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Competitiveness of rapeseed, soybeans and palm oil

Yelto Zimmer

Institute of Farm Economics, von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Bundesallee 501 38116 Braunschweig, Germany
Corresponding author: yelto.zimmer@vti.bund.de

Abstract

With increasing global demand for vegetable oils for both food and biofuels, the question arises what raw materials are the most competitive ones. Based on ***"agri benchmark"*** data, the cost of production for soybeans, rapeseed and oil palm are calculated. A cross crop comparison has to cope with the fact that these crops contain two high value components: vegetable oil and protein. Therefore, the allocation of cost is done according to the value shares of the two components. One is the cost of raw material for one tonne of rapeseed oil, which is in the range of 1,000 to 1,200 USD/t for Western European farms. Farms in Eastern Europe and Australia are spending 500 to 700 USD/t. In soybeans, cost of production varies between 400 and 800 USD/t. These figures compare to palm oil, where cost of production is 300 USD/t. With regard to the impact of energy prices and greenhouse gas emissions, the productivity of nitrogen in these crops is compared. While in rapeseed one tonne of vegetable oil requires about 100 kg of nitrogen, in palm oil this figure is only 30 kg/t. The nitrogen cost per tonne of raw material is 40 USD/t in palm oil but 100 USD/t in rapeseed. Only soybeans are much better because they don't get fertilized with nitrogen at all.

Key words: *vegetable oil, competitiveness, production cost, international comparison*

Introduction

With increasing global demand for vegetable oils for both food and biofuels, the question arises what raw materials are the most competitive ones from an economic standpoint. Furthermore, with higher energy prices expected in future the issue of energy needed to produce raw materials becomes a crucial point: Is there a systematic difference among different crops and production systems in the importance of nitrogen fertilization, both in quantitative and in economic terms. The lower the nitrogen input and nitrogen cost, the better the relative position of a crop as a feedstock for biofuels. This is not only true in terms of cost of production but also in the light of various initiatives to monitor and limit greenhouse gas emissions from biofuel production. Production and application of nitrogen fertilizers is by far the most important source of greenhouse gas emissions in production of feedstock, as long as land use changes are not part of the analysis. Last but not the least, due to the high labour intensity of palm oil production the question arises, whether this might become a strategic disadvantage as economies evolve and labour costs tend to increase.

Materials and Methods

Since currently there is no data source publicaly available which allows for the harmonized international comparison of cost of production in oilseeds (Parkhomenko, 2004) data from ***agri benchmark*** has been used to do this research.

agri benchmark is a world-wide association of agricultural scientists, advisors and farmers. Within the framework of this co-operation, farms and agricultural production systems are defined that are typical for their region. For the most important agricultural products and production regions in the world, ***agri benchmark*** provides answers to the following questions :

– How is farming done (farming systems, production technology)?

– What is the level of variable and total production cost?

– What are the reasons for advantages and disadvantages in competitiveness?

– What is the future perspective of agricultural production at the locations considered?

The cash crop branch of ***agri benchmark*** was established in 2004. It is currently active in 24 countries – including the most dynamic and important ones like Brazil, Argentina, US and Canada or Ukraine. Specifically with regard to India and surrounding contries ***agri benchmark*** is still looking for new partnerships. Initially, the network was focusing on globally traded commodities such as corn, wheat or soybeans and rapeseed. Based on a partnership with MOPB in 2009 the first step into palm oil analysis took place; a further expansion into sugar cane is foreseen.

Members of the global network meet once a year in a conference to discuss results, prepare joint Cash Crop Reports and decide on future projects of the network. The overhead costs at the ***agri benchmark*** co-ordination centre are financed through sponsoring from agribusiness companies and institutional partners and joint research projects.

Although ***agri benchmark*** provides advice to policy-makers and actors in the entire supply chain, ***agri benchmark*** is not supposed to judge (in the sense of 'good' and 'bad') or to design policies. Rather, ***agri benchmark*** aims to understand the dynamics of farms, to project their future and to create knowledge to help to validate farm policy, technology and management strategies. In this way, ***agri benchmark*** can be seen as a navigation system in the rapidly changing global agricultural sector.

Based on statistical data about farm structures for each location, models of typical farms are established by the national scientific partners which make use of the knowledge of regional farm advisors and growers; afterwards respective farm data is analyzed by applying internationally harmonized methods. The application of harmonized methods is essential because other existing data sets– if there are any–show significant differences from country to country. They are based on a heterogeneous methodology; the depth and the breadth of data sets is limited (no physical figures about production systems and intensity) and very often up-to-date figures are not available (Isermeyer, 1988).

The crops looked at are annual crops as far as farms from the northern hemisphere are concerned. Farms from Latin America and China typically run a bouble cropping system with two harvests per year. This fact is reflected in respective land cost. Since oil palm is a perennial crop and annual value for cost of establishment had to be taken into account.

But even with detailed cost of production for oilseeds and palm oil (fresh fruit bunches) there is still the issue of (a) different oil content and (b) different value shares for the oil content relative to the other ingredients of raw products.

Results and Discussion

The most important by-product in all three products is protein, which is used as feed and/or as fertilizer. For palm oil, also the heating value of empty fruit bunches has to be taken into account. Aim is to identify the cost of agricultural raw material production per tonne of vegetable oil. This will be achieved by following steps:

1. Calculating the vegetable oil production per ha, based on the oil content of the agricultural raw products. In soybeans 18 percent of the commodity is assumed to be the average oil content, in rapeseed 42 percent and in palm oil 22 percent.

2. The next step is to allocate the cost of agricultural production to the vegetable oil output from the oil crops. Here, value shares of the final output vegetable oil and protein meal have been used. A respective analysis of historical data reveals that about 80 percent of the total value of rapeseed, 40 percent of soybeans and 90 percent of palm oil stems from the oil content of the crops.

3. When calculating the importance of nitrogen and labour input, the same approach has been used to allocate respective cost and quantities.

Cost of production for raw material

The analysis of cost of production starts with calculating the oil yield per ha of the different crops. In figure 1 the respective values can be seen and should read like this: the first letters in the farm code indicate the country in which the farm is located, the figure shows the total acreage in ha and the last letter indicates the region in the respective country. Farms with an asterisk are top performing farms and not typical farms. According to the ***agri benchmark*** standard operating procedure (see agribenchmark.org) these farms are established in order to get a favour about what cost level is achievable when top management and good structural conditions are in place. The term "East" signals Eastern European and Asian farms, "EU" stands for European Union while "NA" is North America and "SH" is Southern Hemisphere. The following findings from figure 1 are worth mentioning :

- On average, typical European ***agri benchmark*** farms are much more productive in rapeseed production than their Australian, Canadian or Asian counterparts. While in Europe, many farms produce about 1.5 t/ha and in Australia or Kazakhstan the respective values are in the range of 0.5 t/ha.

- Palm oil has a very strong stand in this comparison: 5.5 t/ha vegetable oil output compared to 0.5 t/ha in soybeans or 2 t/ha in rapeseed.

- In global soybean production the oil yield per ha is much lower but also much more homogeneous. The yields vary between 0.4 and 0.7 t/ha.

Based on the cost allocation concept defined above, raw material costs per tonne of vegetable oil have been calculated for which the figure 2 displays the results. Key findings including land cost (see yellow bars) are :

- With cost of production of 380 USD/t soybean based oil production of typical farms in Argentina and on the large Brazilian farm – together with Palm oil – is by far the cheapest way to produce the raw material for one tonne of vegetable oil. When judging the results of Argentine farms, keep in mind that the Argentine government is asking for an export tax on soy products of about 30 to 35 percent - depending on the degree of processing. That means, in such an environment, intensity of production is very low – leading to low cost of production. This information is especially important given high land prices in Argentina, because in a free trade environment this implies a strong economic incentive to intensify production. When considering cost of the large Brazilian farm it should be noted that this farm is located in Matto Grosso, a region with is rather far away from harbour and processing facilities. Hence, intra-national transport cost in the range of at least 50 USD/t has to be borne before processing and export to international markets is possible.

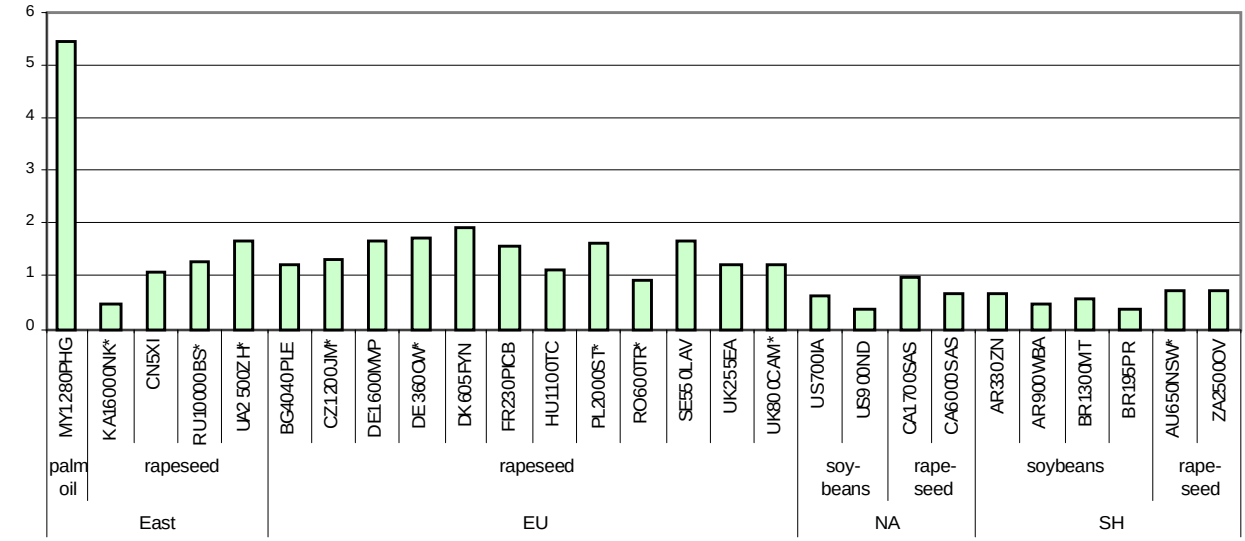

Figure 1: Yield vegetable oil (t/ha)

- The second most cost effective group of typical farms producing rapeseed is located in Russia, Kazakhstan and Ukraine; the cost figure for this group is about 500 USD/t. What has been said about the Brazilian farm also applies for the farms in this group – domestic transport and logistic cost matter a lot.

- The third group consists of other not yet mentioned soybean producers in the US and in South Africa–they have to spend about 800 USD/t in order to produce raw material for one tonne of vegetable oil.

- Finally, the majority of European ***agri benchmark*** rapeseed producers are spending about 1,000 to 1,200 USD/t in order to produce raw material for one tonne of vegetable oil.

Figure 2 also contains a value called "raw material cost without land cost." The reason for this is, that especially in the EU, farmers receive significant amounts of decoupled government payments. Depending on the region, these payments vary between 150 and 400 USD/ha. Since these payments, in the end, result in higher land rents, cost of production in Europe is inflated. In order to get an understanding about the "real" cost of production, respective values (see dark bars) have been calculated. The key messages from this exercise are:

- In general, the gap between high costs in Europe and the rest of the world narrow. For instance, cost of production for farms in France, Sweden, Denmark or Germany is reduced by 200 to almost 400 USD/t or between 20 and 40 percent. Operating cost of production is in the range of 80 USD/t which is the same level as the small Brazilian farm or the one in South Africa.

- However, without land cost, the ranking of crops and a region do not change.

- Palm oil production at MY1280 is not that much dependent on land cost, but still on a per-tonne basis the reduction is 50 USD/t or about 15 percent.

In order to get a better understanding about key cost factors at the different locations, figure 3 contains a break down in relative terms.

Most remarkable is the fact that palm oil production at the typical plantation MY1280PHG is primarily driven by direct cost such as fertilizers and plant protection cost. Land cost only accounts for roughly 15 percent. At the other end of the spectrum there are South American farms in Argentina on which only about 30 percent of all costs are spent on direct cost. These two farms together with the US700 farm, UK255 and CN5XI – very much rely on contractor input. The share of spending for contractors is in the range of 20 to 30 percent.

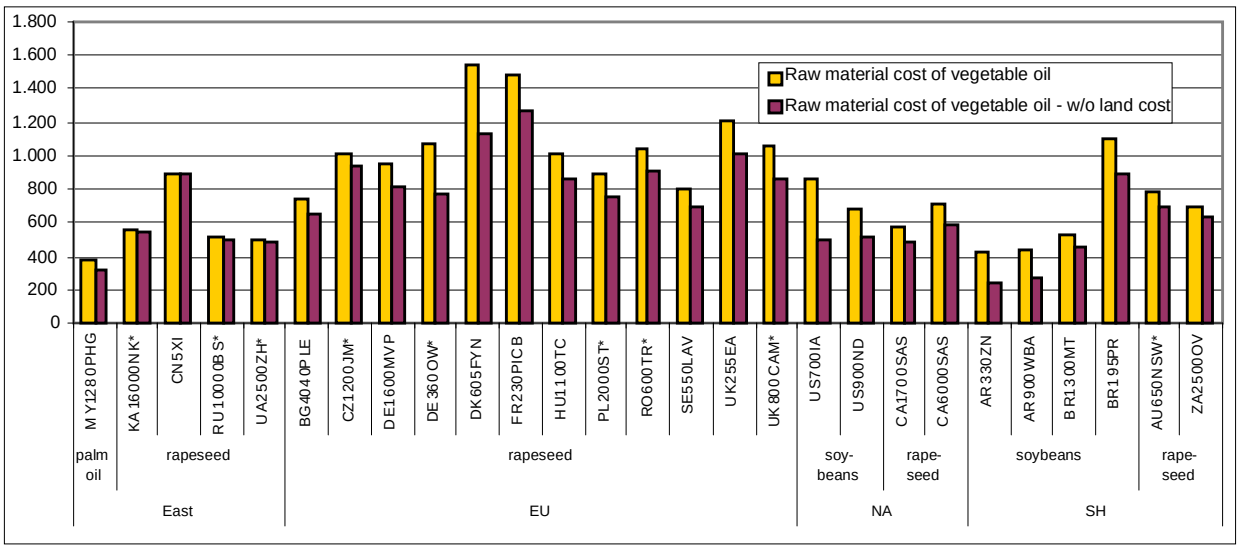

Figure 2: Cost of production for raw material for vegetable oil (USD/t)

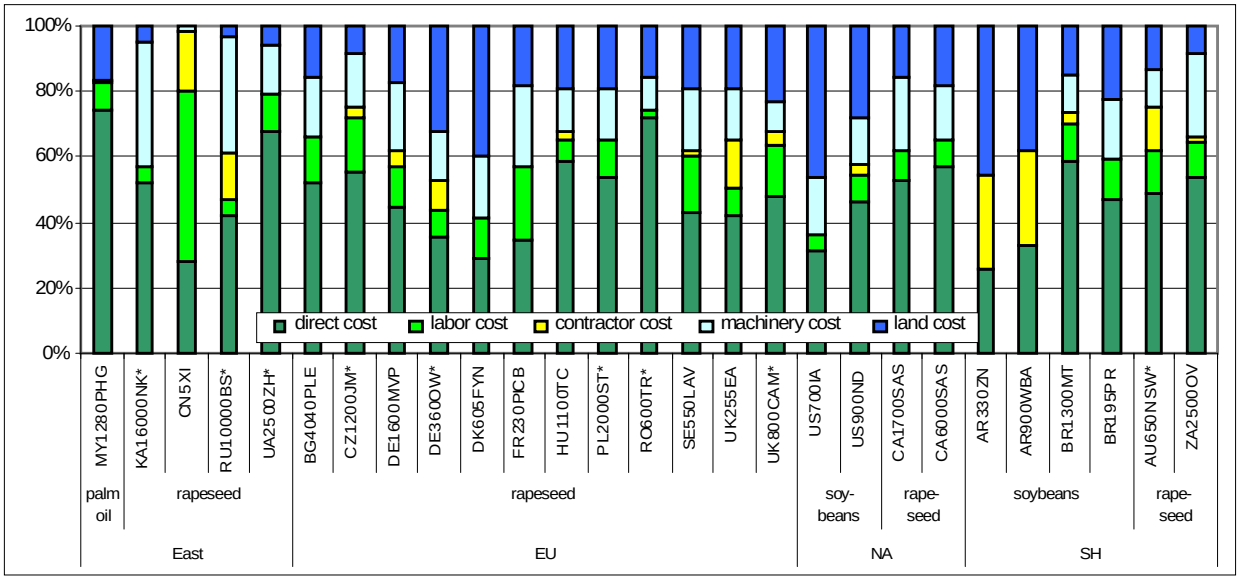

Figure 3: Structure of cost of production raw material for vegetable oil

Impact of nitrogen fertilization

As demonstrated in figure 4, the intensity of nitrogen application differs dramatically between different crops. The following findings are most important:

- Because soybeans are a leguminous crop, there is no relevant nitrogen input and consequently, the share in total cost is negligible or even zero.

- In terms of cost for nitrogen input per tonne of raw product, palm oil is the next best crop–only 30 kg are needed. However, due to very high nitrogen prices in 2008 and very low total cost the share of nitrogen cost for MY1280 is relatively high (approx. 10 per cent).

- The only oil production systems which are at the same level as palm oil are ***agri benchmark*** farms in Canada and Kazakhstan, which produce rapeseed.

- In general, rapeseed based oil production is very intensive as far as nitrogen input is concerned. About 100 kg/t are needed – the share of nitrogen cost in

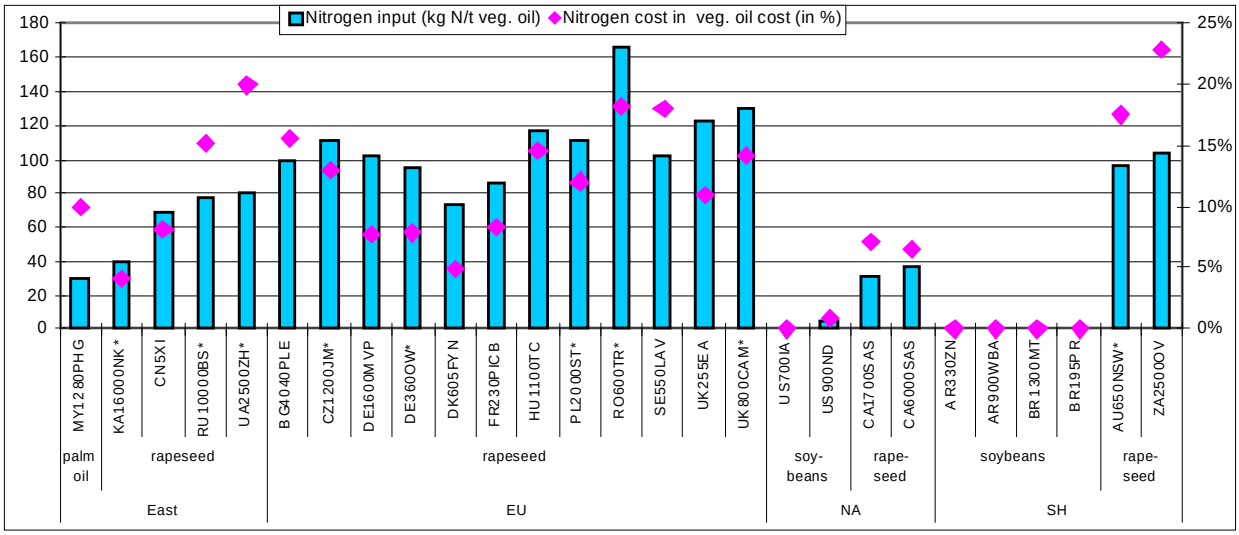

Figure 4: Nitrogen input for raw material production for vegetable oil

total cost fluctuates between a little less than 10 per cent and up to 20 per cent.

- With regard to the productivity of nitrogen input, the results for the two German and the Danish farms are worth to note, because these three farms have the highest oil productivity among all rapeseed producing farms (figure 1) but nitrogen input per tonne of vegetable oil is the lowest.

From these findings it can be concluded that palm oil is not as competitive as soybeans in terms of dependency on nitrogen input but much better than most locations and production systems for rapeseed production.

Impact of labour cost

Since palm oil production – or to be more precise – harvest of fresh fruit bunches is very labour intensive, the question arises, to what degree palm oil production is vulnerable with regard to increasing labour cost. Therefore, a calculation of labour cost per tonne of raw material has been done. Furthermore, the share of labour cost in total cost was calculated (figure 5). Regarding the importance of labour cost, the following results are worthwhile to mention :

Except for outliers in China and France, labour cost fluctuate between 25 USD and 150 USD. Zero values for the Argentine farms are due to the fact that they totally rely on contract work. Since contractor cost include labour cost, machinery and diesel cost, it is impossible to identify the labour cost share in it. Because contract work is very important in the small UK farm (UK255EA) as well as for US700IA labour cost values for these farms has to be treated with some care.

Share of labour cost in total cost can be as low as less than 5 percent in the Romanian farm and almost roughly 20 percent for French, Swedish or larger UK farm.

The extreme high value for the Chinese farm is caused by the extreme high labour input: every single plant is pre-grown in a nursery and transplanted by hand. On a per hactare basis, labour input would be more than 1,000 ha. Due to low opportunity cost for family labour input (0.5 USD/ha) labour cost per ha is still reasonable but very high.

Surprisingly, due to very low labour cost per hour (1.4 USD/ha) labour cost for the palm oil production is very low (25 USD/tonne) and even the share in total cost is only about 7.5 percent. This is higher than what is realized by the farms in Kazakhstan, Russia and Romania but still very competitive in this sample. Based on our results, the study concluded as follows :

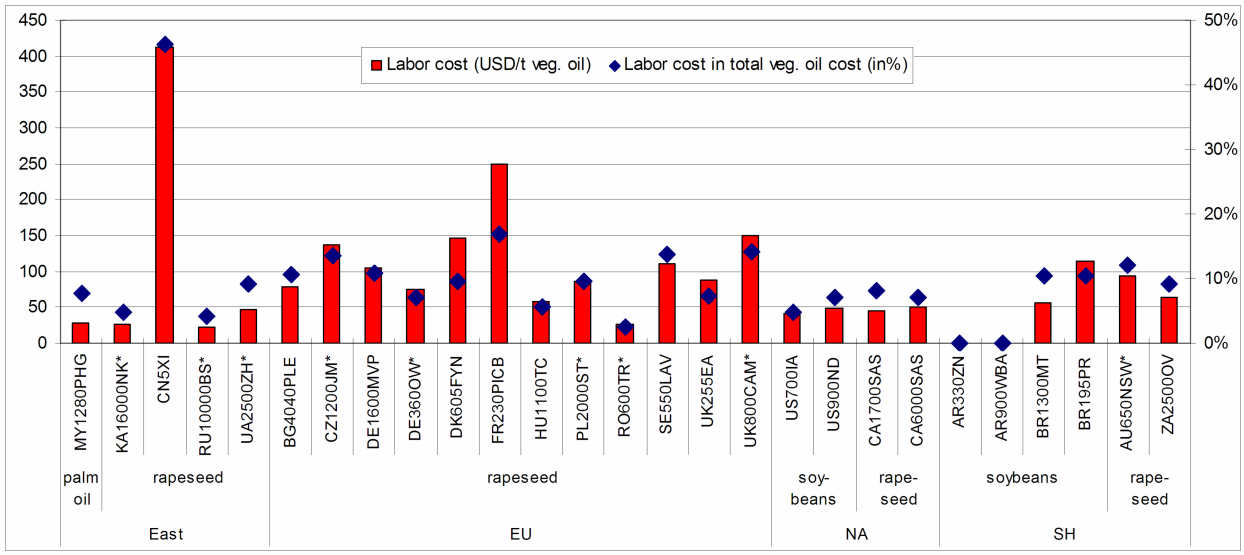

Figure 5: Labour input for raw material production for vegetable oil

1. To the extent crop specific consumer preferences do occur in the market place, cost of production alone is no longer the only relevant parameter. In such an environment, market prices for different vegetable oils may differ permanently and hence cost of production alone does no longer drive the decision making in the market.

2. This comparison is limited to the cost of production at the farm level. To the extent that crops compared cause different costs in converting the crop to vegetable oil, this will affect the competitive position of the crops. The future expansion of ***agri benchmark*** analysis into processing will generate new results on this issue.

3. The cost of raw material production per tonne of rapeseed oil is in the range of 1,000 to 1,200 USD/t as far as Western Europe is concerned; typical farms in Eastern Europe and Australia have to spend roughly 500 to 700 USD/t. In soybeans respective costs vary between 400 USD/t in Argentina and Brazil and 800 USD/t in the US. Compared to the results in palm oil, where the typical plantation exhibits cost of production of about 380 USD/t the majority of other crops and production system are rather expensive.

4. The strong relative cost advantage of palm oil is not only valid under current conditions, but also in a high crude oil price world, which we most likely will experience in the foreseeable future. The main reason for this is the high nitrogen productivity of palm oil. While in rapeseed one tonne of vegetable oil requires about 100 kg of nitrogen, in palm oil the respective figure is only about 25 kg/t or 25 percent. With regard to greenhouse gas balances, this result puts palm oil production into relatively strong position. The nitrogen cost per tonne of raw material for vegetable oil is about 30 USD/t in palm oil but about 100 USD/t in rapeseed. In both crops the share of nitrogen cost is around 10 percent.

5. The only potentially weak strategic feature of palm oil production is in labour input. While the typical plantation uses more than 120 hours per ha per year, the typical arable production only involves less than a 10th of that. But since wage rates are currently very low in countries like Malaysia, labour cost per tonne of raw material is just about 25 USD/t while major soybean and rapeseed producers have to spend about 50 to 100 USD/t and more.

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