IPNI POLICY BRIEF

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Contributions of Best Management Practices towards Sustainable Oil Palm Production through Intensification

IPNI Southeast Asia Program has long been engaged in sustainable oil palm production through intensification. By using Best Management Practices (BMPs), we have shown an increase in the productivity of oil palm within the first year after using BMPs. This is about the history, success, and future of BMP implementation in oil palm in Southeast Asia.
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The world's population is expected to increase to more than 9 billion people in 2050, with more than half living in urban areas. The demand for vegetable oil by this "urbanizing" population is expected to be between 200-340 million tons, based on a range of per capita consumption (Corley, 2009).

At the start of the new millennium in 2000, consumption was 85 million tons per year. By 2012, it increased by 77% to reach over 150 million tons, largely due to changing dietary habits particularly in rapidly developing countries, with China and India now accounting for 30% of the total edible oil consumption.

Oil palm has become the most important source of vegetable oil due to its very high productivity, low production costs, use versatility and high profitability. Palm and palm kernel oil now account for more than 30% of all edible oils consumed.

There has been rapid expansion of oil palm in Malaysia and Indonesia, which now produces more than 85% of the world's palm oil. Oil palm has replaced such perennial crops as rubber and cocoa in many areas, and according to recent studies has also expanded in areas of the rainforest that in parts were previously logged or cleared for other uses. Expansion has been on both mineral and peat soils. Details can be found in Koh and Wilcove (2008) and Carlson et al. (2012).

Agricultural intensification is often considered when there are incentives to increase productivity per unit land area. In the same way, there is a propensity for expansion as a solution for increasing productivity when incentives are provided for expanding productive area. What is meant by intensification? In the context of minimizing expansion of cultivated land and at the same time increasing production, intensification refers to increased productivity per unit of land area, which can be achieved using sustainable management practices, often coupled with increased but responsible use of inputs.

The increase in oil palm production has been almost entirely due to expansion of area planted to oil palm, for which the oil palm sector in Southeast Asia has been severely criticized by environmental lobby groups, in that, forest conversion leads to losses of biodiversity and carbon emissions. Additionally, the industry has also been associated with social conflict over land tenure and land rights.

Whilst oil palm has been denounced for its negative effects on the environment, it is in many ways extraordinarily benign. Pesticides are largely limited to localized applications; the by-product palm kernel cake is used in animal feed thus reducing the need to cultivate land to produce animal feed; the energy in the harvested fruit bunches is sufficient to power the extraction plants and can provide excess electrical energy which is often supplied to the grid or to local populations that otherwise would be bereft of a regular electricity supply. Residue from processing is normally returned to the field to improve soil fertility and structure, including carbon content in soil organic matter, with no external contamination from efficient extraction plants. Permanent ground cover reduces erosion while the standing biomass of mature plantations tie up substantial quantities of carbon and oil palm is currently one of the most efficient sources of biofuels in terms of both net energy gain and total energy produced per unit of land area.

On the one hand, increased production of palm oil to meet future demand solely from expansion into the rainforest is no longer a feasible option. However, on the other hand, the land area needed to satisfy future demand using other crops is truly alarming: we estimate that 5-8 ha of rapeseed or soybean are needed to produce the same amount of edible oil as 1 ha of oil palm at current yield levels. The environmental consequences of expanding soybean and rapeseed production into vast new areas are not without its own environmental pitfalls. Under these circumstances the best course of action appears to be one that cashes in on the proven, extremely high productivity of oil palm to limit environmental damage that would be the result of the expansion of vegetable oil production into vast new areas that are presently not cultivated. The question then becomes how can we increase palm oil production with minimal damage to the environment?

ACHIEVEMENTS

Current average oil production in Malaysia is approximately 4 t CPO per ha per year for mature palm plantations, and even lower in Indonesia. However, there is much variation about the mean. Leading companies in the industry have regularly exceeded the national average in recent years. For example, annual reports for the years 2008 and 2011 of IOI Group, United Plantations Berhad and IJM Plantations Berhad indicate oil yields between 4.95 and 6.1, 5.28 and 6.38, and 5.05 and 5.46 t CPO per ha per year for mature palm, respectively. These yields have been achieved over large areas. This information suggests that good management can consistently produce yields that are significantly higher than current average yields. An analysis of CPO yield increase from 1.3 t/ha to 5.4 t/ha, over a 40-year period, was attributed to breeding advances and improved management (Davidson, 1993). Improved fertilization practices alone accounted for 29% of the reported increase in yield.

In a long-term perennial crop such as oil palm, with millions of hectares already planted and in production, a key question is whether the productivity of existing plantations can be increased, or if companies such as those mentioned above only obtain high yields because they have had excellent management from the initial establishment of their plantations. The International Plant Nutrition Institute's Southeast Asia Program (IPNI SEAP) tested the hypothesis that good management could

substantially increase yields of mature oil palm plantations in Indonesia. A process to deploy a series of Best Management Practices (BMP) consistent with the guidelines of the Roundtable on Sustainable Palm Oil (RSPO) was developed and tested on commercial blocks in oil palm plantations.

The production of fresh fruit bunches (FFB) increased within the first year after using BMP. This increase, equivalent to about 0.4 t CPO per ha per year, is attributed to the improved harvesting procedures based on more frequent harvesting rounds to reduce losses. The effectiveness of these harvesting procedures was so evident that they were sometimes immediately adopted on the estates. After four years, BMP increased FFB yield by 4 tons per ha per year, equivalent to approximately 0.9 t CPO per ha per year. It should be noted that these gains were obtained on plantations that had an average yield in year four with standard management of 25 t FFB, which is above average for the region. The scope for increasing yield on less well-managed plantations or those in marginal lands should be even greater, especially with improved nutrient management. Hence, application of BMP on existing plantations, even mature, well-managed ones, has been shown to increase FFB yields substantially (**Figure 1**).

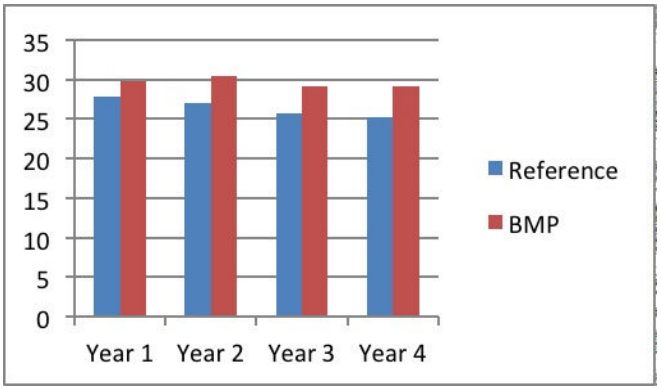

Figure 1: *Comparison of BMP and reference blocks in oil palm plantations that have optimal site conditions. (Results are based on the average tons of fresh fruit bunches per hectare and year obtained from 3 plantation sites in Sumatra and Kalimantan)*

As an alternative, to conserve tropical forests, expansion on heavily degraded forests and 'degraded lands' such as the extensive 'alang-alang' grasslands is an attractive option. The application of BMP at a poor site, with poor soil conditions and subject to periodic drought, increased yields to levels considerably greater than current average yields indicating that expansion of production into degraded lands is indeed an interesting option (**Figure 2**).

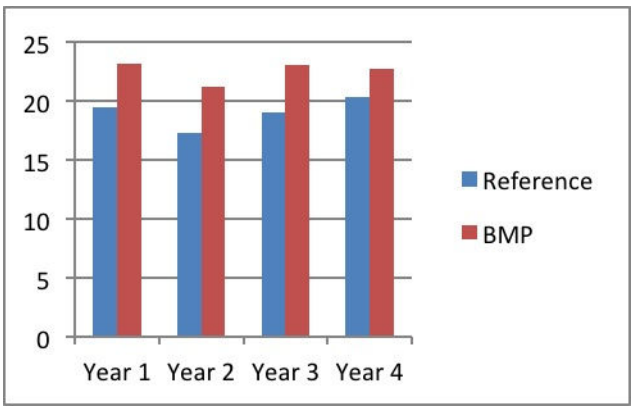

Figure 2: *Comparison of BMP and reference blocks in oil palm plantations with sub-optimal site conditions. (Results are based on the average tons of fresh fruit bunches per hectare and year obtained from 3 plantation sites in Sumatra and Kalimantan)*

The World Resources Institute (WRI) recently developed an online mapping application, the Suitability Mapper that enables palm oil producers, investors and government planners to use WRI's maps and single out low-carbon sink areas with little biodiversity as potential sites for oil palm plantations

(www.wri.org/applications/maps/suitability-mapper). By setting parameters that exclude rainforests, high conservation value areas, peat-lands and lands used by local communities, this online tool identifies lands (currently only in Indonesia) that can be used for oil palm with minimal controversy. The Suitability Mapper identified at least 14 million hectares of land in Indonesia alone that could be planted to oil palm as a means to increase production and, at least partially, to meet global demands without the need to consider forest clearance or drainage of peat lands. It is likely that in these areas, the local population would benefit from the equitable development of the currently unproductive lands, reducing the likelihood of social conflict if they are developed responsibly: the local communities would probably welcome the opportunities. Field sites with sub-optimal environmental growing conditions for oil palm where IPNI has worked can produce more than 5 t CPO per ha per year.

CONCLUSIONS

Oil palm is highly productive and requires far less land to satisfy increasing demand than other crops. Apart from concerns about moving into rainforest areas, oil palm is environmentally benign and a mainstay in the development of the economies of major producing areas that brings benefits to local communities. The oil palm industry provides jobs, infrastructure like roads, electricity, schools, nurseries and clinics in areas that were previously isolated and under-utilized (USDA, 2007).

The experiences of large corporations, the BMP recommended by IPNI and government incentives demonstrate that production can be intensified by improved management of existing plantations. We estimate that 15 to 20% yield increases are indeed very reasonable. Such intensification of production on existing plantations will go a long way to mitigate the threat of deforestation, loss of biodiversity and increased carbon emissions. Even so, increasing the productivity of the area currently planted to oil palm will not be sufficient to meet world demand for palm oil. However, expansion into low value lands that are neither high conservation value forests, nor peat lands, nor land use conflict zones, is perfectly feasible. Land that is highly suitable for oil palm plantation expansions can be identified by the Suitability Mapper. These 'degraded' and 'non-degraded' lands are extensive and offer the opportunity to produce more palm oil, with minimal negative and possibly positive impacts on the environment.

POLICY RECOMMENDATIONS: OPPORTUNITIES and IMPLICATIONS

- **Yield intensification without area expansion**: This is an almost instant solution for rainforest preservation, biodiversity conservation and minimal carbon loss. By turning the focus on existing plantations, plantation owners can increase palm oil yields substantially with effective crop management.
- **Suitability Mapper**: This online interactive tool may be used to identify land suitable for palm oil production that is currently under-utilized, under-valued, and of little environmental value in Indonesia.
- **Expansion into 'degraded' and 'non-degraded' lands**: Expansion of production into low carbon sink areas with little conservation value offers the opportunity to increase palm oil production with minimal controversy. By using land with low conservation value that is not necessarily infertile, plantation owners will largely avoid issues of conflict with local communities over land tenure or land rights. Degraded, sub-optimal sites can be rehabilitated with BMP for yield intensification.

- **Incentives**: Regional government incentives that sway production towards increasing productivity as opposed to expansion. Government incentives coupled with policies and support can alter the balance between intensification and area expansion, to create a more sustainable oil palm industry with an overall increase in productivity with minimal damage to the environment.

REFERENCES

Corley R.H.V. 2009. How much palm oil do we need? Environ. Sci. & Policy 12:134-139.

Koh L.P. and D.S. Wilcove. 2008. Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters 1(2):60-64.

Carlson K.M., L.M. Curran, G.P. Asner, A.M. Pittman, S.N. Trigg, and J.M. Adeney. 2013. Carbon emissions from forest conversion by Kalimantan oil palm plantations. Nature Climate Change 3:283-287.

Davidson, L. 1993. Management for efficient cost-effective and productive plantations. In: Yusof B. et. al. (eds.) Proceedings of 1991 PORIM International Palm Oil Conference, Module 1 - Agriculture, PORIM, Kuala Lumpur, pp. 153-167.

USDA (United States Department of Agriculture). 2007. Indonesian Palm Oil Production, available at: www.pecad.fas.usda.gov/highlights/2007/12/Indonesia_palmoil/

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About IPNI
The International Plant Nutrition Institute (IPNI) is a not-for-profit, science-based organization dedicated to the responsible management of plant nutrition for the benefit of people. Through cooperation and partnerships with respected institutions around the world, IPNI adds its strength to agronomic research, education, demonstrations, training, and other endeavors. Best management practices for nutrient stewardship encourage the concept of 4Rs - applying the right nutrient source, at the right rate, at the right time, and in the right place. To learn more about IPNI, please visit: www.ipni.net

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