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The endless palm oil debate

Science-based solutions beyond controversies

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SUMMARY

Opinionated and controversial debates currently dominate the public discourse on oil palm cultivation. The outstanding economic potential for the palm oil industry, from large plantations to small producers and for the development of poor countries stand in stark contrast to social and environmental impacts together with threat on sensitive tropical ecosystems.

The present article focuses on the objectification of the sometimes ideological and irrational discussions on the cultivation of oil palm. Scientists are encouraged to participate in order to avoid the dissemination of simplified correlations and to promote a public discourse based on verified sources and evidence. The direct connection between oil palm plantations and deforestation belongs to this category of quick and simple statements. Various industrial and agricultural sectors, including palm oil, as well as several illegal activities share the responsibility for deforestation and environmental degradation in tropical areas.

In order to ensure that the palm oil sector's share of deforestation is reduced to a minimum will be soon lowered to zero, several sustainability initiatives have been launched in recent years, most notably the RSPO (Roundtable on Sustainable Palm Oil) and national approaches by the two largest palm oil producing countries, namely Indonesia and Malaysia. An increasing number of stakeholders are taking part in these mostly voluntary initiatives and are pushing them further, based on even clearer and more stringent criteria. These are for example POIG (Palm Oil Innovation Group) and RSPO Next.

To simply boycott palm oil will not solve any of the most urgent problems. First, this would promote the cultivation of alternative crops, which on the one hand provide less oil yield per hectare and on the other hand do not necessarily have a better ecological and social balance. And second, the demand for sustainably produced palm oil on the world would collapse, because only western markets actually demand certified sustainable palm oil. Indeed a boycott of palm oil would promote the emergence on non-certified palm oil thus having the opposite effect to what is actually urgent to be achieved.

SCIENTISTS IN THE PUBLIC CONTROVERSY

Scientists have a part to play in the debate over oil palm cultivation which has captured and polarized public opinions, especially in Europe, kindled and undoubtedly shaped by the media.

How can this palm be viewed as a 'miracle plant' by both the agro-food industry in the North and farmers in the tropical zone, but a serious ecological threat by non-governmental organizations (NGOs) campaigning for the environment or rights of local indigenous peoples?

The time has come to move on from this biased and often irrational debate, rooted in issues which are topical in our contemporary society such as balanced nutrition, biodiversity conservation, energy policy and ethical consumption. One of the reasons the public has developed polarized ideas about oil palm cultivation is that there has been a lack of accurate information on the sector and its actors, and a clear headed analysis of what's at stake. Scientists must jump into the public arena, providing peer-reviewed and verified facts and figures, deciphering fake and easy correlations between agriculture and deforestation, confronting sources and evidences...

STRENGTHS AND WEAKNESSES OF A CHAMPION

The oil palm offers exceptional oil yields of 3.8 tons per hectare (t/ha) as a global average, nearly 6 t/ha in the best plantations in Southeast Asia and more than 10 t/ha in the highest yielding genetic trials currently underway in research institutions. Such yields make the oil palm the leader of industrial oil crops (see Figure 1). The proportion of the oil palm in worldwide production of vegetable oils has continued to grow over recent decades to reach the number one spot, ahead of soybean. Today it accounts for over a third of the vegetable oil produced worldwide.

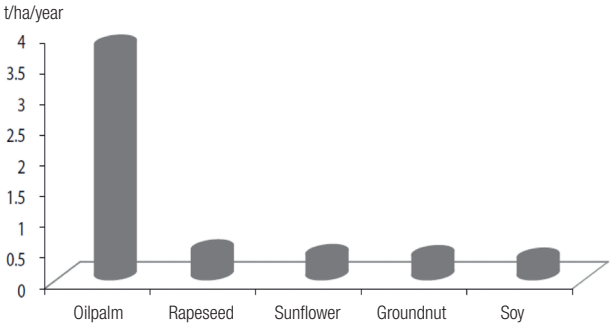

Figure 1: Average oil yield (t/ha/year) of major oil crops [1]

Above its outstanding oil productivity, the oil palm proves to be a very versatile crop as its oil can replace most other vegetable oils and it has a very wide range of uses. Indeed, the agri-food industry absorbs around 80% of global production for table oil, frying oil, margarines, fat for bakery products, patisserie and all types of food preparation. Oleochemicals accounts for 15% of usage, including: cosmetics, soap production, lubricants and greases, candles, pharmaceutical products, surfactants, agrochemicals, paint and lacquer, electronics... Today, around 5% of produced palm oil is used for biodiesel. The European Union passed legislation in 2009 through its Renewable Energy Directive (RED) that required 10% of all transportation energy to come from renewable resources by 2020, thus expanding the region's use of biofuels and directly palm oil [2]. Indeed, biodiesel produced from palm oil raised from 1.45 Gt in 2010 to 3.22 Gt in 2014, thus representing 48% of European uses of palm oil (Oil World Statistics, 2015).

The biological requirements for oil palm cultivation mean its distribution is limited to the intertropical belt, and it is thus forced to share some of the planet's last biodiversity hotspots, namely the Congo Basin, the Amazon and Borneo. Such a coexistence with fragile biodiversity-rich ecosystems is at the origin of major subjects of controversy.

A COMMODITY CHAIN ANCHORED IN THE GLOBAL SOUTH

The production and processing of palm oil is part of a complex globalized agro industrial sector with multiple actors and stakeholders defending conflicting interests. This sector, which now finds itself in the limelight, symbolizes the evolving North-South relationship in agricultural development. Palm oil is also a showcase for South-South trade and the development of its trade is mainly driven by newly emerging economies. As is the case in many industrial sectors – from cars to cell phones – countries from the global North no longer dominate markets, a situation which will continue for some time into the future.

Developed countries still play a leading role, not only in innovation (although how long this will last we do not know), but also in challenging the industry on ethical and environmental grounds. In addition, the bulk of agro-food processing involving palm oil takes place in the North, the home of the major agro-food companies which are the stated targets of NGOs. The self-appointed role of world policeman taken on by some governments and NGOs in the North is questionable, but it is clear that their dramatic and inevitably oversimplified campaigns have played a direct role in encouraging people to think about sustainability.

Oil palm is cultivated exclusively in humid tropical zones where it represents a major source of cash, both in terms of exports and as a raw material for local industry (fractionation and refining). Two countries – Indonesia and Malaysia – are responsible for the bulk of world palm oil production, and between them they account for 87% of supplies (see Figure 2).

Consumption of palm oil is gouverned by the countries from the global South and it is driven by demographic growth and the rising standard of living in emerging countries with large populations

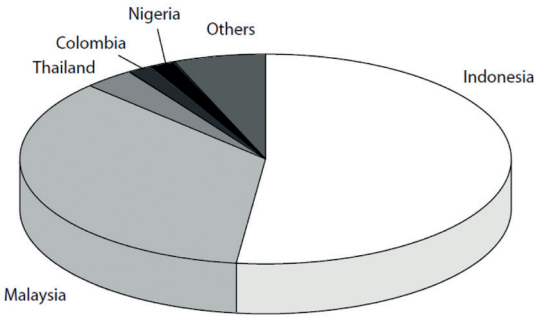

Figure 2. Major palm-oil-producing countries. Source: USDA-FAS

such as India, Indonesia and China (see Figure 3). European consumption accounts for 12% of the world total and the United States' share is 3%.

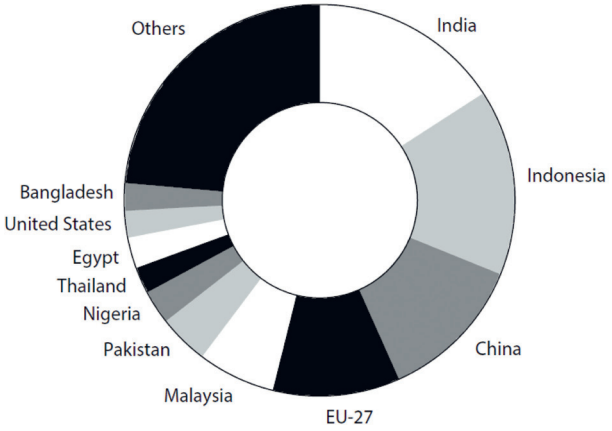

Figure 3. Main palm-oil-consuming countries. Source: USDA-FAS

MUST TROPICAL FORESTS BE SACRIFICED?

The relationship between palm plantations and deforestation is neither direct nor automatic. Concessions are granted by public authorities, often at local level, to forestry companies which extract timber. Degraded forests can become fallow land, savannah or farmed land, depending on local laws. Only a portion of deforested land is converted into palm plantations. Out of 21 million hectares of primary forest which disappeared in Indonesia between 1990 and 2005, no more than 3 million have been developed as palm plantations [1].

Agriculture is therefore the leading cause of global deforestation, with 24% for livestock and 29% for crops, with various contributions: soybean (19%), maize (11%), oil palm (8%), rice (6%) and sugarcane (5%). Oil palm plantations accounts for 8% of the deforestation attributed to agricultural crops. In total, this represents 8% of 29%, thus 2.3% or 5.6 million hectares from the 239 million hectares of forest which were lost between 1990 and 2008 [3].

However, there are growing signs of a direct link in new frontier areas, such as Borneo, where nearly 30% of the primary forests felled have been planted with oil palm [4], while on average new plantations are responsible for 10% of the deforestation that has taken place in Indonesia and Malaysia [5]. These figures do not take into account the indirect causes of deforestation linked to activities which spring up following the introduction of plantations at the edge of forests; these activities are difficult to estimate but are far from negligible.

Losses in primary forests have increased steadily in Indonesia between 2000 and 2012, from 200,000ha to 800,000ha per year, particularly in the islands of Sumatra and Borneo [6]. Deciphering the causes of deforestation, Abood et al [7] estimated the responsibility of several major sectors for total deforestation in Indonesia between 2000 and 2010: tree plantations for pulp (12.8%), concessions for timber (12.5%), industrial oil palm plantations (11%) and mining concessions (2.1%). The share attributable to palm oil is higher on the island of Borneo and also higher on peatlands (18.2%). To these figures must be added the share of direct and indirect deforestation due to small farmers, which is much more difficult to evaluate. Gaveau et al [8] stressed that that links between industrial plantations and deforestation are not always direct. Indeed, in Borneo Island, 25% of deforestation corresponds to a direct conversion to plantations (less than a 5-year lag between deforestation and planting). In other cases, forests are exploited for their timber, either legally or illegally, which weakens them and exposes them to more and more frequent fires and deforested areas are not immediately or automatically grown. Both smallholders' and agro-industrial oil palm plantations therefore have a real responsibility for deforestation, but this responsibility is shared with other sectors of the Indonesian economy, such as paper industries, forestry and mining. The increase in the frequency of uncontrolled fires is also a major cause of degradation of the forests of Sumatra and Borneo.

Before more primary forests of High Conservation Value (HCV) or High Carbon Stock (HCS) are destroyed, production should be intensified in zones which have already been converted into palm plantations. Despite its favorable agro-climatic conditions, Malaysia has an average national yield of less than 4 tons per hectare, which remains far below the top yields achieved in some plantations in the region (6–7 tons per hectare). It is therefore paramount to optimize the production system of existing palm plantations while keeping any negative impact on people and the environment to a minimum.

ECOLOGICAL INTENSIFICATION AS A DRIVER OF SUSTAINABILITY

Ecological intensification of productivity means first and foremost ensuring that all planters – both small-holders and agro-industrial estates – have access to selected and certified seeds, thus benefiting from the latest genetic breakthroughs made by research. The adoption of selected planting material adds value at all stages of oil production and primary processing. Investing US$ 1 in an oil palm seed originating from best hybrids will provide an average income of US$ 1300 by the end of its 20 years of commercial exploitation.

Improved planting material provides the planter with higher yields in terms of bunches and optimizes labor (through easier harvesting of shorter palms). It helps the miller by offering better extraction rates and the refiner by increasing olein con-

tent. By providing better resistance to diseases and making it possible to use the same land for several generations, genetic selection and the availability of selected hybrid seeds help reduce pressure on land, particularly since yield also rises. Genetic progress for the oil palm has been measured at 1–1.5% per year (similar to maize) which makes a significant contribution to ecological intensification. However, this alone is not enough to meet increased needs for vegetable oil (+ 3–4% per year) and for palm oil in particular (+ 5–6%). Best agricultural practices should also be adopted in order to contribute to this intensification, which is designed to meet global demand by limiting the area under cultivation.

Ecological intensification also relies on the implementation of well-planned fertilization, both for economic reasons (fertilizers account for over 60% of the running costs of a palm plantation) and out of respect for people and the environment. On average, over the economic lifetime of a plantation (20 years), around 850 kg of fertilizer are applied per year per hectare. The use of compost made from the stalks and liquid effluents from of oil mills enables a very significant reduction in these inputs. Fertilizers made from petrochemical products or non-renewable mineral sources have a limited future. The challenge is therefore to optimize the use of fertilizers (mineral and organic) to ensure they provide maximum benefit to the plant through divided and well-planned applications that avoid any surplus leaching into ground or surface water. These needs are assessed from mineral analysis of soil and leaf samples taken in the plantations. Analysis provides thresholds for fertilizer use depending on climate, plant physiology, soil type and the genetic origin and age of plantation.

THE LONG AND WINDING ROAD OF INNOVATION

The ecological intensification of oil palm cultivation comes up against the biological constraints of the plant which make production difficult to mechanize and therefore relatively demanding in terms of labor (one person per 10 hectares on average). Oil has to be extracted promptly from the fruit to avoid losing its physical and chemical properties. This requires an efficient harvesting network, maintained infrastructures and reliable organization of the harvesting areas around mills.

The transfer of innovation to smallholders remains one of the main challenges facing ecological intensification. If these planters can be organized through national projects or public and private sector associations, the transfer of innovation (selected seeds and best agricultural practices) is relatively easy and swift; the organizational structure then offers the necessary credit facilities and technical and financial support.

Independent planters who are not grouped together in cooperatives remain harder to reach, and therefore convince, in spite of the enormous gains in yield to be achieved.

Recent collaborative research [9] highlighted the need for some fresh inputs into the general debate about the different types of production systems and growers. For example, not all smallholders are ‘small’ or tied to agro-industry. Practices, perceptions, rationales and impacts widely vary and such variability needs to be accounted for in designing adapted pathways toward sustainability. Certification schemes, such as RSPO, need to be better adapted to the various actors targeted. New criteria, specific to smallholders’ constraints and opportunities should be defined together with smallholder representatives, who can feed the debate with relevant insights. Best management practices need to be designed according to site-specific constraints and integrated into the whole innovation process chain - from the analysis of structural bottlenecks at the grower and household level to good practice uptake in the field. Field research notably highlighted that applied rates of fertilizers

and pesticides are highly variable, ranging from very low doses, which are likely to deplete soil nutrient pools, to very high doses, which are likely to lead to serious environmental pollution.

Multidisciplinary research proved very useful in generating additional understanding and accurate tools for, among others, the description of smallholder typology or the generation of prospective scenarios. Sustainable agricultural development -including oil palm- cannot be designed and implemented without strong interactions between agronomy, environmental, human and social sciences.

IS SUSTAINABLE PALM OIL SUSTAINABLE?

Since the Roundtable on Sustainable Palm Oil (RSPO) created the first sustainable palm oil certification scheme in 2004, a range of other industry and government initiatives aimed at preventing deforestation due to oil palm expansion were developed and implemented over the years [10]. Indeed, Ivancic and Koh [11] recently reviewed the various sustainability standards at stake in South East Asia and they concluded that emerging themes in the evolution of sustainable palm oil include a greater recognition of the complexity of the issue, the importance of maintaining true transparency, and a greater consideration of indigenous land rights. These authors stated that manufacturing companies and consumers are beginning to see the power that they hold when choosing to purchase CSPO (Certified Sustainable Palm Oil, through RSPO standards), so greater awareness and education are key to further improvement.

The Sustainable Palm Oil Transparency Toolkit (SPOTT) is a project from the Zoological Society of London (ZSL) providing information and resources to stakeholders in the palm oil industry in order to reduce its negative environmental impacts. SPOTT's publishes updated assessments for 50 of the largest palm oil - producing companies worldwide using only publicly available information on disclosure of their operations and their commitments to environmental and social best practice.

A study was recently developed by Efeca [12] in order to outline the key differences between the standards and aid buyers' decision making. This work outlined that on social themes, RSPO ranks most highly. It has the most comprehensive Social Impact Assessment (SIA) requirements, strongly emphasizing a participatory process. Noticeably ISPO (Indonesian Sustainable Palm Oil) and MSPO (Malaysian Sustainable Palm Oil) do not have cut-off dates for applicability for any criteria. RSPO also was found to have the strongest biodiversity measures, relying heavily on the HCV process, while ISPO appears to provide the least stringent overall protection for biodiversity. Finally the authors found that the greatest difference between RSPO and ISPO/MSPO was the inclusion of directives on business practices and plantation management, requiring a commitment to transparency and ethical conduct in business operations and transactions, which was not an explicit principle in ISPO/MSPO.

With smallholders accounting for 40% of the global palm oil production, the financing of RSPO certification for smallholders is more crucial than ever; this was the focus of a review of the certification Principles and Criteria engaged in 2013. The first experiment, carried out in Thailand [5], produced very high costs of certification (US$ 28 per hectare) and a premium for planters that was not sufficiently motivating (US$ 0.0003 per kilogram of harvested fruits). These cooperatives were only certified thanks to the intervention of outside donors.

In spite of its recognized weaknesses, which are shared by a number of private multi-stakeholder initiatives which pre-date it, the RSPO has the great merit of setting out the basis for constructive dialogue within the industry. It offers imperfect but useful tools for raising the moral standard of the palm oil production chain and for steering it towards greater sustainability.

These certification tools are still basically qualitative and, if they are to gain credibility, must be refined and consolidated on the basis of proven scientific results, which are shared and recognized. Much of the collaborative research underway on the oil palm is designed to identify suitable solid indicators of sustainability.

RSPO - Roundtable on Sustainable Palm Oil

When it was launched in 2004, RSPO was a business-to-business initiative bringing together about ten members, both private actors in the industry and NGOs (such as WWF). It is an international, multi-stakeholder initiative, aimed at certifying and promoting sustainable palm oil. In November 2005, eight principles and 39 criteria for certification were approved, leading to certification of the first plantations in 2008. The first Certified Sustainable Palm Oil (CSPO) was sold at the end of 2008. Today, the Roundtable has reached 3300 members, divided into seven categories: growers, processors and traders, manufacturers, banks and investors, retailers, environmental/nature conservation NGOs and social/developmental NGOs.

The Roundtable has various working groups through which it carries out, diversifies and enhances its activities. National or regional interpretation groups are responsible for integrating the certification principles and criteria into national legislation. There is still some way to go before they are adapted to the specific constraints of family farmers; the cost of certification and corrective action, estimated at US$ 20–40 per hectare is often prohibitive for smallholders who are barely, if at all, organized into cooperative arrangements [13].

Today, 3.3 million hectares of plantations are RSPO certified, (as compared to 106,000 hectares in 2008) and 12 million tons of palm oil certified as sustainable were produced in 2016 that is about 21% of global palm oil (620,000 tons in 2008).

Like a large number of multi-stakeholders initiatives devoted to the promotion and standardization of a sustainable product (Forest Stewardship Council, Marine Stewardship Council, Round Table on Responsible Soybean, BonSucro), the RSPO receives considerable criticism. It is based on the voluntary acceptance, by consensus of all members, of its principles and criteria and is therefore considered as not rigorous enough and lacking in power [1].

However, RSPO is by far the best known and recognized sustainability standard for palm oil, especially in Europe and in producing countries targeting the EU market. For example, 93% of certified Oil pall in the UK is CSPO (Certified Sustainable Palm Oil from RSPO, which is becoming a common name for all types of sustainably farmed and certified palm oil products).

RSPO NEXT has been developed to recognize the efforts of RSPO members who are exceeding the requirements of the RSPO Principles and Criteria (P&C). It is a voluntary commitment put forth in addition to the existing P&Cs and incorporates more stringent assessment standards, with guidelines regarding deforestation, fire, peat, human rights and landscape approaches, among other issues. These are measured through a combination of reviewing company policies and on-the-ground verification. This additional assessment gives member companies the opportunity to go beyond the requirements of the RSPO and demonstrate a stronger commitment to environmental and social responsibility.

International Sustainability and Carbon Certification (ISCC) scheme is a system for certifying the biomass and bioenergy industries, oriented towards the reduction of greenhouse gas emissions, sustainable land use, protection of the natural biosphere and social sustainability. ISCC applies across the supply chain and doing so it can verify traceability from a plantation right through to the consumer. ISCC can be applied to meet legal requirements in the bioenergy

markets, as well as to demonstrate the sustainability and traceability of feedstock in the food, feed and chemical industries. The scheme received the world's first official state recognition through the German government's biomass sustainability ordinance (BioNachV) in 2010, and has since been recognized by the European Commission as one of the first certification standards to demonstrate compliance with the EU Renewable Energy Directive's (RED) requirements. The system currently certifies over 300 palm related operations worldwide including plantations, mills, refineries, biogas plants, warehouses, trading and waste management systems.

ISPO: Indonesian Sustainable Palm Oil

ISPO was introduced by the government of Indonesia in March 2011. ISPO was designed from a legal framework based on Indonesian regulation (27 Laws and Regulations) involving the Ministry of Agriculture, the State Ministry for the Environment, the Ministry of Forestry and the National Land Agency. ISPO is mandatory: it is legally binding to all palm oil plantations within Indonesia and involves fines and sanctions. Indeed, punishment is applied to plantations/mills which cannot prove conformity to the required laws and regulations. ISPO audits have been conducted by independent certification bodies since May 2012, with a deadline involving all Indonesian growers by the end of 2014, and eligible plantations which were uncertified by 2014 can be downgraded [14].

Malaysian Sustainable Palm Oil (MSPO) is a national certification standard created by the Malaysian government and developed with input from various stakeholders in the palm oil industry. It was first launched in November 2013, and officially came into implementation as of 1st January 2015. The MSPO standard follows seven principles surrounding the themes of 'Management', 'Social Equity', 'Environmental Protection' and 'Economic Progress', namely Management and commitment responsibilities, Transparency, Compliance to legal requirements, Social responsibility, health, safety and employment conditions, Environment, natural resources, biodiversity and ecosystems, Best practices and Development of new planting. MSPO aligns the management of palm oil production with many existing national laws and regulations, although unlike ISPO, the MSPO standard is not currently mandatory.

In 2015 the Malaysian and Indonesian governments announced a plan to merge their two national sustainability standards – ISPO and MSPO – to form the 'Council of Palm Oil Producing Countries' (CPOPC), with the aim of improving production and coordinating control of the palm oil market. The council aims to develop the industry in member countries, "improve smallholders' welfare and build a global sustainable palm oil framework". The CPOPC is also open to other palm oil producing countries, including the Philippines, Thailand, Colombia, and Brazil, among others. Founding countries Malaysia and Indonesia also proposed e+POP, a global framework that provides laws and regulations for the industry's sustainable development.

The Palm Oil Innovation Group (POIG) is an initiative between environmental and civil society organizations and industry companies that aims to build upon the RSPO Principles and Criteria (P&C) and existing company commitments – especially on issues of deforestation, carbon stocks, biodiversity, greenhouse gas (GHG) emissions, pesticide use and social relations. Launched in 2013, the POIG Charter holds that certain P&C should set clearer performance standards for certified growers. POIG members argue that this builds a business case for responsible palm oil by bridging the gap between producers and consumer companies, which have made "No Deforestation" commitments. In 2014 POIG released its first 'Charter Indicators' list, which stipulates the specific conditions to be met regarding issues such as peat development, HCV and HCS management and the FPIC (Free, Proir and Informed Consent) process, among others. These indicators

have since been trialed and revised. The High Carbon Stock Approach (HCSA) Steering Group is a separate development that governs an established methodology supporting industry stakeholders to implement commitments to end deforestation associated with the production of palm oil and other commodities. Established in 2014, the group was formed to oversee the further development of the methodology and its use in the field.

The Sustainable Palm Oil Manifesto (SPOM) commits its signatories to supply chain sustainability through three main objectives:

- No deforestation in High Carbon Stock forest areas and the protection of peatlands.
- To create traceable and transparent supply chains.
- To provide positive economic and social impacts for people and communities.

These standards aim to build upon those set by RSPO, of which all signatories are members. Five of the largest oil palm growers in the industry – together producing more than 9% of the world's palm oil – were the first to sign the Manifesto, and then other signatories have joined. The Manifesto signatories are funding a study on HCS aiming to establish thresholds and suitable assessment methods to identify HCS forests, which will be excluded from future oil palm plantation development, thereby ensuring that environmental concerns are addressed whilst not stifling economic development.

The Indonesia Palm Oil Pledge (IPOP) was a partnership of palm oil companies with a mission to create an environment in Indonesia which enables and promotes the production of sustainable palm oil that is deforestation free, expands social benefits, and improves Indonesia's market competitiveness. Since 1st July 2016, IPOP signatories have decided that recent groundbreaking policy developments in Indonesia have fulfilled the purpose of IPOP to help accelerate and promote this transformation toward sustainability and therefore its presence can be dissolved. The Signatories will continue to implement their sustainability commitments independently. To find out more about IPOP signatories sustainability commitments please refer to each of IPOP member companies' official website. All IPOP expired at the end of September 2016.

SURVIVING THE CERTIFICATION JUNGLE

A number of standards exist to support responsible palm oil production: Certification standards, such as the Roundtable on Sustainable Palm Oil (RSPO), establish common commitments and guidance for growers and lend credibility to their claims on the sustainability of their operations; therefore providing assurances to buyers and investors. In addition to certification schemes, voluntary initiatives, such as the Palm Oil Innovation Group (POIG) and the Sustainable Palm Oil Manifesto (SPOM), have been established and endorsed by a number of growers, committing them to criteria for sustainable production. Mandatory national standards, such as the Indonesian Sustainable Palm Oil system (ISPO), which is applicable to all oil palm growers in Indonesia, have also been developed to address industry sustainability at a national level.

Van Duijn [15] showed that procedures in the globalized and complex palm oil supply chain guarantee stepwise traceability as required by food safety regulations, although continuous traceability is usually not achievable. To the author, the RSPO trace and traceability systems do not improve this. Exception is the Identity Preserved system, however, the high costs and low volume of this system makes it only applicable for niche market products.

Moreno-Peñaranda et al. [16] worked on the perceptions on the barriers for improving palm oil sustainability as held by the main RSPO stakeholder groups and they contrasted them with the views of local communities in oil palm expansion areas. These authors suggested that RSPO stakeholders' perceptions about enhancing palm oil sustainability are overall highly divergent. However there seemed

to be an underlying common optimism among some RSPO stakeholders and local communities about the feasibility of a technical fix.

BOYCOTTING PALM OIL: THE BOOMERANG EFFECT

Stocks of palm oil are very low and demand is driven by countries with high economic and demographic growth. This means that withdrawing from the market the 17% destined to meet the needs of the global North (if we include biofuel) will have the effect of re-inflating supply, by bypassing any certification constraints, which do not exist in the markets of the South (China, India, Pakistan). The effect will be the opposite of that sought; non-RSPO certified palm oil will be indirectly encouraged. Indeed, if there is no demand left for sustainably produced palm oil, the market will easily absorb such efforts as "conventional palm oil", which finally would mean the end of all sustainability initiatives. No demand – no market – no need for commitments to sustainable practices...

Boycotting palm oil will also serve to boost the production of other vegetable oils of different chemical composition, often genetically modified and not necessarily more ecologically or socially acceptable, bearing in mind their low yield per hectare and the need for intensive application of pesticides in their cultivation.

Our consumption of different vegetable oils has followed changes in our eating habits. While the pattern of intake in the northern hemisphere remains varied, with overall consumption stable or even dropping, consumption in emerging countries has soared in a generation from 5 to 15 kg of oil per inhabitant per year.

This development is accompanied by qualitative changes, linked to the switch from consumption of vegetable oils with different saturated and unsaturated fat content to 100% palm oil and a trend towards an increasingly urban, sedentary lifestyle. This is no doubt a factor to watch for in the future. We can only hope that once urgent and essential needs for lipids are met, the people of India, China or Indonesia will have access to a range of sources of fat comparable to those on offer to shoppers in the North today.

ESTATES OR FAMILY FARMS FOR SUSTAINABLE DEVELOPMENT?

Smallholders or agro-industries? Which is the best development model? This is the question policy makers keep asking researchers. The quick answer is that this is not a technical choice. There is no doubt that agro-industries are often more efficient than family farming in terms of fruit and oil yield. Transaction costs are lower and State involvement may be limited to granting easy terms to investors. In addition, in terms of duties and taxation, monitoring compliance with environmental rules (such as the Roundtable on Sustainable Palm Oil [RSPO] certification or environmental control) or social standards (workers' rights), it is always easier to deal with a small number of big enterprises than thousands of unorganized or poorly organized smallholders.

But, in terms of social justice, job creation and reduction of poverty, there is also no doubt that family farming has proved itself. The choice of development model is therefore not a technical decision but a societal choice. What future do we want for our children? Do we want them to live the lives of independent smallholders or employees of agro-industries? Both options have advantages and disadvantages. And the choice we make may not be the choice our children would make. One thing alone is definite: the oil palm as a plant has nothing to do with it.

A CLAY-FOOTED COLOSSUS?

In terms of sustainability and resilience, the large scale development of oil palm cultivation seems to rely for some aspects on a clay-footed colossus

and researchers and decision-makers must avoid sleeping too much on their laurels ...

Indeed, besides the risks and fragility linked to the large scale monoculture of a single species on huge areas, it is worth noticing that global palm oil production is concentrated on a quite narrow geographical region which is limited to both sides of the Malacca Strait. This situation may pose severe problems in case of either a climatic (tsunamis) event or a pest/disease invasion. One must remember that palm oil was almost wiped out from Brazil because of the Bud Rot syndrome a few decades ago [17].

Furthermore, the genetic basis of present palm oil hybrid seedlings cultivated around the world is very narrow when compared to other crops. Would be this restricted genetic diversity enough to make the crop survive a major pathology/agronomy disaster?

Finally, the present production systems still rely on estate-type farming which was inherited from colonial times with very few major structural changes: such times were those of abundant arable land and cheap, docile rural manpower. Such situation does not exist anymore in major producing countries: Malaysia is already facing major crises of rural labor shortage and several major producing countries are facing charges of human trafficking and employment of undocumented workers. Have both public and private sector invested enough in mechanization and/or genetic improvement through biotechnologies? How and when the expected output of such investments will reach end-users?

Today, competitive advantages of palm oil compared to other competing oil crops still rely on cheap production costs which are structurally based on natural high productivity and cheap labor: it is about time for research to address the long terme stability of such situation.

ADDRESS FOR CORRESPONDENCE

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