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An Introduction of Bio-Ethanol to Thai Economy (I)
– A Survey on Sugarcane and Cassava Fields

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Content

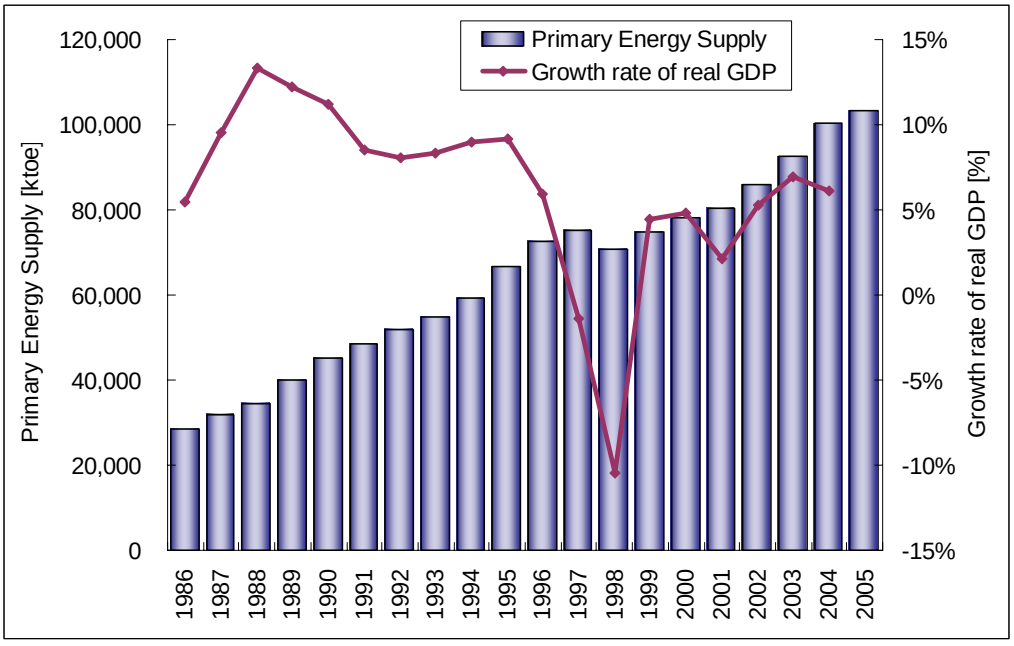
1. Introduction

1.1 Crude oil import dependency

After changing from industrial substitution policy to export – orientation policy in 1970s, Thailand has introduced and attached great importance to foreign direct investment as one of the main tools to expedite its economy. Since the Plaza Accord in 1985, MNCs from NIEs especially Japan have paid an importance role in Thailand's rapid economic growth. During 10 years from 1987 until before the Asian financial crisis in 1997 Thailand's economy grew more or less 10 percent a year (Figure 1.1). Over this period energy consumption also grew dramatically from 28 Mtoe in 1986 to 100 Mtoe in 2004 (Figure 1.1).

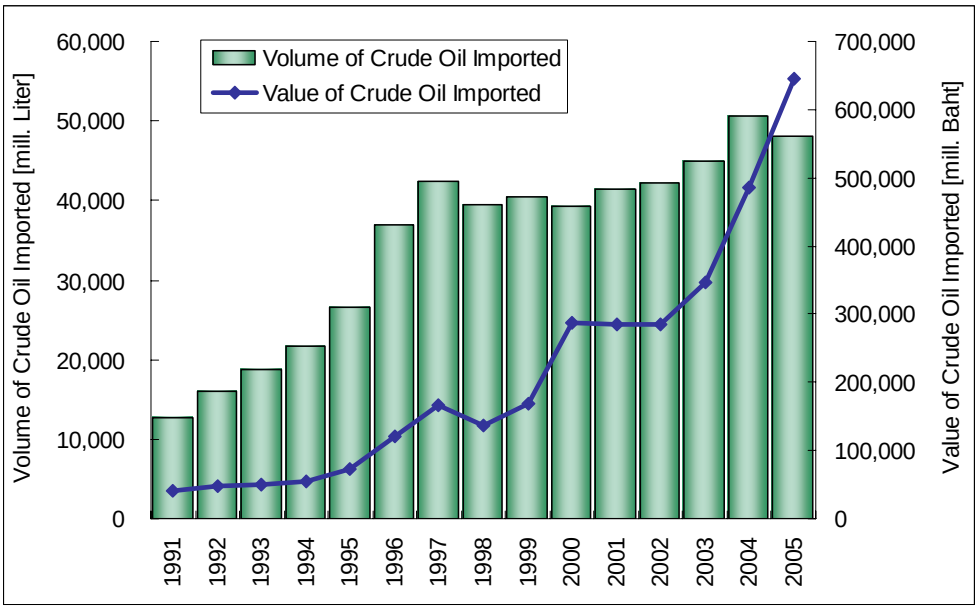
Although Thailand has some natural gas and lignite, it is not rich in energy resources at all. Its energy import dependency rate in 2005 is 56%. Crude oil import accounts for more than 70% of energy import. Crude oil import dependency rate is very high, 90%. In addition, due to transport sector expansion, demand in crude oil grows without a turning point. Figure 1.2 shows both amount and value of crude oil import. Between 1991 and 1997 annual percentage increase of crude oil import is 25%; whereas after 1998 it has increased slower. 13 million liters of crude oil import in 1991 rose to 50 million liters in 2004.

Figure 1.1 Thailand's Primary Energy Supply, 1986 – 2005



Source: National Economic and Social Development Board (NESDB), and "Thailand Energy Situation", Department of Alternative Energy Development and Efficiency (DEDE)

Figure 1.2 Thailand's Import of Crude Oil, 1988 – 2005



Source: "Oil in Thailand", Department of Alternative Energy Development and Efficiency (DEDE)

As for the price aspect, since 2000 the world oil price has rapidly increased. In 2005 it skyrocketed to 70 dollars a barrel despite the fact that after the second oil shock the world oil price had been stabilized at around 20 dollars a barrel for almost 20 years. This substantially affects Thai economy that depends mostly on crude oil import.

As can be seen in Table 1.1, an amount of crude oil import value compared to the total import value has obviously increased up to 14% in 2005. This resulted in a trade deficit in the same year. Besides, this also raises a burden on oil fund, which helps stabilize a domestic price of the petroleum products such as gasoline and diesel when the world oil price fluctuates.

1.2 Gasohol promotion policy

Thailand's government therefore launched a package of energy policies to reduce dependency on energy import and increase the country's energy use efficiency in 2003. One of the long run strategic plans is to develop renewable energy and the target has been set at 8% of the commercial primary energy consumption by 2011, compared to 0.5% in 2002.

The main renewable energy Thailand focuses on is biofuel especially bioethanol and biodiesel. Due to the bottleneck of biodiesel supply, bioethanol is much more speedily promoted through various measures. Bioethanol in Thailand up to now has

been mainly produced from molasses and cassava. 10% of ethanol will be blended with 90% of gasoline to form 'E10' or widely known in Thailand as 'Gasohol'. With a high alcohol percentage, at least 99.5% alcohol or known as anhydrous ethanol, and a blending proportion of only 10%, there is no need to alter the current car engines.

Table 1.1 Thailand's Top Ten Import Value, 2001 -2006 (Jan-Nov)

Unit: million US$

Item	2001		2003		2005		2006(Jan-Nov)	
Crude oil	5,756	9%	7,133	10%	16,999	14%	18,529	16%
Non-Electrical Machinery and Parts	6,086	10%	7,943	11%	11,210	9%	10,598	9%
Electrical Machinery and Parts	5,966	10%	6,628	9%	9,526	8%	8,871	8%
Chemicals	4,301	7%	5,574	7%	8,463	7%	8,381	7%
Integrated Circuits and Components	5,419	9%	5,865	8%	7,986	7%	8,045	7%
Computer and Components	3,774	6%	4,228	6%	6,673	6%	6,859	6%
Iron, Steel and Its Products	2,714	4%	4,247	6%	8,697	7%	6,679	6%
Metal Manufactures	1,891	3%	2,342	3%	4,340	4%	5,518	5%
Gem and Jewelry	1,881	3%	2,077	3%	3,925	3%	3,582	3%
Electronic Appliances and Parts	1,620	3%	2,491	3%	3,215	3%	2,806	2%
Top Ten Import Value	39,408	64%	48,528	65%	81,034	69%	79,868	68%
Others	22,321	36%	26,506	35%	37,156	31%	36,932	32%
Total Import Value	61,729	100%	75,034	100%	118,190	100%	116,800	100%

Source: Ministry of Commerce, Thailand

According to the cabinet's approval in December 2003, the following policies were launched. By January 2007 MTBE[1] (Methyl Tertiary Butyl Ether) use would be abolished and gasohol (90% octane-91 gasoline + 10% ethanol) would be fully used instead of gasoline 95 (octane-95/ ULG 95). Plus, by 2011 all gasoline sold in the market would be substituted by gasohol. This means apart from gasohol 95, gasohol 91 (90% octane-87

[1] MTBE has been used as an octane number booster to mix with gasoline 91 to make gasoline 95. Since it is believed that MTBE is carcinogenic, ethanol which is an octane booster without carcinogen has been used instead of MTBE worldwide.

gasoline + 10% ethanol) will be sold instead of octane-91 gasoline

To complete the policy, gasohol has been highly promoted through price difference, 1.5 – 2 baht lower than that of gasoline 95. A reduction in taxes involved is the mean that the government has chosen. Table 1.2 shows special tax treatment for gasohol resulting in a lower selling price compared to that of gasoline.

Table 1.2 Price Structures of Gasoline and Gasohol
At February 23, 2007

Unit: baht/liter

	ULG95R	ULG91R	Gasohol 95	Gasohol 91	Special Treatment For Gasohol
Ex-refinery Price (average)	15.6692	15.2224	16.2380	15.8359	
Excise Tax	3.6850	3.6850	3.3165	3.3165	Tax exemption for ethanol
Municipal Tax (10% of excise tax)	0.3685	0.3685	0.3317	0.3317	
Oil Fund	3.4600	3.2600	1.5000	1.5000	Special funding rate for gasohol
Energy Conservation Fund	0.0700	0.0700	0.0630	0.0630	Exemption for ethanol
Wholesale Price	23.2527	22.6059	21.4492	21.0471	
VAT(7%)	1.6277	1.5824	1.5014	1.4733	
Wholesale Price + VAT	24.8804	24.1883	22.9506	22.5203	
Marketing Margin	0.6632	0.5623	0.7845	0.7193	
VAT(7%)	0.0464	0.0394	0.0549	0.0504	
Retail Price	25.59	24.79	23.79	23.29	

Source: Energy Policy Planning Office (EPPO), Ministry of Energy, Thailand

Excise tax and municipal tax exemption for ethanol, which is blended 10%, is equal to 10% reduction in both taxes or 0.3685 and 0.0368 baht/liter, respectively. Also, money collected to the energy conservation fund is exempted as well for ethanol or 10% reduction compared to that of gasoline. As for oil fund, a special funding rate is set for gasohol, less than half of that of gasoline. Oil fund rates for both gasoline and gasohol change over time, though. As a result, at February 23, 2007 the price of gasohol 95 is 1.8 baht/ liter cheaper than that of gasoline 95. By the same token, the price of gasohol 91 is 1.5 baht/liter cheaper compared to that of gasoline 91.

For this reason, gasohol has therefore received high customer acceptance that

its sale rose up to almost half of total premium gasoline sale (gasoline 95) in 2006 (Table 1.3).

Table 1.3 Sale of Gasoline by Type, 2003 – 2006

Unit: million liters

Gasoline Type	2003	2004	2005	2006
Regular	4,550.3	4,631.2	4,332.9	4,464.4
Premium	3,084.8	3,029.4	2,915.2	2,750.8
- Gasohol	2.6	59.6	674.9	1,279.3
- U95	3,082.2	2,969.8	2,240.3	1,471.5
Total	7,635.1	7,660.7	7,248.1	7,215.1

Source: Energy Policy Planning Office (EPPO), Ministry of Energy, Thailand

Bio-ethanol production is not only an energy policy but an agricultural policy as well. It is believed that it would not only help reduce dependency of imported energy, but also help increase demand in agricultural products that often experience low prices and need subsidy from the government. This also helps stabilize the agricultural products' price and increase their value-added. Furthermore, the low income problem in the northeastern region, where occupies the largest plantation area of cassava and sugarcane, is expected to be solved through this policy.

Nevertheless, the production of agricultural products relies much on the weather condition; that the constant supply of cassava and sugarcane as ethanol raw materials is possible or not is still questionable. Moreover, these raw materials basically are food. Demand for them to produce energy at the same time can result in raw material procurement competition, in turn leading to a higher related food price, a problem recently occurring in the US and Japan.

From now on to promote bio-ethanol use and production in Thailand what are constrained and what are needed for success are the questions of our survey this time.

1.3 Survey Outline

First we started from surveying on cultivation and transportation of sugarcane and cassava. What is needed in their cultivation method and how their produce is transported to related factories were examined. Then we visited sugar factories, where their facilities are expanded for ethanol production. As for cassava, we visited a cassava chip factory and a starch factory. We examined production process and possibility of cassava-based ethanol production. All of these schedules are listed in Table 1.4 and Figure 1.3 shows the provinces where our survey targets are located.

This report is based on the result of the survey on sugarcane and cassava

cultivation and interviews with experts about the potential of sugarcane and cassava as a raw material for ethanol production. The result of the survey on sugar production and ethanol conversion will nevertheless be presented in the next report.

Table 1.4 Schedule of Bio – Ethanol Survey in Thailand

Date	Outline	Interviewee
18 March 2007 (Khon Kaen province)	1. Visit to sugarcane and cassava fields	Mr.Kimlee
	2. Visit to Preeda Produce (cassava chip factory)	Mr.Preeda Itsaraviriyakul
19 March 2007 (Khon Kaen province)	1. Visit to Khon Kaen Sugar Industry Public Co.,Ltd. (sugar factory) 2. Visit to Khon Kaen Alcohol Co.,Ltd. (alcohol plant)	Mr.Ittipon Ratanawisit, Production Manager
	3. Visit to Kaen Khwan Co.,Ltd. (factory sewage used as fertilizer in sugarcane fields)	Mr.Montree Chongtrakansombut, Asst. Manager
20 March 2007 (Chaiyaphum province)	1. Visit to United Farmer & Industry Co.,Ltd. (Mitr Phu Khieo Sugar Factory)	Ms.Anutin Pattamasuwan, Head of Quality Assurance Office
	2. Visit to Petrogreen Co.,Ltd. (ethanol plant)	Mr.Chatkul Panin, Factory Manager
(Khon Kaen province)	3. Visit to Faculty of Agriculture, Khon Kaen University	Assoc.Prof.Dr.Prasit Jaisil
21 March 2007 (Khon Kaen province)	1. Visit to Khon Kaen Field Crops Research Center	Dr.Phengpen Sornwat
22 March 2007 (Nakhon Ratchasima province)	1. Visit to Sanguan Wongse Industries Co.,Ltd. (cassava starch factory) 2. Korat Waste to Energy Co., Ltd.	Mr.Chaiwat Choketaworn, General Manager

Figure 1.3 Thailand Map

Survey Targets in Three Provinces: Khon Kaen, Chaiyaphum, Nakhon Ratchasima

2. Sugarcane and Cassava Cultivation

2.1 Sugarcane cultivation

Sugarcane, one of Thailand's main cash crops, grows well in any kinds of soil that absorbs water and at the same time can release water well. Two months before harvest cold weather is needed for sugar accumulation. Once planted, it can be harvested three or four times or more than that. After each harvest, the cane sends up new stalks. Nonetheless, due to unfertile soil in the northeastern region sugarcane sometimes can be harvested only for two or three years. Usually, each successive harvest gives a smaller yield, and replanting is eventually needed.

Planting period

A planting period differs from region to region.

- The beginning of rainy season is a normal planting period of the whole country. The areas that produces sugarcane in this period are divided in to two types
  - Irrigation area (20% of the total sugarcane cultivation area): a planting period is from February to April.
  - Rain area: a planting period is from April to June.
- The end of rainy season (the end of October to the middle of December) is a planting period for the areas that are sandy soil and have enough rainfall in the northeastern, northern, and eastern regions.

Harvesting period

Sugarcane can be harvested within 10 – 12 months after plantation. Thailand's sugarcane harvesting period is from November to May.

Cultivation area and production

In general Thailand has sugarcane cultivation areas of around 6 – 7 million rai, which are concentrated in the northeastern, central and northern regions, respectively. In 2005 the highest sugarcane cultivating area and production is the northeastern region, 2.5 million rai and 18.4 million tons, while the highest productivity is the northern area, 7.6 tons/rai (Table 2.1). The top five sugarcane production provinces are Karnchanaburi, Nakhon Sawan, Suphanburi, Nakhon Ratchasima and Khon Kaen. Khon Kaen where we visited a sugarcane field has sugarcane plantation area of 526,418 rai in 2005/2006 (Department of Agricultural Extension, 2006).

Table 2.1 Sugarcane: Cultivating Area, Production and Productivity, 2003 – 2005

Region	Cultivating Area (thousand rai)			Production (thousand ton)			Productivity (kg/rai)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Northern	1,469	1,822	1,819	14,992	16,944	13,805	10,206	9,300	7,590
Northeastern	2,929	2,650	2,461	30,998	24,254	18,373	10,582	9,152	7,467
Central	2,722	2,537	2,388	28,269	23,776	17,394	10,384	9,372	7,283
Whole Kingdom	7,121	7,009	6,668	74,259	64,974	49,572	10,429	9,270	7,435

Source: Department of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

In the international level Table 2.2 shows that among the world cultivating area of 123.5 million rai with the production of 1,293 million tons in 2005 Thailand is the fourth major sugarcane producer with the cultivating area of 6.7 million rai and the production of 49.6 million tons. Nevertheless, in terms of productivity, Thailand performs below the world average. This is because of differences in climate and low investment in research and development (Sriroth, K. et al., 2001).

Table 2.2 Sugarcane: World Major Producers' Cultivating Area, Production, and Productivity, 2003 – 2005

Country	Cultivating Area (thousand rai)			Production (thousand tons)			Productivity (kg/rai)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
World	130,052	127,558	123,529	1,358,817	1,327,936	1,292,931	10,448	10,410	10,467
Brazil	33,569	35,216	36,045	396,012	416,256	420,121	11,797	11,820	11,655
India	28,798	25,000	23,438	281,600	236,180	232,320	9,779	9,447	9,912
China	8,949	8,701	8,838	91,930	90,979	92,130	10,273	10,457	10,425
Thailand	7,121	7,012	6,670	74,259	64,996	49,586	10,429	9,269	7,434
Rest of the world	51,615	51,629	48,538	515,016	519,525	498,774	n.a.	n.a.	n.a.

Source: Department of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

Sugarcane market and price

Sugarcane we are mentioning is sugarcane planted for sugar production. There exists nonetheless a small number of sugarcane produced for direct consumption both as fruit and juice. Therefore, all sugarcane planted for sugar production will be supplied to the sugar factory that a farmer has a contract with. Sugarcane's price is basically not determined by market mechanism. The Cane and Sugar Board, established at the same time that the Cane and Sugar Act 1984 was enacted, will first calculate sugarcane and sugar production of the current year, and then calculate the total revenue from domestic sale and export. After subtracting expenditures, 70% of the rest is the farmers' pay, which will be used to calculate sugarcane price, and the other 30% is the earning of the sugar factories.

At least 80% of the expected final price, known as *'preliminary sugarcane price,'* will be announced in October every year so that a sugar factory can use it as a standard when it purchases sugarcane from the farmers in the coming season (November – May). When a sugar production period ends (May/June), the Committee will calculate the total revenue and expenditure of that year to get the net revenue. This net revenue will be used to calculate *'final sugarcane price,'* which will be announced on the same day that a preliminary sugarcane price of the next season is announced. Usually a final price is higher than a preliminary price; as a result, farmers will receive more revenue later. To note that a sugarcane price, both preliminary and final, is a price at the Commercial Cane Sugar (CCS) value of 10. The CCS value means an amount of sugar able to be produced from cane in the normal production process, and widely meaning as the sweetness of the cane. The more value, the more sweetness, in turn, the more price. If an announced preliminary price is 500 baht/ton but on average the canes' real CCS value is 11, farmers will receive revenue of about 550 baht/ton. Each year's preliminary and final prices are showed in Table 2.3.

Table 2.3 Sugarcane: Preliminary and Final Prices, 1999/2000 – 2005/2006

Production Year	Preliminary Price (baht/ton)	Final Price (baht/ton)
1999/2000	450	478.27
2000/2001	600	688.71
2001/2002	530	520.38
2002/2003	500	530.74
2003/2004	465	503.94
2004/2005	620	657.65
2005/2006	800	846.50
2006/2007	800	n.a.

Source: Office of the Cane and Sugar Board, Thailand

2.2 Cassava cultivation

Cassava is well aridity – resistant and does not need much care but gives high productivity and low production cost. Main cultivating areas in the world are in South Africa, South America, Asia and North America. Cassava was first planted in the south of Thailand and then expanded to the eastern region especially Chonburi and Rayong because of proper climate and soil condition. After that cultivation area has further rapidly expanded to the northeastern region, becoming the present largest cassava planting area of Thailand.

Cassava mainly is divided into two types, sweet type and bitter type. The former is suitable for direct consumption; while the latter is not because of high cyanide (CN). Cassava mostly produced for industry use in Thailand is the bitter type.

Planting period

Basically cassava can be planted all the year. More than 65% of the whole country's cassava cultivating area is the area where cassava is planted at the beginning of rainy season, March to May. 20% is planted in dry season, November to February. The other 15% is planted between June and October. Planting in the rainy season gives the highest production. With rough soil type, plantation in the dry season nonetheless gives the highest production as well. Therefore, decision about planting period must be done with consideration on both rainfall and soil type.

Harvesting period

Cassava can be harvested within 10 – 12 months after plantation. The period that cassava is most harvested is January and February.

Cultivation area and production

Thailand's cassava cultivation area varies between 6 and 7 million rai with an annual production of 20 million tons or productivity of 3 ton per rai on average. Table 2.3 shows that the northeastern area occupies more than half of all cultivating/harvesting area and production; however, its productivity is the lowest. The first five provinces that produce cassava most are Nakhon Ratchasima, Chaiyaphum, Chacheongsao, Kamphangphet, and Chonburi, respectively. Khonkaen, where we visited a cassava field, has a cassava planting area of 276,086 rai in 2005/2006 (Department of Agricultural Extension, 2006).

Table 2.3 Cassava: Cultivating Area, Harvesting Area, Production, and Productivity, 2004 - 2006

Region	Cultivating Area (thousand rai)			Harvesting Area (thousand rai)			Production (thousand ton)			Productivity (kg/rai)		
	2004	2005	2006	2004	2005	2006	2004	2005	2006	2004	2005	2006
Northern	914	938	968	886	907	937	2,819	2,596	3,208	3,181	2,863	3,424
Northeastern	3,699	3,493	3,814	3,616	3,260	3,683	11,399	8,719	12,152	3,153	2,674	3,300
Central	2,144	2,093	2,151	2,106	1,995	2,073	7,222	5,623	7,224	3,428	2,819	3,485
Whole Kingdom	6,757	6,524	6,933	6,608	6,162	6,693	21,440	16,938	22,584	3,244	2,749	3,375

Source: Department of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

Among leading cassava cultivating countries Thailand is ranked third in terms of production, 21 million tons, following Nigeria, 33 million tons and Brazil, 24 million tons in 2004; whereas in terms of productivity Thailand is number two producing 3.2 ton/rai after India who can produce 4.2 ton/rai.

Table 2.4 Cassava: World Major Producers' Cultivating Area, Production, and Productivity, 2002 – 2004

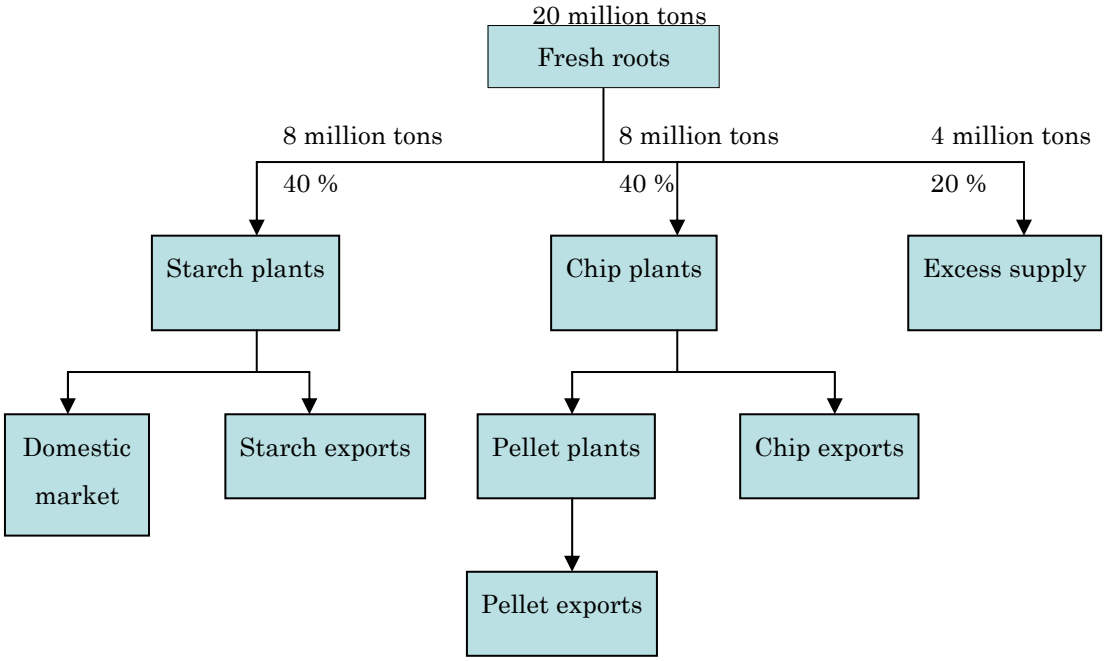
Country	Cultivating Area (thousand rai)			Production (thousand tons)			Productivity (kg/rai)		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
World	108,349	109,933	111,690	186,141	191,310	196,541	1,718	1,740	1,760
Nigeria	21,594	21,875	21,875	34,476	33,379	33,379	1,597	1,526	1,526
Brazil	10,470	10,286	11,130	23,066	22,147	24,230	2,203	2,153	2,177
Thailand	6,176	6,386	6,608	16,868	19,718	21,440	2,731	3,087	3,244
Indonesia	7,978	7,748	8,036	16,913	18,474	19,197	2,120	2,384	2,389
Rest of the world	62,131	63,638	64,041	94,818	97,592	98,295	n.a.	n.a.	n.a.

Source: Department of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

Cassava market and price

Out of 20 million tons of the total annual production, 16 million tons of cassava roots are basically sold to starch factories and chip factories accounting for 8 million tons each or 40% each. Cassava starch produced is both used in domestic industry and for export; whereas, cassava chips are either directly exported or used to process pellets before export. As a result, domestic use of fresh roots is only 4 – 5 million tons or about 20% of total roots cultivated; the rest 80% is processed as starch, chips or pellets for export. One can say that Thailand produces cassava mainly for export. Cassava roots distribution is displayed in Diagram 2.1 below.

Diagram 2.1 Cassava Distribution



Thailand is the number one cassava product exporter grasping the world market share of 75 – 80%. Main export markets for starch are Japan, Taiwan, China and Indonesia. Those for cassava chips and pellets are China and EU, respectively. EU had been a promising export market for Thai cassava processors; however, after EU implemented the Common Agricultural Policy Reform/ CAP Reform in 1992, this has resulted in a rapid decline in Thailand's cassava pellet export to EU. Besides, since 2000 feed producers are required by EU's food safety regulations to use raw materials that reach Netherlands' standard. This retards export of cassava pellets normally used to mix in feed in EU. This can be seen that even Thailand is the largest exporter, due to limited export markets; Thailand cannot control and stabilize the export price.

Export difficulties have led to the excess supply of 4 million tons or 20% of the whole fresh roots produced yearly. The government has therefore put a lot of efforts into promotion of domestic use of the remaining roots in the feed industry. Besides, the government has launched many measures to stabilize the roots' price, for example, a special loan project for farmers to postpone root digging for three months in 1999. The most popular implemented measure is that the government buys cassava products and let a producer buy back within 4 – 6 months under the condition that a producer must buy fresh roots from farmers at a previously determined price. As a result, the government uses a huge amount of budget to subsidize cassava roots and products every year. Bioethanol produced from cassava is therefore expected to be a promising product that can help reduce cassava root oversupply and increase farmers' income.

3. The survey on sugarcane and cassava fields in Thailand's northeastern region

3.1 Survey targets

Our interview target is Mr.Kimlee, a large-scale sugarcane and cassava cultivator. All of his cultivation land pieces may comprise up to 1,000 rai. Since he was afraid that our survey might result in his income tax calculation, his actual planting area, revenue and cost were not answered.

Due to large-scale cultivation, he uses many agricultural tools and machines, for instance, a tractor that grasps sheaves of sugarcane after being cut and tied together by workers (Picture 2.1). This one is made of some imported parts such as German engine (300,000 baht) (Picture 2.2) and pump (200,000 baht). The remaining parts are made and then assembled in Thailand (100,000 baht). This machine can harvest 1 ton of sugarcane within 1.5 hours. Another one in Picture 1.3 is made of US parts and Thai parts. This tractor can be used for both harvesting and leveling the land. But because it is an old model with rather low productivity, 2.5 hours are needed for harvesting 1 ton of sugarcane.

Picture 2.1
Sugarcane Harvest Tractor

Picture 2.2 Engine Made in Germany

Picture 1.3 Sugarcane Harvest Tractor (Made in Thailand)

As for fuel used in those tractors with 60-liter fuel tank, 10 liters of diesel is filled each time but he cannot tell how much work can be done with those 10 liters of diesel. Although durability years cannot be told, he said apart from changing grasping hands when they get old or broken, the tractor itself lasts long for more than 10 years. The tractor in Picture 1.3 has been used for 4 years. Besides, he also possesses 1 million-baht bulldozer and more than 10 small planting tractors as in Picture 2.4. The planting tractor can be used for both raising raised beds and planting sugarcane and

cassava. Its engine is Kubota's and one tractor costs 40,000 baht. Furthermore, he also has a number of trucks for transporting harvested sugarcane and cassava as in Picture 2.5.

Picture 2.4 Planting Tractor

Picture 2.5 Trucks for Transporting Harvested Sugarcane and Cassava

3.2 Sugarcane cultivating method

Mr.Kimlee's sugarcane cultivating method is as follows.

1. Land preparation

First is to plow soil 3 times. The fourth time is to raise raised beds. This can be done by both human labor and a machine such as Kubota small tractor. Mr.Kimlee puts 16 tons/rai of self-produced manure on the soil before placing stems but he said a small farmer usually does not fertilize at this step. Besides, termite – killing pesticide is put on the soil as well. A bag of termite – killing pesticide costing 550 baht can be used for 5 rai.

2. Stem seeking

Mr.Kimlee uses Uthong stem, 850 baht/ton. He hires workers to choose, cut and put stems on the truck from Thaphra research center in Khon Kaen. A hiring rate is 70 baht for 1-ton stem. This also can be done by hiring workers to choose, cut and bring back the stems including stem cost as a lump sum of around 1,250 baht of 1-ton stem. A small-scale farmer usually selects stems for the next cultivation period from his own field. However, Mr.Kimlee, who practices large-scale plantation, is likely to use good quality of stems for higher productivity per rai.

3. Planting

A next step is to cut sugarcane stems into pieces and place them between raised beds (not on the beds). He hires workers for this step for 300 baht/rai.

Picture 2.6 Sugarcane after Planting for 5 Months

4. Fertilizing and weeding

He fertilizes one rai of new stems with a 50-kg bag of 16-16-8 formula chemical fertilizer costing around 500 baht a bag. He hires workers for fertilization 20 baht a bag. Then, it is to cover up with soil. He pays workers for covering up 100 baht a rai. Also, covering up can be done by using the Kubota small tractor as well.

Weeding is very important after planting. Before stems grow out of soil surface, weeding is done by hands. Hiring rate is round 300 – 400 baht a rai. After it rains, he has to hire workers to plow to open soil surface to fertilize stems with chemical fertilizer and cover up. This costs another 100 baht/rai. After stems grow out of soil surface, it is to spread herbicide by using a dispenser as in Picture 2.7 with a cost of 1,500 – 1,600 baht each. 5 liters of herbicide are used for 2-3 rai. Mr.Kimlee hires

workers to spread herbicide with a wage rate of 70 baht/rai.

Picture 2.7
Herbicide Dispenser

There are many sugarcane diseases spreading in the northeastern region but the most harmful on in his land is White Leaf disease. If a cane is infected by White Leaf disease, there are no ways to cure; only removing it from the field and destroying it. Some of his lands were damaged by this disease (Picture 2.8). Besides, there are many other diseases such as Black Whip disease (Picture 2.9).

Picture 2.8 White Leaf Disease

Picture 2.9 Black Whip Disease

5. Harvesting

Before harvesting, many farmers burn the cane's leaves for easier harvesting and at the same time it also kills weed and insects. This is called "Burnt Cane". Mr.Kimlee does not burn the cane but rather he plows leaves and stumps up and over because this is organic fertilizer for soil as suggested by a professor of Kasetsart University who Mr.Kimlee often consults about sugarcane and cassava cultivation. This not only reduces fertilizer cost but "Green Cane" results in higher selling price since cane burning causes a decrease in cane's sweetness.

Picture 2.10 Burnt Cane

Picture 2.11 Sugarcane before Harvest

Mr.Kimlee hires workers[2] to cut canes and bind 15 canes to make a sheaf. This costs 1 baht per bundle. One ton is made up of 35-40 sheaves. Then, he uses a tractor with grasping hands to grasp sheaves of sugarcane and put in the tractor. If hiring this type of tractor, it would cost 50 – 60 baht/ton.

Mr.Kimlee's sugarcane fields produce output of 8 – 10 tons per rai. If a lot of chemical fertilizer is used, productivity per rai can be raised up to 15 tons/rai. This year (2006/2007)'s preliminary selling price is 800 baht a rai. All output is sold to the sugar factory that he has a contract with.

6. Transportation

Truck hire within 30 kilometers costs 120 baht/ton. As for a longer distance, it would cost around 150 – 170 baht/ton.

Picture 2.12 Trucks Transporting Cane

3.3 Cassava cultivating method

In the northeastern region farmers usually rotate the plantation of cassava and sugarcane depending on their prices.

Mr.Kimlee used to use "Rayong" stem but he now uses "Kasetsart" stem, developed by Kasetsart University. Rayong 72 gives a high production of 7 – 8 tons per rai but low starch percentage less than 20%. Kasetsart gives lower production of 5 tons per rai but with higher starch percentage of 24 – 25 %.

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[2] Lots of labor is needed for harvest; consequently, due to a lack of labor some farmers use a machine for harvest instead. Nonetheless, use of the machine causes root breaking and leaving some roots non-harvested especially in the uneven field. As a result, 80% of farmers still use labor for harvest (Sriroth et al., 2001).

Mr.Kimlee's cassava planting method is as follows.

1. Land preparation

First is to plow soil 2 times. The third time is to raise raised beds. This can be done by both human labor and a machine such as the Kubota small tractor. To hire this small truck costs around 200 – 300 baht a rai depending diesel price.

Picture 2.13 Raised Beds

2. Stem seeking

Mr.Kimlee uses more than 10 workers to seek good stems from other fields with a wage rate of 120 – 150 baht a day. A stem costing 2 baht can be cut into more than 10 pieces for plantation.

3. Planting

Then, it is to cut and place cassava stems on the raised beds by hiring workers 130 baht/day. Each stem is planted in a distance of 50 centimeter.

4. Weeding and fertilizing

Weeding is needed 2 – 3 times in the planting period. Each time costs 250 – 300 baht/rai. Fertilization is also done 1 – 2 times before harvesting. 16-8-8 formula chemical fertilizer is used. A 50-kg bag costing around 500 baht is used for one rai. Workers are hired to spread the fertilizer with a wage of 20 baht a bag.

5. Harvesting

To hire workers to dig cassava roots costs 60 baht/ton. Then, putting roots in the truck costs another 150 baht/day/person.

6. Transportation

A farmer, who has E-Taen, a Northeastern typical small truck, transports roots to a cassava chip factory or starch factory himself. Or, he hires 6-wheeled truck costing 100 – 120 baht/ton.

Picture 2.14 Cassava Field (1 month after Plantation)

Picture 2.15 Cassava Roots (4 months)

4. Viewpoints on potential of raw materials for ethanol production

4.1 Interview at Khon Kaen University

We interviewed Associate Professor Dr.Prasit Jaisil, Faculty of Agriculture, Khon Kaen University. Dr.Prasit has conducted a research on sweet sorghum as a raw material for ethanol production.

Sorghum is a tropical and semitropical plant which is aridity-resistant. As one of the main cereals, sorghum's planting area is ranked 5th in the world. Sorghum is used in various ways; grain sorghum and grass sorghum are used for animal feed; whereas sweet sorghum is used to produce sugar and syrup. Sorghum that can be used to produce ethanol is sweet sorghum. But the part used is not its seed, but its stem. It is like sugarcane that we extract juice from its stem.

One ton of sweet sorghum juice can produce 60 liters of ethanol. But one ton of sweet sorghum syrup at 80 ° Bx can produce 380 liters of ethanol; while that of molasses at 83° Bx can produce 250 liters of ethanol (Jaisil, interview).

Sweet sorghum can be planted in Thailand nationwide with a short planting period of only 4 months. Planting in May will bring the highest harvest. Nevertheless, it may be encouraged to plant right after the harvest of sugarcane finishes in April. This is because sweet sorghum plantation can perfectly fill the gap between May (after the end of sugarcane harvesting period) and October (the beginning of sugarcane planting period), and there are one or two months left for land preparation before the next sugarcane planting period.

2.7 Interview at Khon Kaen Field Crops Research Center

We had an opportunity to talk to Dr.Phengpen Sornwat, a cassava expert. They basically agree on use of bio-ethanol blended in gasohol. As for the raw materials that have potential in ethanol production, they are the ones that have potential in supply side such as cassava and sugarcane or by-product like molasses. Ethanol production from sweet sorghum is unfortunately still in a research level. Besides, cellulose-based ethanol is still too far from reality in case of Thailand due to a lack of technology. In the world cellulose ethanol technology has been developed by many leading companies, for instance Iogen Corporation of Canada and Abengoa Bioenergy of Spain. Nevertheless, use of strong acid in the production process might cause adverse effect to the environment.

The northeastern region's soil and climate condition together with a lack of irrigation system allows few plants to grow well. Cassava and sugarcane are among those choices. Vegetable and rice plantation requiring a great deal of water is possible only for the land nearby the rivers or surrounding areas with the irrigation system. Cassava and sugarcane is suitable to the area the irrigation system could not reach.

Due to sandy soil lacking organic matters, typical characteristics of northeastern region's land, mixing bagasse or any kinds of organic substances will help sustain the land quality. Besides, with cellulose, sandy soil can keep water longer. Therefore, even use of chemical fertilizer is the most effective way to get higher production, organic matters are also important in crop cultivation from this point of view.

In terms of bio-energy policy, the reason gasohol production and consumption is far beyond those of bio-diesel is that supply of bio-ethanol is easier and faster. Cassava and sugarcane can be harvested within a year after plantation; whereas oil palm gives a fruit after 7 years of plantation. Furthermore, this also relates to agricultural policy to increase farmers' income, cassava and sugarcane planting promotion thus has more concrete and apparent effect in terms of policy.

As for LCA analysis, we found that the Department of Alternative Energy Development and Efficiency (DEDE) has asked Thai Environment Foundation (TEF) to conduct a research on "Life Cycle Assessment of Ethanol from Cassava and Sugar Cane". Life cycle assessment (LCA) is used to assess one product's life cycle to see how much raw materials and energy are used and how much waste esp. CO_2 is released from the production process, transport, its use to the disposal. The final report will be open to the public after it is submitted to DEDE and the conference to present the research result is held.

Picture 2.15 Cassava planted for 30 years in the Research Center's Field

5. Conclusion

Due to an unfertile soil condition of the northeastern area, sugarcane and cassava are among the few cash crops that can be planted and are a main income source of the farmers. The loss of the main export market of cassava products has caused excess supply of cassava roots. Even though there is no excess supply of sugarcane due to a contract farming system, a decrease in the sugar price eventually leads to a low price of sugarcane. These situations need a huge government budget to subsidize their prices through various measures every year.

That sugarcane and cassava are the choice of the farmers in the northeastern region in which its land condition does not allow many crop choices is rational for the government to support the farmers. One of the resolutions is to find a market for them. Bio-ethanol is expected to be another promising market. Apart from cassava chip plants and starch plants, an ethanol plant would help absorb cassava's excess supply. As for sugarcane, ethanol conversion expanded from the sugar production would provide another choice for the sugar plants when a sugar price is low. This would help stabilize the sugarcane's price.

In the next report a result of the survey on cassava product factories, sugar factories, and bio-ethanol factories are reported. The potential of ethanol production using different raw materials, cassava and sugarcane, are examined. This would in turn affect demand for fresh cassava and sugarcane and certainly farmers' income.

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