

COMPARISON OF SOIL/WATER POLLUTION BETWEEN OIL PALM, SOYBEAN, AND RAPESEED PLANTATION

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RESUME

The production of soybeans and rapeseeds to produce one ton of vegetable oil uses more fertilizers and pesticides than oil palm. The implication is that pollutant emissions from the use of fertilizers and pesticides on soybean crops are the largest, so that it has become a major threat to the sustainability of biota life in soil and water. Meanwhile, palm oil production technology uses fewer fertilizers and pesticides, so their emissions/pollutants are also relatively low.

If it is associated with the SDGs achievement, especially SDGs-14 and SDGs-15, the global community should choose palm oil as the best alternative to vegetable oil that produces the lowest emissions/pollutants. The facts also correct the NGO movement and the European Union policy of phasing out palm oil both as a biofuel feedstock and for food. Efforts to discredit or phase out palm oil from global vegetable oil consumption mean a movement to encourage increased emissions of fertilizer and pesticide pollutants into soil and water. Because the reduction in the consumption of palm oil, which consequently encourages the consumption of soybean and or rapeseed vegetable oil, will be paid for by increasing emissions/pollutants from the use of fertilizers and pesticides globally, it could potentially threaten the life of biota in the soil or water.

INTRODUCTION

Preserving life on land and in the soil as well as in water are two of the 17 Sustainable Development Goals (SDGs), namely SDG-14 (life below water), and SDG-15 (life on land). Sustainability of life in and on land and life in water needs to be ensured because it also involves human life, both food and health (Lu et al., 2015).

One source of threat to life on land and water is pollution from various sources of global community activities, for example, fertilizer and pesticide residues from agricultural activities (FAO, 2013 and 2017). Therefore, efforts to minimize pollution from the global agricultural sector must be the focus and an important agenda of the global community.

In the agricultural production process, how much fertilizer and pesticide residues enter the soil and water depends on many factors, such as agricultural production technology and the type of crop. Agriculture with intensive fertilizer and pesticide technology generally produces larger residues of fertilizers and pesticides.

On the other hand, in global vegetable oil production, there are top vegetable oil-producer crops, namely palm oil, soybeans, and rapeseed. What is interesting to discuss is how much pollutant emissions both from fertilizer and pesticide residues pollute the soil and water produced by top-3 vegetable oil crops.

This article will answer these empirical questions by showing a comparison of pollutant emissions to soil and water from these vegetable oils. In addition, it also discussed the contribution of these vegetable oils to the achievement of the SDGs, especially SDGs-14 and SDGs-15. To discuss these issues, data from international institutions such as FAO is used.

FERTILIZER AND PESTICIDE RESIDUES FROM TOP-3 VEGETABLE OIL-PRODUCER CROPS

The top-3 vegetable oil producers in the world are palm oil, soybeans, and rapeseed. Data from USDA (2021) and Oil World (2020) show that there has been significant growth in the area of top-3 vegetable oil crops in the world in the last 20 years. During the period 2000-2020, the soybean area has increased from 75.5 million hectares to 127 million hectares. The same thing happened with the increase in the area of rapeseed plantations from 24.7 million hectares to 35.5 million hectares. Oil palm plantations also experienced an increase, but the growth was lower than the soybean and rapeseed areas, from 10 million hectares to 24 million hectares.

Meanwhile, total vegetable oil production data for 2020 (USDA, 2021) respectively shows the production volume of soybean oil at 58.7 million tons, rapeseed oil at 27.3 million tons, and palm oil at 83.5 million tons. So, the oil productivity per hectare for each of these vegetable oil plants is palm oil (CPO+CPKO) reaching 4.3 tons per hectare. Meanwhile, the productivity of rapeseed and soybeans is only 0.7 tons per hectare and 0.45 tons per hectare, respectively.

In the process of producing vegetable oil, the top-3 vegetable oil crops use the same production inputs, namely Nitrogen (N), Phosphate (P_2O_5), fertilizers, and pesticides. However, to produce each ton of vegetable oil, the use of fertilizers and pesticides among them is relatively different (Table 1).

In general, for every tonne of vegetable oil produced, soybean production technology uses more N and P fertilizers (fertilizer intensive) than rapeseed or oil palm crops. When compared to producing one ton of palm oil, the technology for producing one ton of rapeseed oil uses more fertilizer. So overall, soybeans and rapeseed crops use fertilizer more intensively than oil palm. In other words, oil palm is a vegetable oil crop that uses less fertilizer.

Table 1. Comparison of the Use of Fertilizers and Pesticides to Produce One Ton of Palm Oil, Soybean Oil, and Rapeseed Oil

Indicator	Palm Oil	Soybean Oil	Rapeseed Oil
Nitrogen (kg/ton oil)	47	315	99
Phosphate (kg/ton oil)	8	77	42
Pesticides/Herbicides (kg/ton Oil)	2	29	11

Source : FAO (2013)

Likewise, the production technology of soybean and rapeseed crops to produce one tonne of their vegetable oils uses more pesticides than oil palm. The data also shows that the production technology for producing one ton of palm oil is more efficient at using pesticides.

The use of fertilizers and pesticides has implications for pollution. Not all of the fertilizers and pesticides applied to crops can be absorbed by them. Some are wasted as emissions or pollutants that pollute the soil and water, thus potentially endangering the life of soil and water biota.

Based on FAO (2013), residues of nitrogen (N), phosphate (P_2O_5) fertilizers, and pesticides that were generated from the production of Top-3 vegetable oil crops are presented in Table 2. The emissions or pollution from fertilizer and pesticide residues used to produce one ton of soybean oil are the highest compared to rapeseed and oil palm crops. Even among them, oil palm is a vegetable oil crop that has the lowest emissions of fertilizers and pesticides, which means less polluting the water and soil.

Table 2. Emissions/Pollution of Fertilizers and Pesticides Produced to Produce One Ton of Palm Oil, Soybean Oil, and Rapeseed Oil

Indicator	Palm Oil	Soybean Oil	Rapeseed Oil
Emissions to soil/water:			
Nitrogen (kg/ton oil)	5	32	10
Phosphate (kg/ton oil)	2	23	13
Pesticides/Herbicides (kg/ton oil)	0.4	23	9

Source : FAO (2013)

IMPLICATIONS FOR ACHIEVEMENT OF SDGs

Residues of fertilizers and pesticides from the production process of vegetable oils have the risk of contaminating the land and water (FAO, 2013) and threatening the life of biota both in the soil and in the water. Soybean oil crops produce the largest fertilizer and pesticide residues, so they have a greater potential to threaten the life of biota in soil and water. In contrast, oil palm crops produce fewer fertilizer and pesticide emissions, so their potential as a threat to biota life in soil and water is relatively lower.

The quality of vegetable oil production has implications for the achievement of the SDGs. To help achieve SDG-14 and SDG-15 in global vegetable oil production, ideally (the

first best), the global community must choose vegetable oil crops with zero pollutants. Unfortunately, the process of producing vegetable oil with zero pollutants from fertilizers and pesticides almost does not exist on planet earth. So, the best alternative is to choose vegetable oil crops, which is a production process that can minimize emissions/pollutants from the use of fertilizers and pesticides. With these criteria, palm oil is a realistic choice internationally. The argument is that the palm oil production process uses lower fertilizers and pesticides, so that the emissions or residues produced are also lower than soybeans and rapeseed.

If the quality of the environment both on land and water becomes an important concern of the global community and is part

of the SDGs that must be achieved internationally, then the global community should dare to take the decision to choose palm oil as an alternative to vegetable oil that can minimize emissions/pollutants resulting from the use of fertilizers and pesticides. This choice is also an important effort to achieve SDG-12 (Responsible Consumption and Production), which is choosing the consumption and production of vegetable oil that produces the minimum amount of emission/pollution.

The facts also correct the NGO movement and the European Union policy of phasing out palm oil both as a biofuel feedstock and for food. Efforts to discredit or phase out palm oil from global vegetable oil consumption mean a movement to encourage increased emissions of fertilizer and pesticide pollutants into soil and water. Because the reduction in the consumption of palm oil, which consequently encourages the consumption of soybean and or rapeseed vegetable oil, will be paid for by increasing emissions/pollutants from the use of fertilizers and pesticides globally, it could potentially threaten the life of biota in the soil or water.

CONCLUSION

The production of soybeans and rapeseeds to produce one ton of vegetable oil uses more fertilizers and pesticides than oil palm. The implication is that pollutant emissions from the use of fertilizers and pesticides on soybean crops are the largest,

so that it has become a major threat to the sustainability of biota life in soil and water.

On the other hand, palm oil production technology uses fewer fertilizers and pesticides, so their emissions/pollutants are also relatively low. If it is associated with the SDGs achievement, especially SDGs-14 and SDGs-15, the global community should choose palm oil as the best alternative to vegetable oil that produces the lowest emissions/pollutants.

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