thus a total waste of empty fruit bunches estimated 58.8 million tons / yr. The empty fruit bunches, previously only stacked near the factory even spread on sidewalks to the garden, thus disturbing environment. On a small scale empty fruit bunches used for fuel and ash to raise the pH of acid soils.



*) potential as soil organic matter

Figure 1. Chart of Palm Oil Products and Possible It Usage (Naibaho, 1990; modified).

In 1982 some researchers began using the ash bunches for soil research, although the numbers are still limited. Panjaitan, Soegijono and Sirait (1983) have examined the effect of empty fruit bunches ash on podzolic, regosol and alluvial soil pH changes. Empty fruit bunches ash analysis results obtained highest K_2O content is 40.79% (Table 1), so it is often used as a fertilizer K is equated with KCl. Another element that is also high after K_2O are MgO, CaO and Cl. The results showed that for podzolic soil pH

change from 5.2 to 6.5 requires empty fruit bunches ash dose 5.2 kg / palm trees, whereas the ground regosol of pH 5.7 to 6.5 requires 2.5 kg ash / trees and alluvial soils of pH 5.3 to 6.5 requires ash 5.8 kg / tree.

Table 1. Results Analysis of oil palm empty fruit bunch ash (Tampubolon, 1982)

No	Kind the element	Average
1.	pH	12.0
2.	K_2O	40.79 %
3.	C-organic	0.79 %
4.	N-total	0.10 %
5.	P_2O_5	4.51 %
6.	CaO	5.51 %
7.	MgO	9.77 %
8.	Cl	4.90 %
9.	Na_2O	0.14 %
10.	Mn	0.13 %
11.	Fe	0.31 %
12.	Cu	99 ppm
13.	B	295 ppm
14.	Zn	381 ppm

At different times Panjaitan et al (1983) to continue his research on the P available on the same soil type with empty fruit bunches ash dose equivalent to 0.215 kg P_2O5/tree for podzolic soil, 0.232 kg /tree for alluvial soil and 0.103 kg/tree to the ground regosol . The results showed that the dose increase P available on podzolic soil, but do not raise the P available on alluvial soil and regosol, because the soil is already available P have each medium and high.

Empty fruit bunches mostly composed by long-chain C such as lignin 27.4% (Tun Tedja, 1991), cellulose and other carbohydrates, making it difficult to decompose. With the rapid development of biotechnology, it has been discovered microorganisms capable of producing extracellular enzymes that degradated lignin and cellulose quickly on oil palm empty fruit bunches. In practice empty fruit bunches should be cut first, and composted. At the time composting efforts need to be made as follows:

Adding nutrients N, to lower the C / N ratio to avoid immobilization N.

a. Adding cellulolytic microorganisms namely fungi Neurospora sitophila as cellulase and xylanase enzyme producer. This enzyme is able to hydrolyze empty fruit bunches and palm coir into sugar before having delignification (Tun Tedja, 1991). Thus the decomposition will be faster.
b. Adding elements of P. Decomposition will be faster when the ratio of C / N / P = 100/10/1
c. With attention to environmental factors such as pH compost, aeration, moisture and temperature.

2. Coir Palm Oil

Coir obtained from the results separation of the fruit into coir (still containing oil) with nuts; later coir pressed crude palm oil will come out and leave the coir / wet pulp. On a

small scale wet pulp is dried to be used to make car seats, fuel, cement board, rayon, carpet, pulp and paper. This effort has not been widespread all oil palm plantations, so still not solve the problem of oil palm coir waste. Coir is also dominated by lignin is 21.56% (Table 2), then composting into soil organic matter the same with compost empty bunches. To accelerate the degradation, Harrey (1992) have examined the composting coir palm with inoculum giving *Humicola lanuginosa* and *Neurospora sitophila. H. lanuginosa* used because they have the privilege to be thermophilic, can degrades lignin compost 45-65 °C, while *N. sitophila* are mesophilic, can degrades lignin at a temperature of 25-35 °C compost (Wardoyo, 1993). The results showed that after the inoculum was grown for 10 days, it can be 50% lower lignin content.

Table 2. Palm Coir composition (Harrey, 1992)

No	Kind the element	Contents (%)
1.	Lignin	21,56
2.	P_2O_5	0,12
3.	K	0,91
4.	Ca	0,19
5.	Mg	0,23
6.	Na	0,81
7.	Mn	0,08

3. Palm oil sludge

Sludge is the residual liquid waste processing palm oil that has been compacted. The amount of sludge is less than 2% of FFB. Pada 1988 the amount of waste palm oil mills in Indonesia about 44,400 tons of BOD per day with 25 g / l (Tobing and Loebis, 1990). The resulting sludge that can be directly used and is non-toxic, then the waste water must be treated by anaerobic fermentation. The treatment will be BOD of 25,000 mg / l to 200 mg / l and COD of 54 850 mg / l to 1,230 mg / l. Similarly, the concentration of elements is generally down, except Boron (Table 3). With such treatment, then the rest of the solidified waste can be used directly as an ingredient stabilizer soil structure.

Table 3. Results of analysis Liquid Waste Palm Oil (Tobing and Loebis, 1990).

No	Type of Nutrients	Concentration before fermentation (mg / l)	Concentration after fermentation (mg / l)
1.	N-total	100	50
2.	P total	50	10
3.	K total	300	100
4.	Ca total	240	200
5.	Mg total	120	30
6.	Mn	0,40	0,01
7.	Fe	3,30	0,80
8.	Cu	0,07	0,03
9.	B	0,01	0,20
10.	Zn	0,70	0,20

Hanafiah and Jusuf (1988) have examined the effect of sludge on the growth and production of corn. The results showed that a dose of 1.8 kg / plant with sludge 12 weeks maturity level, it can increase corn production of 1.1 tonnes / ha.

B. Benefits Of Soil Organic Matter

No doubt that organic matter can improve the physical, chemical and biological soil; either directly or indirectly. Improvement of soil properties reflected in better plant growth and satisfactory results.

1. **Physical properties of soil**
   Organic matter can improve the structure, because it stimulates the formation of soil aggregates through physico-chemical processes. Stable aggregates will increase the ability to binding water and soil nutrients, better aeration, tillage-range is greater, the fulcrum of the reduced penetration and permeability is more stable. Organic matter also reduce soil erosion, because of the infiltration capacity and run-off are small

2. **Chemical Properties**
   The direct benefits of organic matter as a source of N, P, S through mineralization. Mineralization process sometimes produces nutrient elements available in the form of a profitable crop, but sometimes freeing toxic compounds. Indirect benefits that increase the CEC, help provide N through fixation of atmospheric N_2, freeing a fixed P, chelating micro elements, adsorbs pesticide and other organic compounds. Humus formed from organic matter has a positive and negatively charged groups. Positive cluster can hold such phosphate anions, nitrate and sulfate.

3. **Biological Properties**
   Organic matter were as a source of energy and C source for soil microbes. The addition of organic matter will improve the soil mibrobia activity, increased microbial saprophyte that produces antibiotics, phenolic acids and even compounds inhibiting pathogen.

CONCLUSION

The rapid degradation organic matter in the tropics, if attributed with the use of organic matter, then it is imperative for us to manage the land in such a way that the lack organic matter is not the case. I increase the original organic matter in the soil and add from outside the land.

Organic matter does have some weakness such as low nutrient levels, high volume, making it difficult to transport, difficult dose determined with certainty, often contain heavy metals as well as disease carriers, but if we are oriented to save the environment, then the composting the waste that has accumulated around the palm oil mill important. Finally compost from empty fruit bunches waste can be reused by plants as fertilizer, while the environment for the better. Thus the utilization of palm oil waste can support green agro-industry.

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