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REPORT OF IBG OIL PALM NURSERY

R & D field trial to determine the efficacy of IBG Bio Fertilizer on oil palm in IBG nursery

Period: April – October 2009

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Introduction

A nursery was proposed to be set up by our Chief Agronomist Mr. Ng Wei Chiang in order to have IBG Bio Ventures own experimental plot to test the efficacy of IBG Bio Fertilizer on the nursery palm physical (or biological) growth.

This project was originated from the Mr. Ng idea to have our own recording data on the physical growth of the nursery palm. The data will be collected and compiled together in the proposal in order to further convince our potential customers.

Objective

a. To record the physical (or biological) growth of the nursery after using IBG Bio Fertilizer manuring program compared with other chemical fertilizer manuring program.

b. To exhibit the potential growth of IBG Bio Fertilizer on the nursery palm in terms of palm physiology.

c. To setup an efficient IBG Bio Fertilizer manuring program for oil palm nursery plot in order to convince our potential customers and small holders.

Fertilizer Program

a. Treatment 1 (T1) – IBG bio fertilizer plus chemical fertilizer with reducing dosage

IBG Nursery Manuring Program (T1)			
Month	Application Date	Fertilizer	Dosage
April	4-Apr-09	15:15:6:4	0.015 kg
	27-Apr-09	IBG OP*	5 ml**
May	7-May-09	15:15:6:4	0.015 kg
	22-May-09	IBG OP*	5 ml**
June	19-Jun-09	15:15:6:4	0.020 kg
July	18-Jul-09	IBG OP*	10 ml**
August	18-Aug-09	15:15:6:4	0.030 kg
September	19-Sep-09	IBG OP*	10 ml**
Total Chemical Fertilizer Used			0.080 kg
Total IBG OP* Used			30 ml

b. Treatment 2 (T2) – IBG bio fertilizer without chemical fertilizer

IBG without Chemical Fertilizer Nursery Manuring Program (T2)			
Month	Application Date	Fertilizer	Dosage
April	27-Apr-09	IBG OP*	5 ml**
May	22-May-09	IBG OP*	5 ml**
June	19-Jun-09	IBG OP*	10 ml**
July	18-Jul-09	IBG OP*	10 ml**
August	18-Aug-09	IBG OP*	10 ml**
September	19-Sep-09	IBG OP*	10 ml**
Total IBG OP* Used			50 ml

c. Treatment 3 (T3) – Chemical fertilizer only program

Chemical Fertilizer Program (T3)			
Month	Application Date	Fertilizer	Dosage
April	4-Apr-09	15:15:6:4	0.015 kg
	27-Apr-09	15:15:6:4	0.015 kg
May	7-May-09	15:15:6:4	0.015 kg
	22-May-09	15:15:6:4	0.015 kg
June	19-Jun-09	15:15:6:4	0.020 kg
July	18-Jul-09	15:15:6:4	0.020 kg
August	18-Aug-09	15:15:6:4	0.020 kg
September	19-Sep-09	15:15:6:4	0.030 kg
Total Chemical Fertilizer Used			0.150 kg

*IBG OP (IBG Oil Palm Bio Fertilizer) is the product of IBG Manufacturing Berhad.
**Dilute in 4 liters water and apply to 25 palms.

Materials and Methods of application

The project will be conducted on Mr. Ng supervision. The plotting will be as below:-

a. Location

The research project has been carried out at Nursery Park of IBG Bio Ventures Bhd.

b. Duration of research

The duration of research was carried out for 6 months (April 2009 to October 2009)

c. Material of cultivation

Source of oil palm seedling was from Felda Sungai Tengi and the age of seedling was 4 months (as of April 2009). Felda did not manage to disclose the manuring program; they did mention NPK Mixture and RP were being used for nursery.

d. Treatment

Treatment 1 (T1) – IBG bio fertilizer plus chemical fertilizer with reducing dosage

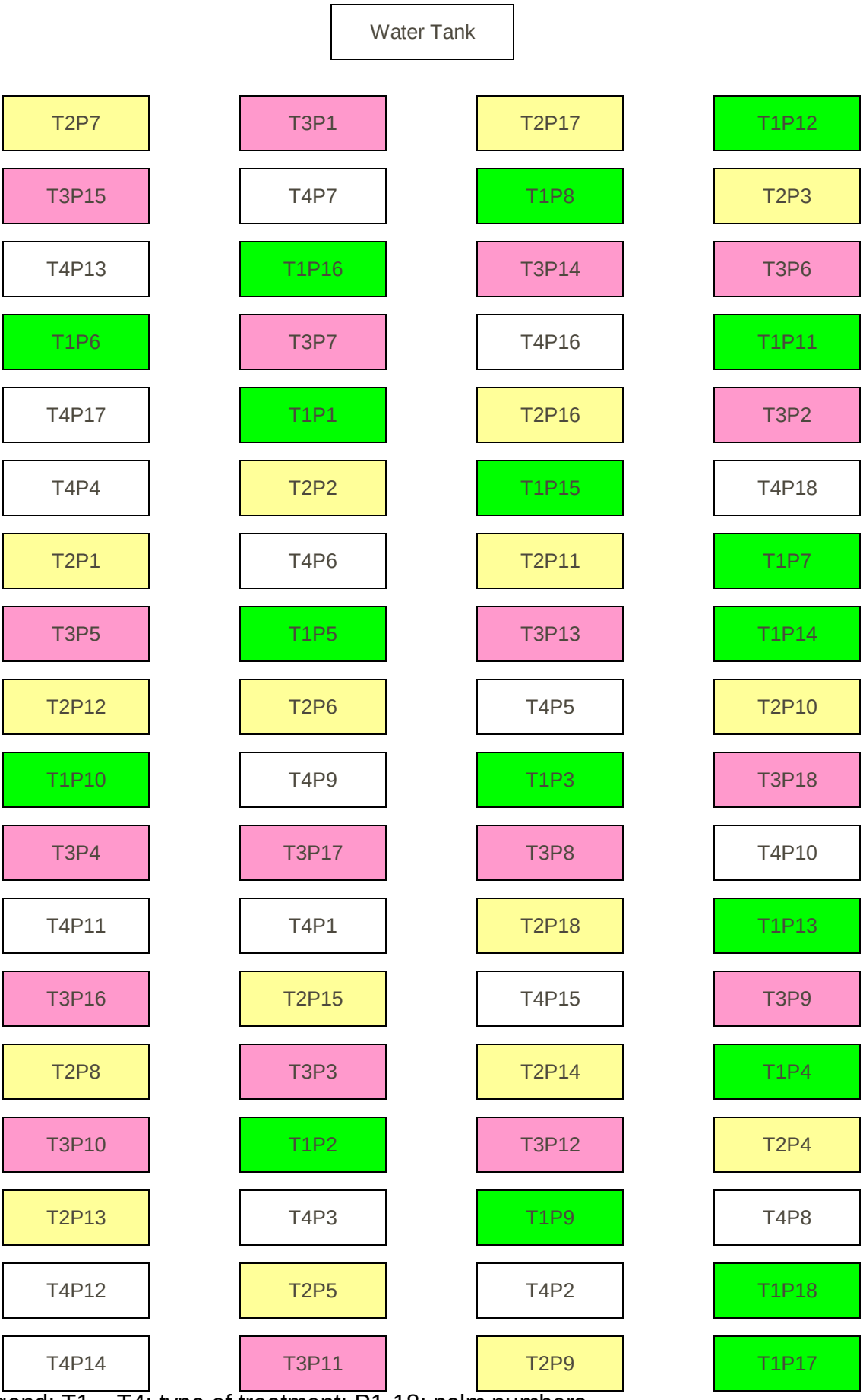
Treatment 2 (T2) – IBG bio fertilizer without chemical fertilizer

Treatment 3 (T3) – Chemical fertilizer only program

Treatment 4 (T4) – Control (without any fertilizer)

e. Experimental design

The project has been conducted by using Randomized Block Design with 4 treatments and 18 palms / treatment.



Legend: T1 – T4: type of treatment; P1-18: palm numbers

f. Method of application

The straight/compound fertilizers were to be applied to the palm circles using ordinary practices while IBG Bio Fertilizer was to be applied to the palm base using pail and measurement cup.

Duration: 6 months

Results

The palm was measured month by month for 6 months for its parameters and recorded.

a. Parameters

Four parameters were collected recently to show the experimental result. These four parameters were frond number, palm girth, palm height. The data was collect every month.

Treatment	Treatment	Frond No.	Palm Girth	Palm Height
T1	IBG Bio Fertilizer + Chemical Fertilizer with Reducing Dosage	18	3.93 cm	95.97 cm
T2	IBG Bio Fertilizer without chemical fertilizer	12	2.57 cm	48.64 cm
T3	Chemical fertilizer only	18	3.86 cm	92.93 cm
T4	Control (without any fertilizer)	12	2.20 cm	40.66 cm

T-test result has shown that palm girth and palm height has no significant differences between T1 and T3. It means that IBG Bio Fertilizer + chemical fertilizer with reducing dosage and chemical fertilizer alone has no significant differences in terms of palm girth and palm height.

b. Root and frond mass weight

Root and frond mass weight was measured for T1 and T3:

Measurement	Sample	IBG Bio Fertilizer + Chemical Fertilizer with Reducing Dosage (T1)				Sample	Chemical fertilizer only (T3)			
		Root		Frond			Root		Frond	
		Fresh Weight (kg)	Dry Weight (kg)	Fresh Weight (kg)	Dry Weight (kg)		Fresh Weight (kg)	Dry Weight (kg)	Fresh Weight (kg)	Dry Weight (kg)
1	T1D	0.48	0.14	0.82	0.32	T3F	0.36	0.08	0.70	0.26
2		0.46	0.14	0.82	0.32		0.34	0.08	0.68	0.24
3		0.46	0.14	0.82	0.32		0.34	0.10	0.70	0.24
Average		**0.47**	**0.14**	**0.82**	**0.32**		**0.35**	**0.09**	**0.69**	**0.25**
Moisture content			0.33		0.50			0.26		0.45
1	T1B	0.30	0.06	0.74	0.30	T3C	0.30	0.08	0.70	0.26
2		0.28	0.06	0.72	0.28		0.30	0.08	0.70	0.26
3		0.28	0.06	0.74	0.28		0.28	0.06	0.70	0.26
Average		**0.29**	**0.06**	**0.73**	**0.29**		**0.29**	**0.07**	**0.70**	**0.26**
Moisture content			0.23		0.45			0.22		0.44
	Average weight	**0.38**	**0.10**	**0.78**	**0.30**	Average weight	**0.32**	**0.08**	**0.70**	**0.25**
	Average moisture content		**0.28**		**0.47**	Average moisture content		**0.24**		**0.44**

Each treatment's root and fronds were measured 3 times to get the average. The average roots' fresh weight of two samples of IBG was 0.38 kg while that of control was 0.32 kg. The average roots' dry weight of two samples of IBG was 0.10 kg while that of control was 0.08 kg. The average fronts' fresh weight of two samples of IBG was 0.78 kg while that of control was 0.70 kg. The average fronts' dry weight of two samples of IBG was 0.30 kg while that of control was 0.25 kg. As a result,

Roots fresh weight of T1 were	18%	heavier than that of T3
Roots dry weight of T1 were	25%	heavier than that of T3
Fronds fresh weight of T1 were	11%	heavier than that of T3
Fronds dry weight of T1 were	20%	heavier than that of T3
% moisture content of roots of T1 was	15%	more than that of T3
% moisture content of fronds of T1 was	7%	more than that of T3

c. Visual Observation on Root System

Some comparison of root system has been carry during October 2009. The comparison among the T1 and T3 were as below:

Picture 1: T1B: IBG Bio Fertilizer + Chemical Fertilizer with Reducing Dosage; T3C: Chemical fertilizer only

Picture 3 & 4: Root comparison between T1 (IBG Bio Fertilizer + Chemical Fertilizer with Reducing Dosage) and T3 (Chemical fertilizer only)

Root system for T1 was more compacted than T3. This was due to PGPR bacteria which containing in IBG Bio Fertilizer can help to enhance the root proliferation. High density of root system will help to increase the nutrient uptake.

Conclusion

IBG Bio Fertilizer has showed the effectiveness to enhance the root system. Although there was no significant different between the treatment in terms of palm girth, frond number and palm height, but in terms of root system IBG has shown that the density of root system for T1 was more than T3 about 20 - 30% by visual observation. Actual measurement shows that the dry weight of the roots of T1 were 25% heavier than T3, and dry weight of the fronds of T1 were 20% heavier than T3. Percentage moisture of roots and fronds of T1 were also 15% and 7 %, respectively, higher than that of T3. On the other hand, by using IBG, the usage of chemical fertilizer will be reducing and also helps in cost saving.

Appendix

Conducted date: 10th April 2009

Sample	Frond no	Girth (cm)	Height (cm)
T1P1	5	0.90	21.00
T1P2	4	0.90	22.50
T1P3	5	0.80	24.00
T1P4	5	0.90	18.00
T1P5	5	1.00	23.50
T1P6	5	0.70	20.10
T1P7	5	0.70	19.00
T1P8	5	1.00	22.70
T1P9	5	0.60	22.30
T1P10	4	0.70	18.20
T1P11	5	0.80	21.40
T1P12	5	0.70	24.30
T1P13	5	0.90	20.50
T1P14	5	1.00	20.10
T1P15	5	1.00	20.10
T1P16	5	1.00	23.50
T1P17	5	1.00	21.90
T1P18	5	0.60	23.40
Average	4.89	0.84	21.47

Sample	Frond no	Girth (cm)	Height (cm)
T2P1	5	1.00	23.60
T2P2	4	0.90	24.50
T2P3	5	1.00	25.10
T2P4	4	0.90	21.80
T2P5	4	1.00	24.50
T2P6	5	0.90	22.50
T2P7	5	1.00	22.90
T2P8	5	1.00	20.80
T2P9	5	1.00	23.50
T2P10	5	1.10	24.80
T2P11	5	1.00	26.50
T2P12	5	1.00	25.30
T2P13	5	0.80	19.50
T2P14	5	0.60	17.60
T2P15	4	0.90	23.60
T2P16	5	1.10	26.80
T2P17	4	1.10	23.30
T2P18	5	1.00	21.60
Average	4.72	0.96	23.23

Sample	Frond no	Girth (cm)	Height (cm)
T3P1	4	0.70	20.20
T3P2	4	0.80	18.60
T3P3	4	1.00	24.60
T3P4	4	0.90	20.70
T3P5	5	1.10	22.90
T3P6	5	1.10	24.90
T3P7	5	0.70	17.60
T3P8	4	0.40	19.80
T3P9	5	0.90	28.60
T3P10	5	0.80	19.60
T3P11	4	1.00	19.60
T3P12	5	0.70	20.60
T3P13	4	0.80	20.10
T3P14	5	1.10	22.60
T3P15	5	0.70	24.10
T3P16	5	1.10	27.80
T3P17	5	1.00	23.10
T3P18	5	1.00	21.50
Average	4.61	0.88	22.05

Sample	Frond no	Girth (cm)	Height (cm)
T4P1	4	0.70	24.10
T4P2	5	1.10	24.50
T4P3	4	0.80	18.40
T4P4	4	0.90	18.00
T4P5	5	1.00	23.20
T4P6	5	0.50	22.60
T4P7	4	0.70	23.80
T4P8	5	1.00	21.70
T4P9	5	1.00	26.10
T4P10	4	1.00	21.10
T4P11	4	1.00	20.60
T4P12	5	1.00	22.00
T4P13	5	0.70	19.50
T4P14	4	0.50	21.00
T4P15	4	0.70	19.30
T4P16	5	0.80	20.00
T4P17	5	0.80	22.10
T4P18	4	1.00	19.40
Average	4.50	0.84	21.52

Conducted date: 8th May 2009

Sample	Frond no	Girth (cm)	Height (cm)
T1P1	7	1.20	24.70
T1P2	7	1.40	33.00
T1P3	7	1.60	30.10
T1P4	7	1.50	22.00
T1P5	8	1.50	27.30
T1P6	7	1.50	21.40
T1P7	9	1.50	26.50
T1P8	8	1.50	30.00
T1P9	9	1.40	25.10
T1P10	7	1.20	26.60
T1P11	8	1.50	22.60
T1P12	7	1.60	30.20
T1P13	7	1.30	23.80
T1P14	8	1.40	25.00
T1P15	7	1.20	25.00
T1P16	7	1.00	24.30
T1P17	8	1.60	26.00
T1P18	8	1.40	24.00
Average	7.56	1.41	25.98

Sample	Frond no	Girth (cm)	Height (cm)
T2P1	8	1.70	31.10
T2P2	7	1.50	27.30
T2P3	8	1.30	28.70
T2P4	7	1.30	22.50
T2P5	6	1.20	29.30
T2P6	8	1.80	25.60
T2P7	8	1.40	25.00
T2P8	8	1.30	24.40
T2P9	7	1.30	27.20
T2P10	9	1.40	31.00
T2P11	7	1.70	29.00
T2P12	8	1.50	26.80
T2P13	8	1.40	27.00
T2P14	6	1.20	21.40
T2P15	6	1.20	24.50
T2P16	8	1.50	32.50
T2P17	7	1.50	23.40
T2P18	7	1.50	22.00
Average	7.39	1.43	26.59

Sample	Frond no	Girth (cm)	Height (cm)
T3P1	7	1.40	24.00
T3P2	7	1.40	20.00
T3P3	6	1.50	29.50
T3P4	6	1.70	26.10
T3P5	8	1.70	26.50
T3P6	8	1.50	28.60
T3P7	8	1.60	26.80
T3P8	6	1.20	20.60
T3P9	8	1.60	31.90
T3P10	7	1.50	36.40
T3P11	7	1.40	29.00
T3P12	8	1.40	24.20
T3P13	6	1.10	22.00
T3P14	8	1.40	28.00
T3P15	8	1.50	29.40
T3P16	7	1.50	32.00
T3P17	8	1.40	24.80
T3P18	8	1.50	22.00
Average	7.28	1.46	26.77

Sample	Frond no	Girth (cm)	Height (cm)
T4P1	7	1.50	26.50
T4P2	7	1.60	27.00
T4P3	6	1.20	24.30
T4P4	7	1.50	26.40
T4P5	8	1.50	27.00
T4P6	7	1.10	23.00
T4P7	7	1.40	23.70
T4P8	8	1.50	22.30
T4P9	8	1.50	27.50
T4P10	7	1.50	24.10
T4P11	7	1.30	25.50
T4P12	7	1.50	28.60
T4P13	7	1.70	20.30
T4P14	7	1.40	24.50
T4P15	5	1.00	20.30
T4P16	7	1.30	23.60
T4P17	7	1.30	24.00
T4P18	7	1.10	22.60
Average	7.00	1.38	24.51

Conducted date: 8th June 2009

Sample	Frond no	Girth (cm)	Height (cm)
T1P1	10	2.00	37.00
T1P2	10	2.10	34.80
T1P3	10	2.40	35.40
T1P4	11	2.00	33.90
T1P5	11	2.50	37.60
T1P6	10	1.90	29.50
T1P7	11	2.50	34.20
T1P8	10	2.00	38.80
T1P9	10	2.00	36.00
T1P10	11	1.90	37.90
T1P11	10	1.70	36.60
T1P12	10	1.70	41.80
T1P13	10	2.20	37.10
T1P14	10	2.10	38.00
T1P15	9	1.20	35.60
T1P16	9	1.90	36.80
T1P17	10	2.20	37.80
T1P18	10	1.90	40.40
Average	10.11	2.01	36.62

Sample	Frond no	Girth (cm)	Height (cm)
T2P1	11	1.80	35.90
T2P2	9	1.80	44.00
T2P3	8	1.70	33.40
T2P4	8	1.70	32.00
T2P5	9	2.00	29.10
T2P6	9	1.80	33.40
T2P7	9	1.80	29.10
T2P8	11	1.50	30.60
T2P9	8	1.50	32.00
T2P10	10	2.20	32.10
T2P11	9	1.80	34.50
T2P12	9	1.70	34.40
T2P13	10	2.00	32.80
T2P14	9	1.60	30.00
T2P15	9	1.60	28.20
T2P16	9	2.00	41.00
T2P17	9	1.80	36.20
T2P18	9	1.70	33.10
Average	9.17	1.78	33.43

Sample	Frond no	Girth (cm)	Height (cm)
T3P1	9	1.70	32.80
T3P2	9	1.90	34.10
T3P3	9	1.90	37.60
T3P4	10	2.30	39.80
T3P5	11	2.00	41.00
T3P6	10	2.10	40.10
T3P7	10	2.00	29.60
T3P8	8	1.60	31.00
T3P9	10	2.40	43.00
T3P10	10	1.80	34.70
T3P11	10	2.20	38.10
T3P12	9	1.70	37.70
T3P13	9	1.80	26.00
T3P14	11	2.40	38.10
T3P15	10	2.00	41.20
T3P16	11	2.30	43.00
T3P17	11	1.80	37.50
T3P18	9	1.70	32.40
Average	9.78	1.98	36.54

Sample	Frond no	Girth (cm)	Height (cm)
T4P1	8	1.50	30.00
T4P2	9	1.50	35.10
T4P3	8	1.80	30.50
T4P4	9	2.00	31.30
T4P5	9	1.70	32.00
T4P6	9	1.10	27.00
T4P7	8	1.50	29.00
T4P8	8	1.70	25.50
T4P9	8	1.60	35.40
T4P10	8	1.60	29.30
T4P11	9	1.50	29.60
T4P12	9	2.00	32.00
T4P13	10	2.00	27.10
T4P14	8	1.70	29.80
T4P15	8	1.60	21.60
T4P16	8	1.80	33.10
T4P17	10	1.50	28.90
T4P18	8	1.40	24.10
Average	8.56	1.64	29.52

Conducted date: 8th July 2009

Sample	Frond no	Girth (cm)	Height (cm)
T1P1	12	2.80	53.80
T1P2	12	2.50	49.00
T1P3	13	2.50	55.50
T1P4	12	2.40	40.60
T1P5	13	2.60	50.70
T1P6	13	2.20	53.80
T1P7	13	2.60	48.70
T1P8	12	2.50	51.30
T1P9	13	2.50	48.00
T1P10	13	2.60	48.60
T1P11	11	2.00	49.60
T1P12	12	2.60	50.10
T1P13	13	2.00	45.10
T1P14	12	2.30	45.60
T1P15	12	2.50	46.60
T1P16	12	2.10	42.70
T1P17	13	2.90	50.00
T1P18	13	2.60	61.60
Average	12.44	2.46	49.52

Sample	Frond no	Girth (cm)	Height (cm)
T2P1	12	2.00	46.50
T2P2	10	2.00	46.00
T2P3	10	1.90	34.70
T2P4	10	1.80	36.40
T2P5	10	2.10	40.00
T2P6	10	2.20	36.50
T2P7	10	1.90	40.00
T2P8	12	2.20	40.50
T2P9	9	1.70	40.60
T2P10	11	2.30	45.20
T2P11	11	1.80	36.60
T2P12	10	1.80	49.10
T2P13	11	2.40	38.80
T2P14	10	1.80	36.20
T2P15	10	1.70	35.80
T2P16	11	2.00	42.70
T2P17	10	1.90	42.40
T2P18	9	1.70	34.60
Average	10.33	1.96	40.14

Sample	Frond no	Girth (cm)	Height (cm)
T3P1	12	2.30	45.40
T3P2	11	2.20	45.00
T3P3	11	2.20	48.00
T3P4	12	2.70	49.80
T3P5	13	3.00	59.30
T3P6	13	2.60	64.30
T3P7	13	2.50	46.00
T3P8	11	2.00	40.60
T3P9	13	2.90	56.20
T3P10	12	2.70	47.40
T3P11	12	2.70	47.00
T3P12	12	2.40	48.10
T3P13	11	1.90	36.50
T3P14	13	2.60	52.00
T3P15	13	2.70	58.80
T3P16	13	3.20	55.80
T3P17	12	2.50	49.50
T3P18	12	2.00	46.50
Average	12.17	2.51	49.79

Sample	Frond no	Girth (cm)	Height (cm)
T4P1	9	1.80	32.70
T4P2	10	1.60	37.80
T4P3	9	2.00	34.00
T4P4	10	1.90	34.60
T4P5	10	1.90	37.70
T4P6	10	1.60	32.60
T4P7	9	1.70	38.00
T4P8	9	1.70	29.90
T4P9	10	1.70	36.40
T4P10	9	1.70	29.50
T4P11	10	1.80	40.00
T4P12	10	2.00	40.00
T4P13	11	2.00	35.80
T4P14	9	2.00	30.30
T4P15	10	1.70	27.10
T4P16	9	1.80	34.00
T4P17	11	1.70	33.50
T4P18	9	2.00	28.60
Average	9.67	1.81	34.03

Conducted date: 7th August 2009

Sample	Frond no	Girth (cm)	Height (cm)		Sample	Frond no	Girth (cm)	Height (cm)
T1P1	14	3.50	71.80		T2P1	13	2.40	48.20
T1P2	15	3.50	60.10		T2P2	11	2.20	45.20
T1P3	15	3.20	65.50		T2P3	11	2.00	43.00
T1P4	15	3.10	61.20		T2P4	11	1.80	37.30
T1P5	15	3.50	60.10		T2P5	10	2.40	42.00
T1P6	14	3.20	58.20		T2P6	12	2.20	39.30
T1P7	13	3.30	64.50		T2P7	11	2.20	39.80
T1P8	14	3.20	63.00		T2P8	13	2.50	45.90
T1P9	16	3.00	62.60		T2P9	10	2.20	40.40
T1P10	14	3.20	65.30		T2P10	13	2.30	44.70
T1P11	13	3.10	60.00		T2P11	12	2.00	41.30
T1P12	13	2.80	64.50		T2P12	11	2.40	44.40
T1P13	15	3.10	62.20		T2P13	12	3.10	43.10
T1P14	13	3.20	60.80		T2P14	11	2.20	35.20
T1P15	13	3.30	57.40		T2P15	11	1.90	31.10
T1P16	14	2.90	56.40		T2P16	11	2.50	43.00
T1P17	14	3.50	57.40		T2P17	11	2.00	45.80
T1P18	14	4.00	66.20		T2P18	10	2.20	40.50
Average	14.11	3.26	62.07		Average	11.33	2.25	41.68

Sample	Frond no	Girth (cm)	Height (cm)		Sample	Frond no	Girth (cm)	Height (cm)
T3P1	14	3.00	58.40		T4P1	10	2.00	32.30
T3P2	13	2.80	59.50		T4P2	10	1.90	35.30
T3P3	13	3.00	51.60		T4P3	10	2.00	35.50
T3P4	14	3.20	62.80		T4P4	10	2.20	38.60
T3P5	16	3.50	70.00		T4P5	11	1.90	39.40
T3P6	14	3.30	74.40		T4P6	12	1.70	34.50
T3P7	15	3.30	52.60		T4P7	10	1.70	40.10
T3P8	12	3.40	48.70		T4P8	10	1.80	30.00
T3P9	15	3.60	69.30		T4P9	11	2.00	39.20
T3P10	14	3.30	50.10		T4P10	10	2.10	33.60
T3P11	14	3.30	60.00		T4P11	11	1.90	39.50
T3P12	14	3.00	56.20		T4P12	11	2.00	38.60
T3P13	13	2.60	45.60		T4P13	12	2.00	34.80
T3P14	16	3.60	69.30		T4P14	11	2.00	34.00
T3P15	15	3.60	70.10		T4P15	10	1.80	29.20
T3P16	13	3.20	69.10		T4P16	10	1.90	33.70
T3P17	14	3.20	64.20		T4P17	11	2.10	31.00
T3P18	14	2.80	56.80		T4P18	10	2.00	31.70
Average	14.06	3.21	60.48		Average	10.56	1.94	35.06

Conducted date: 14th September 2009

Sample	Frond no.	Girth (cm)	Height (cm)		Sample	Frond no.	Girth (cm)	Height (cm)
T1P1	16	4.30	85.40		T2P1	13	3.00	53.00
T1P2	17	3.90	82.20		T2P2	11	2.50	52.00
T1P3	18	3.60	88.40		T2P3	13	2.60	45.70
T1P4	18	3.30	78.20		T2P4	11	2.30	44.50
T1P5	18	4.40	85.70		T2P5	11	2.50	45.00
T1P6	16	3.70	80.50		T2P6	12	2.40	40.00
T1P7	17	3.60	71.30		T2P7	11	2.40	42.20
T1P8	17	3.60	85.00		T2P8	14	2.70	55.00
T1P9	18	3.50	75.70		T2P9	12	2.30	45.40
T1P10	17	3.40	81.70		T2P10	13	2.60	51.00
T1P11	16	3.30	77.60		T2P11	12	2.20	45.00
T1P12	16	3.50	86.20		T2P12	13	2.50	45.20
T1P13	18	3.50	78.30		T2P13	14	3.30	48.80
T1P14	16	3.40	71.50		T2P14	13	2.30	42.10
T1P15	16	3.60	80.40		T2P15	11	2.00	41.40
T1P16	16	3.50	73.20		T2P16	11	2.60	51.00
T1P17	17	3.70	76.20		T2P17	11	2.20	51.40
T1P18	17	4.20	91.50		T2P18	12	2.50	40.50
Average	16.89	3.67	80.50		Average	12.11	2.49	46.62

Sample	Frond no.	Girth (cm)	Height (cm)
T3P1	15	3.80	71.00
T3P2	17	3.60	72.10
T3P3	16	4.00	64.00
T3P4	15	3.50	82.90
T3P5	19	4.00	87.80
T3P6	16	3.50	97.10
T3P7	17	3.70	73.60
T3P8	15	3.40	64.90
T3P9	17	3.60	84.00
T3P10	17	3.50	73.00
T3P11	17	4.20	81.00
T3P12	17	3.70	90.30
T3P13	15	2.70	62.60
T3P14	17	3.60	85.90
T3P15	18	4.50	93.40
T3P16	15	3.50	84.20
T3P17	15	3.50	70.00
T3P18	16	3.70	74.00
Average	16.33	3.67	78.43

Sample	Frond no.	Girth (cm)	Height (cm)
T4P1	12	2.40	33.80
T4P2	11	2.10	39.80
T4P3	11	2.40	38.00
T4P4	12	2.20	40.20
T4P5	13	2.30	42.40
T4P6	12	2.20	43.50
T4P7	11	1.70	41.00
T4P8	12	2.10	32.00
T4P9	11	2.00	59.00
T4P10	10	2.10	33.90
T4P11	12	1.90	40.00
T4P12	12	2.00	43.50
T4P13	12	2.10	39.80
T4P14	12	2.90	34.90
T4P15	11	1.90	34.10
T4P16	11	2.00	39.60
T4P17	12	2.30	36.20
T4P18	11	2.00	34.30
Average	11.56	2.14	39.22

Conducted date: 7th October 2009

Sample	Frond no.	Girth (cm)	Height (cm)
T1P1	18	4.50	122.90
T1P2	19	4.30	93.10
T1P3	19	3.70	98.80
T1P4	18	4.20	91.60
T1P5	19	4.60	99.80
T1P6	17	3.80	91.50
T1P7	19	3.80	90.80
T1P8	18	3.70	110.80
T1P9	19	3.80	92.00
T1P10	19	4.00	90.30
T1P11	17	3.50	86.80
T1P12	17	3.60	95.10
T1P13	20	3.70	92.00
T1P14	18	3.60	87.80
T1P15	19	3.80	90.50
T1P16	18	3.70	82.20
T1P17	18	4.00	96.40
T1P18	19	4.50	115.00
Average	18.39	3.93	95.97

Sample	Frond no.	Girth (cm)	Height (cm)
T2P1	14	3.00	53.60
T2P2	11	2.60	52.20
T2P3	13	2.60	46.50
T2P4	12	2.40	44.70
T2P5	12	2.50	46.00
T2P6	13	2.40	43.70
T2P7	13	2.40	52.00
T2P8	14	2.70	55.00
T2P9	12	2.30	45.50
T2P10	13	2.70	52.00
T2P11	12	2.40	45.00
T2P12	15	2.60	45.30
T2P13	14	3.40	49.40
T2P14	13	2.40	44.00
T2P15	13	2.20	46.00
T2P16	11	2.70	55.20
T2P17	12	2.20	52.00
T2P18	13	2.70	47.40
Average	12.78	2.57	48.64

Sample	Frond no.	Girth (cm)	Height (cm)
T3P1	16	3.80	91.80
T3P2	17	3.70	84.50
T3P3	17	4.20	82.80
T3P4	16	3.80	94.70
T3P5	19	4.20	97.60
T3P6	17	3.70	105.60
T3P7	18	3.70	93.40
T3P8	17	3.60	75.50
T3P9	18	4.00	100.00
T3P10	19	4.00	86.80
T3P11	18	4.30	93.60
T3P12	20	3.80	103.80
T3P13	17	2.80	80.00
T3P14	19	4.00	102.60
T3P15	18	4.50	112.90
T3P16	16	4.00	103.00
T3P17	16	3.60	85.40
T3P18	18	3.80	78.70
Average	17.56	3.86	92.93

Sample	Frond no.	Girth (cm)	Height (cm)
T4P1	12	2.40	35.00
T4P2	11	2.10	40.00
T4P3	11	2.40	41.00
T4P4	12	2.30	42.00
T4P5	13	2.30	43.00
T4P6	12	2.20	43.50
T4P7	12	1.80	43.90
T4P8	12	2.20	32.00
T4P9	11	2.00	59.00
T4P10	10	2.20	36.60
T4P11	12	2.00	44.30
T4P12	12	2.10	43.50
T4P13	12	2.20	40.00
T4P14	12	2.90	35.00
T4P15	12	2.00	34.10
T4P16	11	2.10	39.60
T4P17	14	2.30	43.20
T4P18	11	2.10	36.20
Average	11.78	2.20	40.66