Summary Research Report:
Suståne Organic Fertilizers on Oil Palm Nursery Stock
KLK Plantation, Malaysia 2009-2010

Changkat ASA Estate
KLK Oil Palm Plantation
Tanjong Malim, Malaysia

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Suståne Natural Fertilizer, Inc.

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Background:
Malaysia is one of the world's leading producers of palm oil as the climate is ideally suited for optimum growth. There are several large palm oil plantations in Malaysia. Sustâne Natural Fertilizer, Inc. (aka "Sustâne") has a long history of applications and use in Malaysia and several other Southeast Asian nations. While there are many synthetic and several "organic" (both domestic and imported) fertilizers available to the agriculture and horticultural markets in Malaysia and Southeast Asia, Sustâne is the only high quality and high performance organic and organic-based fertilizer with a climate and crop-tested history in the region over the past twenty-plus years. Golden Domes, Sustâne's Malaysian-based distributor, sought out key palm oil nursery plantations that were amenable and supportive of evaluating alternate fertilizers for their nursery production with onsite research trials.

Because the Malaysian climate is hot year around and receives significant and frequent rainfall, typical highly soluble chemical fertilizers provide only short-term fertility due to rapid volatization (ammonification) and ongoing (nitrate) leaching; requiring frequent and continuous topdressing to replace lost nutrients. Although soluble chemical fertilizers have generally lower material costs, the need for repeated applications to individual growing containers increase labor costs and increase environmental damage potential to surface and ground waters in and adjacent to the oil palm plantations. Consequently most of the modernized and larger palm oil plantations in Malaysia rely heavily on various forms of controlled release (time released) plant nutrition. Industry standard controlled released fertilizers are invariably synthetic (man-made) based nutrients that have basic N, P and K granules coated with a polymer resin. Based on soil temperature and water, nutrients are released by osmotic pressure though the outer polymer-coated membrane. As water is imbibed through the polymer shell's micro pores, nutrients are released (exchanged) into the growing media to feed the plant over an extended time period.

By contrast to chemical slow-release plant nutrition, Sustâne organic fertilizers are based on aerobically composted organic materials (composted turkey litter). Sustane's 26-week aerobic composting process through the induction of oxygen and water into carbon and nitrogenous litter provides an ideal environment for thermophilic microorganisms to transform water soluble N into organic – or carbon-bound forms of nitrogen, held within the cell walls of the microbial biomass, creating a natural form of slow release plant nutrition. As Sustâne fertilizer granules are exposed to water, temperature and indigenous soil microorganisms, the organically bound and non-plant available nitrogen is transformed back into plant available ammonium and nitrate nitrogen (i.e. the "nitrogen cycle") over an extended period of time.

Trial Objective:
The objective of the fertilizer comparison trials at KLK Plantation was to evaluate the efficacy of Suståne organic formulations against KLK's standard chemical fertilizer regime under standard Malaysian oil palm nursery growing conditions.

Trial Description:
Two separate fertilizer trials were established at KLK Plantation at KLK's Tanjong Malim, location in northern Malaysia in cooperation with KLK Research Staff, Golden Domes of Kuala Lumpur and Suståne Natural Fertilizer, Inc., Cannon Falls, Minnesota U.S.A. The first trial was on Stage 1 palm oil nursery stock (Ramet A468 clones) planted August 25, 2009, fertilized December 4, 2009 and final observation and rating date June 30, 2010. The second trial was on Stage 2 palm oil nursery stock (Ramet A453 clones) selected from a separate nursery block. This trial commenced on January 13, 2010. In the Stage 1 fertilizer trial Suståne all-organic formulations 4-6-4 and 8-4-4 were compared against KLK Plantation nursery standard fertilizer over a 26-week period (six month's Stage 1 growth). In the Stage 2 fertilizer trial Suståne organic + coated controlled release formulations 12-12-12 90-Day and 16-4-8 180-Day were compared against KLK Plantation nursery standard fertilizer over a 26-week period (six month's Stage 2 growth). This Summary Report is limited to the results of the Stage 1 trial only.

Materials and Methods:
There were three blocks of replicated treatments with 25 plants each of Ramet A468 clones planted August 25, 2009 in KLK standard growth media in (approximately) 1.5-liter plastic bags. After the first 98 days of growth, the plants were fertilized into soil-surface punch holes on December 4, 2009. Treatment Block 1 received a one-time application of Suståne 4-6-4 at 20 grams per container (per plant) at the outset. Treatment Block 2 received a one-time application of Suståne 8-4-4 at 10 grams per container (per plant) at the outset. Treatment Block 3 was fertilized with KLK standard chemical fertilizer. Regrettably and apparently for proprietary reasons, KLK staff refused to describe or divulge the form, quantities and frequencies of fertilization of their standard fertilizers. However, based on anecdotal conversations with KLK support staff, it is understood that the KLK standard chemical fertilizer application significantly exceeded the Suståne organic treatments in NPK formulation concentration, application dose and repetitive fertilizations. (Treatment Blocks 1 and 2 received only one application of Suståne fertilizer each.) Growth measurements and individual plant ratings were made on December 4, 2009, January 2, February 18, and May 19, 2010. The final observations and ratings were made on June 30, 2010. Other than fertilizer treatments all plots were grown under the same cultural conditions including irrigation, weed and insect management.

The following recordings and observations were made:

- height of plant, from base of soil to top of plant shoot/leaves
- width of plant in 2 diagonally opposite directions
- Quality rating from 1-5, 1 being the worst and 5 the best.
- Colour rating of leaves, from 1-5, 1 being the worst and 5 the best.
- Number of leaves – only existing and new shoots that are well developed were recorded as b (big) or s (small) leaves.

The recordings were made by the same two personnel throughout the trial period from December 2009 to June 30, 2010 (trial conclusion). After the final rating date all plants were transplanted into the field. During the six month trial period the plots experienced an infestation of spider mites and were treated with an insecticide. Additionally the plots were attacked by wild monkeys and a repellant was applied to deter future exposure.

Summary Results and Discussion:

Yield differences between the three fertilizer treatments were small, however both Treatment 1. Sustâne 4-6-4 applied one time at 20 grams per plant and Treatment 2. Sustâne 8-4-4 applied one time at 10 grams per plant results exceeded the KLK standard chemical fertilizer treatment by all measures with 4-6-4 scores slightly higher than 8-4-4. While all rating parameters are important, Growth Index is the most significant indicator of fertilizer performance. Sustâne 4-6-4 resulted in 20% greater growth than the KLK standard treatment and Sustâne 8-4-4 resulted in an 8% growth increase over the KLK standard treatment. See Table 1.

Table 1. Plant Growth Ratings at culmination of Stage 1 Oil Palm nursery seedlings 2010

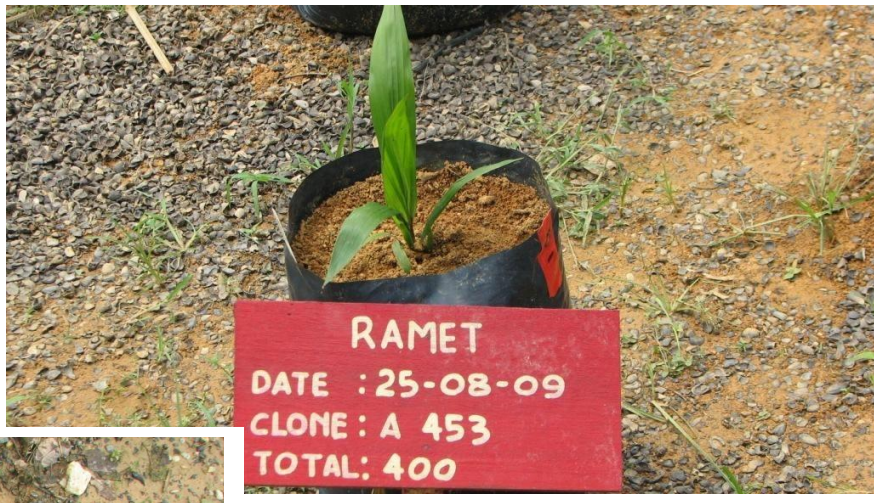
Sustane Organic Fertilizer Trials at Oil Palm Nursery, Changkat ASA Estate, TG Malim, KL Kepong BHD, Malaysia 2009-2010
Date of planting: 1st stage on 25 Aug 2009
Date of fertilizer application: Dec 4, 2009
Dates of observation: 4 Dec 2009, 2 Jan 2010,13 Jan 2010, 18 Feb 2010, 2 Apr 2010,19 May 2010 and 30 June 2010
End of Trial Ratings shown June 30, 2010 only

Summary Results Table 1, 2, 3

Plot No.		Height (cm)	Width (1) (cm)	Width (2) (cm)	Growth Index	Quality Rating (1 to 5)	Colour Rating (1 to 5)	No. Of Leaves		Remarks	Rating Dates
								Big	Small		
Trt. No. 1	Ave. Table 1E	62.44	66.12	55.88	61.48	3.72	4.08	6.64	4.28	4-6-4 @ 20 grams	30.06.2010
Trt. No. 2	Ave. Table 2E	54.72	60.17	51.89	55.59	3.44	3.83	6.11	3.89	8-4-4 @ 10 grams	30.06.2010
Trt. No. 3*	Ave. Table 3E	52.00	54.29	47.94	51.41	3.29	3.24	5.82	3.71	KLK Chem. Fertilizer Control*	30.06.2010

*KLK Plantation Researchers would not reveal the chemical form, NPK analysis or application rates of their standard fertilizer.

KLK Oil Palm Nursery Stage 2 Sustâne fertilizer trials.
Plants Overview, December 4, 2009



Oil Palm seedling type Ramet A453 used in Nursery Stage 2 Sustâne fertilizer trials at initial planting, August 25, 2009

Oil Palm seedling type Ramet A468 (L) used in Nursery Stage 1 Ramet A453 (R) used in Nursery Stage 2 Sustâne fertilizer trials at initial planting, August 25, 2009

Overview of Stage 2 KLK Oil Palm Nursery Trials 2010. Data not shown.