Performance of Tropical Production and Processing Systems Dept.

CIRAD

REPORT ON THE MISSION TO THE GOPDC ESTATES (GHANA)

~ 8 to 14 December 2007 ~

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Persyst

Doc No 2175
March 2008

CONTENTS

SUMMARY

After modification of the protocol as planned in 2007, experiment GH ES 02 (testing of fertilizers compatible with organic oil status) is confirming the good performance of Flanamat as a potassium fertilizer, and is also showing the start of a tendency for Sulpomag natural mineral fertilizer to perform well, also as a potassium fertilizer. The experiment also confirms that split fertilizer applications have no effect, and particularly shows a very strong soil effect: all other things being equal, palms planted in valley bottoms on Temang type soil have much better yields than those on lower slopes on Kokofu type soil.

Experiment GH ES 03 (comparison of 4 potassium fertilizers) confirms the results from last year, with very good growth and a good start to bearing for the young oil palms, and, for the time being, an absence of any effect between the 4 fertilizers being compared. It should be noted that the supplemental NaCl applied in treatment S+ provided chlorine that has been taken up by the young palms. Sodium chloride in moderate amounts therefore proves to be an excellent source of chlorine, without the drawback of excess of sodium.

Experiment GH ES 04 (testing of increasing Flanamat rates on young palms) was set up in May 2007, in compliance with the protocol. The first results are expected in 2008.

Experiment GH CP 03 (testing of two cultural techniques: subsoiling and gypsum application) was set up in May 2007, in compliance with the protocol. The first results are expected in 2008.

In the Kwae Nucleus, 501 ha have been planted in 2007. The priority is to eradicate the *Oryctes* outbreak, probably occurring because the soil was not cleared enough at the time of planting.

At Okumaning, 91 ha have been planted in 2007. *Panicum* eradication is almost complete, and young palm upkeep has progressed well.

In the Outgrowers, Sulpomag was applied in 2007, between 1 and 3 kg per palm, and a halt to the drop in K leaf contents has been seen (though it is not possible to show a correlation).

For fertilization in 2008, a generalized application of Flanamat is recommended, at the standard rates (rather than Sulpomag which is still at the experimental stage in the trials) and supplemental NaCl is also recommended on palms with a low Cl content (usually in an upland situation) to strengthen their ability to resist water stress.

MISSION SCHEDULE

Saturday 8 December 2007

Lagos-Accra on flight VK 803 (Virgin Nigeria)
Accra-Kwae by car. Overnight at the D.O.s house

Sunday 9 December 2007

Morning : Work on Presco report.

Afternoon : Inspection of trial GH CP 03 at Kwae.

Monday 10 December 2007

Morning : Visit to some Outgrower plots around Kwae.

Afternoon : Visit to plantation blocks in Kwae nucleus.

Tuesday 11 December 2007

Morning: Visit to Okumaning: trial GH ES 04 and 2004/2005/2007 plantings.

Afternoon : Visit to Okumaning: trial GH ES 02.

Wednesday 12 December 2007

Morning: Visit to Okumaning: trial GH ES 03 and 2002/2003 plantings.

Afternoon : Discussion on trials with E. Wiafe

Thursday 13 December 2007

Morning : Debriefing meeting.

Afternoon : Kwae-Accra by car.
Accra-Amsterdam on flight KL 590

Friday 14 December 2007

Arrival in Amsterdam.
Amsterdam-Paris on flight KL 2001
Paris-Montpellier on flight KL 2318.

1. PURPOSE OF THE MISSION

Under the contract between SIAT and CIRAD-CP, the purpose of the mission was to:

- assess the nutritional status of the Kwae and Okumaning estates,

- supervise the smooth running of the four support trials (GH ES 02, GH ES 03, GH ES 04 and GH CP 03),

- make fertilization recommendations for 2008

2. ONGOING TRIALS

2.1. GH ES 02

2.1.1. Reminder of the protocol

Testing of different organic fertilizers in comparison with 12-12-17-2 compound fertilizer.

Site: Okumaning, block D4. Planting date: 06/02 Topographical position: (Kokofu soil series like plot 14 of replicate 3) and mostly in a valley bottom (Temang soil series). Some unit plots are in a zone liable to flooding (plots 5 and 6 of replicate 1, plots 28, 29 and 30 of replicate 5 and most of replicate 6).

2.1.2. Treatment application

Fertilizer applications in 2007 were carried out as follows:

Fertilizer rate in kg per palm

	Date	Treatment					
		T	C	SP3	SP1	F3	F1
2007 (Y6)	27-04-07	-	7	1.8	5.4	3.1	9.3
	06-07-07	-	-	1.8	-	3.1	-
	12-10-07	-	-	1.8	-	3.1	-

It should be remembered that the protocol was modified at the end of 2006 (see document 2052 dated March 2007, section 2.1.5. page 11) and the modification applied as planned in 2007.

T = control without fertilizer
C = compound 12-12-17-2
S = Sulpomag
F = Flanamat 3-2-12

2.1.3. Results obtained

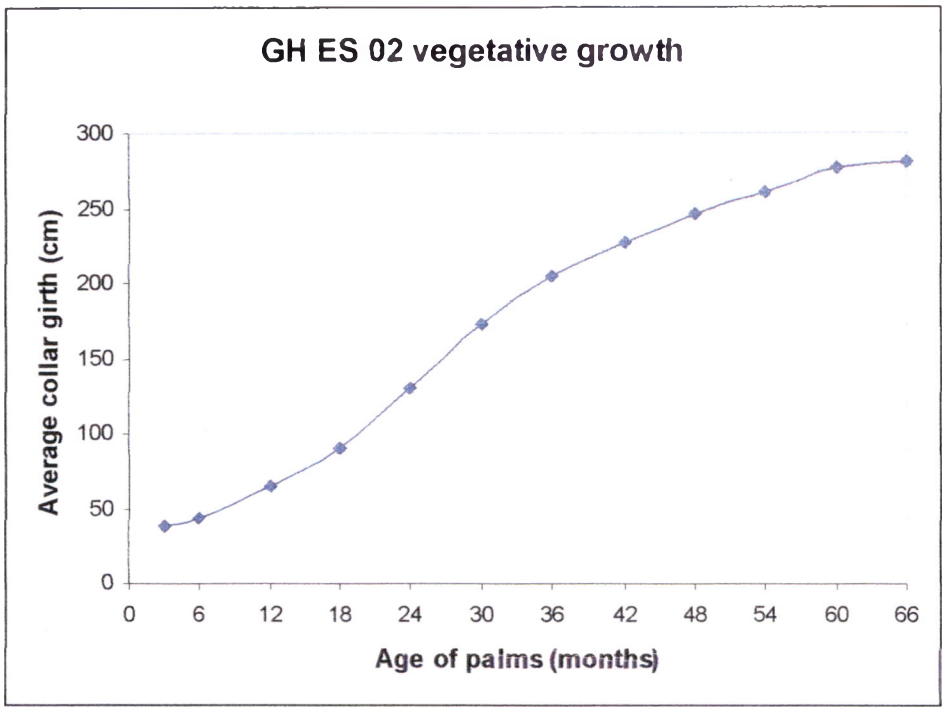
2.1.3.1. Vegetative growth

The results are given in the following table and graph, the detailed statistical analyses can be found in annex 1. There is no difference between treatments for the "collar girth" variable.

The graph shows excellent average growth, with a rapid growth phase in the second and third years after planting, and a slowing down in the fourth and fifth years after planting, but still increasing, with the collar girth of the palms reaching an average value of 275 cm at 5½ years. Judging from the appearance of the palms in December 2007, and from the deceleration in the relative size increase, as shown in the table below, final collar girth ought to become stabilized at 6 years.

GH ES 02 vegetative growth
collar girth (cm)

Treatments	Age of palms (months)											
	3	**6**	**12**	**18**	**24**	**30**	**36**	**42**	**48**	**54**	**61**	**66**
T	40	46	68	89	124	162	190	213	232	246	266	268
C	40	47	67	88	122	165	199	220	237	255	274	278
SP3	38	42	65	84	122	163	196	219	237	254	268	274
SP1	40	43	60	82	119	162	188	216	229	249	269	272
F3	37	42	64	89	125	166	197	219	231	251	271	276
F1	39	44	66	91	131	173	206	228	247	261	277	282
Mean	39	44	65	87	124	165	196	219	236	253	271	275
Absolute increase (cm)		5	21	22	37	41	31	23	17	17	18	4
Relative increase %		13	48	34	42	33	19	12	8	7	7	2



2.1.3.2. Leaf analysis (Annex 2)

The average leaf N content (2.95%) has risen since last year (2.86%), and is at a very satisfactory level. Note an N level in the control treatment (formerly urea) that is significantly below that in the other treatments, though still very acceptable.

Correlatively to N, the average leaf P content is very satisfactory: 0.165%. As for N, the palms in the control treatment have a P content that is significantly below that in the other treatments.

As regards the K contents, there was a slight rise in the average content in 2007, 0.733%, compared to 2006, 0.681%, and confirmation of the main trend: the significant positive effect of Flanamat. It is interesting to see the rise in leaf K contents in the two SP treatments (formerly PKC). They are now on a par with treatment C, whereas they had fallen behind during the PKC application period. Sulpomag is therefore proving to be a good potassium fertilizer in trial GH ES 02, right from the first year of application. Note also, as in previous years, the poorer K contents in blocks 5 and 6, which are more hydromorphic.

Average leaf Ca contents fell slightly in 2007, 0.789%, compared to 2006, 0.868%, but remain high. A positive effect is seen for the compound fertilizer, though of no importance at these high levels of calcium.

Leaf Mg contents are still very high, 0.36% on average, though a little lower than in 2006, 0.39%, with a depressive effect for Flanamat, which resulted of course from K/Mg antagonism, of no consequence on the palms in this range of variation in Mg contents. Note also the higher Mg contents in blocks 5 and 6, which are also the result of K/Mg antagonism.

The average Cl content fell slightly in 2007, 0.419%, compared to 2006, 0.456%, but remains acceptable. A positive effect of compound fertilizer compared to all the other treatments, which proves to be the only fertilizer tested that supplies chlorine to the palms, is confirmed in 2007.

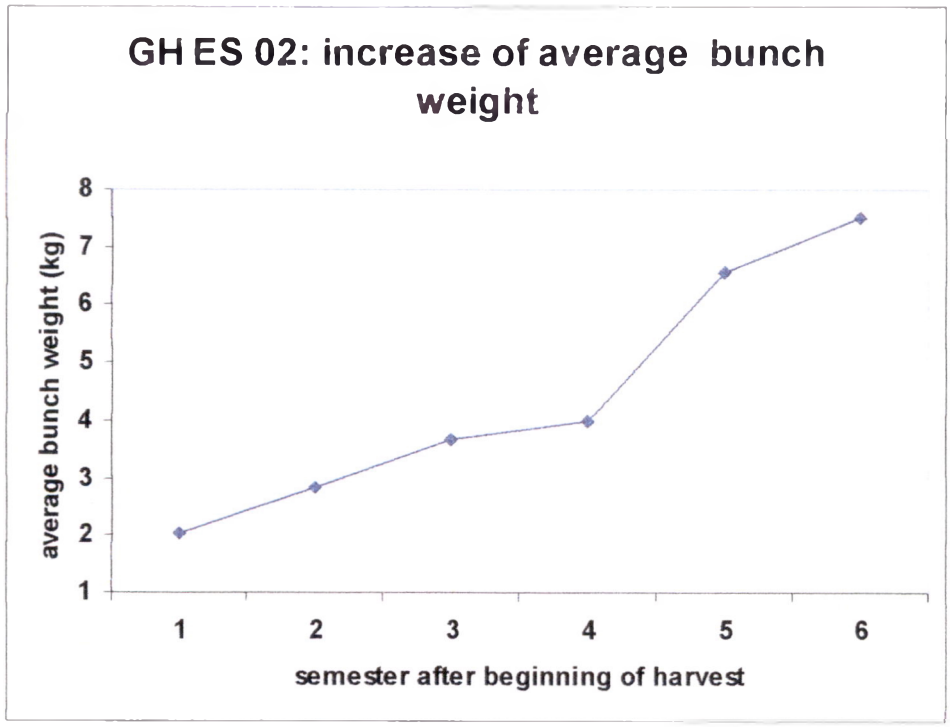
A comparison of fertilizer applications in one go or split into three applications, at equal total quantities, in the SP and F treatments, has so far not revealed any significant effect of split applications that is repeatable over time, for any of the nutrients analysed. This leads to the conclusion that in this type of context fertilizers can quite simply be applied in one go per year.

2.1.3.3. Yields in the 2006/2007 season (Annex 3)

The 2006/2007 season (fifth year after planting) shows stabilization of the average yield: 10.4 tonnes FFB per hectare, equivalent to that of the previous season (10.3 tonnes).

The number of bunches per palm is tending to fall (13.5 in 2006/2007 as opposed to 20.8 in 2005/2006) whilst the average bunch weight is increasing (5.3 kg in 2006/2007 as opposed to 3.4 kg in 2005/2006), giving an equivalent tonnage per hectare.

The following graph shows the increase in average bunch weight in line with age, per six-month period, since the start of production.



There was no significant treatment effect during the 2006/2007 season. Worth noting, however, is that treatment T has slightly fallen behind (equivalent to 12.1

tonnes FFB per hectare) compared to the best treatment SP1 (equivalent to 15.1 tonnes FFB per hectare). It can already be concluded that Temang type soils in valley bottoms are excellent substrates for oil palm growing. Indeed, even without potassium fertilizer for the last six years, the control palms have a yield which, although slightly lower, is comparable to those that have received fertilizer.

It is confirmed that the yields of the palms in unit plot 14 (treatment F3, replicate 3) planted on Kokofu type soil, are well below the mean for the other five replicates of the same treatment planted on Temang soil, as shown by the following table.

Comparison of yields in treatment F3 depending on soil type

Yields of palms in treatment F3 in equivalent tonnes FFB/ha	2004/2005 season (YOP 3)	2005/2006 season (YOP 4)	2006/2007 season (YOP 5)
Block 3 (Kokofu)	0.9	4.3	3.5
Mean of blocks 1,2,4,5,6 (Temang)	2.7	11.2	11.6

These results show that there is a much greater difference from one soil type to the other than from one type of fertilizer to another. The great suitability of the Temang soil series (valley bottom alluvial soils) for oil palm growing, compared to the Kokofu series (colluval soil on lower slopes), which are much less suitable, all other things being equal, is thus confirmed.

2.1.4. Trial status in December 2007

General upkeep in the trial is excellent: there is a regular *Pueraria* cover crop: not very thick because the palms now cast a lot of shade on the soil, but uniform and, especially, weed-free: the weed eradication efforts made when the palms were young has therefore paid off. The circles are well done: wide and clean for each palm.

Palms located in the less well drained zones are not exhibiting any sign of stress linked to excess water. On the one hand, the drainage system installed in susceptible zones has functioned well (water was still flowing at the time of the visit),

and on the other hand the palms have grown well with age: as they are taller and more vigorous, the withstand temporary excess water better than young palms.

No visible difference can be seen between treatments; neither for vegetative appearance: the collars are uniformly well developed (as shown by the latest measurement, see section 2.1.3.1.), the foliage is abundant, the canopy has now closed, with healthy, long, dark green leaves; nor for bunch load: good on average, and regular, with balanced alternation between male and female inflorescences.

The average yield for the 2007/2008 season should exceed 10 tonnes of FFB per hectare.

2.1.5. Timetable for work and observations in 2008 and 2009

The change in protocol recommended last year has been made. It is proposed that the trial should continue with the rates indicated in the new protocol for another few seasons.

In fact, apart from studying the effect of the different types of fertilizer and split applications, this trial GH ES 02 is providing some valuable information about the start of bearing and, secondarily, about the comparative suitability of two types of soil (this was not planned in the initial protocol, but the fact that there is a unit plot on a Kokofu type soil will have enabled us to draw some lessons from it).

GH ES 02: Rates in g of fertilizer per palm

Year	Month	Treatment					
		T	C	SP3	SP1	F3	F1
2008	03	-	7	1.8	5.4	3.0	9.0
	07	-	-	1.8	-	3.0	-
	10	-	-	1.8	-	3.0	-

The collar girth will be measured again in June 2008 (at 6 years), to verify stabilization of the radial size of the stems.

An annual leaf sample will continue to be taken, the next being due in November 2008.

2.1.6. Conclusion

Trial GH ES 02 has produced a large amount of reliable and extrapolatable information, which can be summed up here:

-It is K and not N that is the more sensitive nutrient on this type of soil.

-In that respect, Flanamat proves to be an effective fertilizer.

-There is no effect of split fertilizer applications: from the fourth planting year onwards, it is therefore perfectly possible to apply any fertilizer in one go, at least on this type of soil (alluvial soil in a valley bottom with a gentle slope).

-There is a strong soil type effect: Temang type soils are much better than those of the Kokofu type, all other things being equal. For future extensions or replantings, trial GH ES 02 confirms that the best oil palm yields will be obtained on soils of the Temang series: alluvial soils in valley bottoms with a gentle slope. It has even been seen that it is preferable to approach the bottomland, opening up a few drainage ditches, rather than moving up the slope, where the soils become much less suitable for oil palm cultivation.

2.2. GH ES 03

2.2.1. Reminder of the protocol

Testing of a natural potassium fertilizer, Sulpomag, with or without additional NaCl, compared to KCl and Flanamat. Statistical design: 4 treatments x 6 replicates, each unit plot comprising 25 palms (5 rows of 5) of which 9 useful palms (3 rows of 3).

Site: Okumaning, block J1. Planting date: March 2004. Planting density: 143 p/ha (9 metre triangles). Topography: valley bottom (Temang soil series).

2.2.2. Treatment application

As planned, a switch has been made to a single fertilizer application per year beginning in 2007, as the palms have started bearing.

Protocol fertilization
(rate in kg of fertilizer per palm)

Date	Treatment			
	M	**F**	**S**	**S+**
04-10-05	0.5	2.3	1.4	1.4 + 0.5
08-03-06	0.5	2.3	1.4	1.4 + 0.5
12-09-06	0.5	2.3	1.4	1.4 + 0.5
13-04-07	1.5	6.7	4.2	4.2 + 1.5
cumulative	**3.0**	**13.7**	**8.4**	**8.4 + 3.0**

M = MOP (60 % K_2O).
F = Flanamat, new formula 3-2-13 (13% K_2O).
S = Sulpomag (22% K_2O).
S+ = Sulpomag + NaCl.

2.2.3. Results obtained

2.2.3.1. Vegetative growth (Annex 4)

In March 2007, three years after planting, there was no difference between treatments, for the analysed variable: collar girth.

Note that at three years, average collar girth (222 cm) is better in trial GH ES 03 than in trial GH ES 02 (196 cm).

2.2.3.2. Leaf analysis (Annex 5)

The average leaf N content, 3.04%, is very satisfactory, even better than in 2006, 2.95%, and without any treatment effects in 2007.

The average leaf P content, 0.164%, is satisfactory, though a little lower than in 2006, 0.169%. Like last year, there is a slight positive effect for Flanamat.

The average K content, 0.781%, is much lower than last year, 0.861%. However, the excellent appearance of the palms and the experience acquired in trial GH ES 02 suggest that it is not limiting in this pedoclimatic context. However, we reserve the possibility of increasing K applications in this trial, identically for the 4 treatments, if the contents were to fall too much. This year, there is a positive effect for Sulpomag, 0.829%, compared to Sulpomag and NaCl, 0.734%, most probably due to an antagonistic effect of the Na ion contained in the NaCl applied in S+. For the moment, that depressive effect of the sodium fertilizer on K contents remains limited and therefore still acceptable.

The average Ca content (0.95%) is still virtually as high as in 2006, as is usual in this pedoclimatic context, with a slight positive effect for Flanamat.

The average Mg content, 0.31%, is slightly down on 2006, 0.33%, but is still largely satisfactory. The absence of significant supplementary magnesium uptake through the Sulpomag is confirmed, indicating that it is only supplying potassium to the young palms (moreover, that is especially what we want it to do).

The average Na content (0.011%) is low, with little difference between treatments. However, logically, there is a slight positive effect for treatment S+, due to the NaCl provided.

As in 2006, two groups can clearly be seen for Cl contents: those treatments that have received chlorine fertilizer (treatment M = KCl and treatment S+ = Sulpomag + NaCl) which are positioned at high levels of Cl, 0.515 and 0.513% respectively; and the treatments that have not received any chlorine fertilizer (treatment S = Sulpomag and treatment F = Flanamat), which are positioned at significantly lower levels of Cl, 0.279 and 0.233% respectively. That shows that chlorine in the chlorine fertilizers, be it KCl or NaCl, is taken up well by young palms, and can therefore be used if needed.

2.2.3.3. *Yield* (Annex 6)

The first harvests carried out in trial GH ES 03 (first quarter of 2007, corresponding to the end of the third year after planting) show a positive effect for Flanamat compared to Sulpomag for the "number of bunches per palm" variable, at 8.6 for treatment F as opposed to 6.9 and 6.3 for treatments S+ and S respectively, a difference that is also found for total bunch weight. Treatment M (KCl) falls in between.

It will be seen during the current season whether that difference is confirmed, in which case it will be further proof of the good performance of Flanamat organic fertilizer.

It can also be seen, at a comparable age (first harvests at the end of the third year after planting) that the average yield in trial GH ES 03 is even better than that in trial GH ES 02, 2.6 kg as opposed to 2.1 kg for the "average bunch weight" variable, and 2.7 tonnes FFB/ha as opposed to 2.1 tonnes FFB/ha for the "yield in FFB equivalent tonnage" variable. As subsequent yields in trial GH ES 02 have proved to be highly satisfactory, there are reasons to believe that the average yield in trial GH ES 03 will also be highly satisfactory, maybe better still.

2.2.4. Trial status in December 2007

Upkeep in trial GH ES 03 is excellent: large, perfectly clean circles, thick and uniform *Pueraria* cover crop without any weeds. It can be considered that current upkeep in this trial is a reference for the estate.

The palms have a very uniform appearance: vegetatively in terms of a large collar size, stem height, number length and dark green colour of fronds and reproductively: the palms are uniformly loaded with numerous bunches (more than 10 per palm in general).

There is no visible difference between treatments, and it is the uniform good performance of these palms that an observer sees when walking through the trial.

The only difference noticed is between the blocks; the palms in replicate 2 have slightly shorter leaves (their tips do not meet yet in the middle of the interrow, unlike those seen in the other replicates, where the canopy has now closed), and they seem to have fewer bunches. This needs to be confirmed at the end of the next harvesting campaign in April 2008.

What was written in 2006 is confirmed in 2007: trial GH ES 03 is a reference in oil palm growing for GOPDC. This is what can be achieved on the best soils in flat valley bottoms with good drainage, using good planting material, and with good agricultural practices: land preparation, nursery, planting and fertilization of course, but also investment in upkeep from the outset: establishment of the legume cover crop, total weed eradication and weeded circle cleaning.

This last point is emphasized because it is very important to remind GODPC (which is already convinced of it but it is always a good thing to have a further

illustration): granted, investing in the upkeep of young crops is very labour-intensive, but it is highly rewarding in the medium and long terms: firstly because it ensures good establishment of the palms, and a uniform start to bearing, and also because subsequent upkeep costs are greatly reduced when the soil is weed-free in young crops, even if the cover crop subsequently regresses, the increasingly intense shade cast by the oil palm canopy takes over in preventing weed regrowth, and the cost of controlling weeds is very low throughout the life cycle of the palms.

2.2.5. Timetable for work and observations in 2008 and 2009

2.2.5.1. Fertilization

The following fertilization will be applied in one go in April or May 2008:

Treatment	Type of fertilizer	Rate in kg/palm
M	KCl	1.5
F	Flanamat 3-2-13	7.1
S	Sulpomag	4.2
S +	Sulpomag + NaCl	4.2 + 1.5

2.2.5.2. Observations

At 4 years old (March 2008), the vegetative growth of the palms will be measured: collar girth.

An annual leaf sample will continue to be taken, the next being due in November 2008.

Harvests will continue to be recorded using the standard procedure, the season beginning in April and ending in March of the following year, to coincide with the oil palm planting date.

2.2.6. Conclusion

Trial GH ES 03 started bearing in accordance with the planned schedule and is now in a routine phase. As planned too, production precocity is also very good: already an average of 2.7 tonnes FFB/ha in the third year after planting.

It will have to be checked whether the advantage of the Flanamat treatment seen in the third year after planting is an artefact.

2.3. GH ES 04

2.3.1. *Reminder of the protocol*

Testing the effect of increasing doses of Flanamat on the growth and early yield of young oil palms. Statistical design: 4 treatments x 6 replicates, each unit plot comprising 25 palms (5 rows of 5) of which 9 useful palms (3 rows of 3).

Site: Okumaning, block M5. Planting date: April 2007. Planting density: 143 p/ha (9 metre triangles). Planting material: IRHO Pobé, hybrid C1001F.Topography: 3 replicates (blocks 1, 2 and 3) are located in a valley bottom (Temang soil series), and 3 replicates (blocks 4, 5 and 6) are located in a hilly area (Bekwai soil series).

2.3.2. *Treatment application*

1 kg of Flanamat was applied in the planting hole on all the palms in the experiment. Thereafter, no other fertilizer will be applied apart from the Flanamat of the treatments.

Flanamat application rate in kg per palm

Date	Treatment A Very low	Treatment B Low	Treatment C Moderate	Treatment D High
30-05-07	0.2	0.4	0.6	0.8
19-10-07	0.4	0.8	1.2	1.6

In compliance with the protocol.

2.3.3. *Results obtained*

Two vegetative growth variables, collar girth and plant height, were measured in May (month 1) and October 2007 (month 6). The results are given in annex 7 and in the following table.

GH ES 04 Vegetative growth	Collar girth (cm)		Height of palm (cm)	
	Month 1	Month 6	Month 1	Month 6
Mean of 3 lowland blocks	19,8	36,9	145,2	157,8
Mean of 3 upland blocks	17,0	33,3	110,0	144,3

A clear and immediate block effect is to be noted: only one month after planting, the average growth of the three replicates in the valley bottom, 19.8 cm collar girth and 145 cm height, was significantly better than the average growth of the three replicates in the hilly zone: 17.0 cm collar girth and 110 cm height.

However, at six months, the difference between the lowland and upland blocks was less: 36.9 cm in the valley bottom as opposed to 33.3 cm in the upland zone for collar girth and 158 cm in the valley bottom as opposed to 144 cm in the hilly zone for height. In fact, the heavy rainfall recorded during the rainy season (1,216 mm in six months between May and October 2007, i.e. an average of 203 mm per month and a maximum of 277 mm in September) resulted in excess water for the lowland palms (especially those in replicate 1), which temporarily gave them a slight disadvantage when compared to the upland palms.

No treatment effect has been seen for the moment.

2.3.4. *Trial status in December 2007*

It has in fact been seen that palms in a lowland position suffered from excess water in the previous rainy season, especially those in block 1, some of which were still showing nitrogen deficiency symptoms linked to temporary asphyxia, but were in remission.

Drainage work (digging of ditches towards the neighbouring water course) was under way in the zones most liable to flooding (mainly in replicate 1) and ridging was carried out on the most exposed palms. It is felt that any excess water effect in the coming rainy season will thus be lessened.

The layout of the blocks was judiciously chosen: regular slope of 7 to 8% on soils of the same type (Bekwai series) in the 3 replicates in the upland zone, and a flat to gently sloping zone ranging from 1 to 2.6% in the 3 replicates in the lowland zone (replicate 1 being the flattest), avoiding regularly flooded zones (remember that temporary flooding seen particularly in replicate 1 was exceptional). A topographical map per block on a scale of 1:500 is available.

The trial has been well marked out, with bamboo poles at the corners of the unit plots and information panels in front of each unit plot, but individual labelling of the palms can be simplified and should be in colour.

In the 3 blocks in the upland zone, it is in block 4 that growth seems to be the best: greener and more uniform palms than in the other two blocks, and a more regular, thicker *Pueraria* cover. This needs to be confirmed from the next growth measurements on the palms.

There were very few young palms lost in the first 8 months (only one palm was seen to have been killed by rodent attacks in unit plot 22), which is a success, both agronomically (validity of cultural practices) and statistically (very small percentage of useful palms eliminated in the first year).

Only very few symptoms of *Oryctes* presence were seen, unlike in trial GH CP 03 at Kwae. That illustrates the very high incidence of that pest at Kwae, and its virtual absence at Okumaning, in 2007.

2.3.5. Timetable for work and observations in 2008 and 2009

The fertilizer application protocol will be strictly followed, as indicated below:

Recommended Flanamat rates in kg per palm

Date	Treatment A Very low	Treatment B Low	Treatment C Moderate	Treatment D High
2008 semester 1	0.6	1.2	1.8	2.4
2008 semester 2	0.8	1.6	2.4	3.2
2009 semester 1	1.0	2.0	3.0	4.0
2009 semester 2	1.2	2.4	3.6	4.8

There may be some changes to the rates beginning in 2009, depending on the degree of oil palm response to the treatments in 2008, though always maintaining the principle of arithmetic progression.

Labelling will have to be improved in line with the principles set down in section 2.4.5.

2.3.6. *Conclusion*

The first conclusion on the 2007 season in trial GH ES 04 is the very large difference in growth between young palms depending on whether they are planted in a lowland or upland position: the advantage going to either one group or the other depending on the season: dry or moderately wet periods favour the palms in the lowland position, as they have soils with a high water reserve and an easily available high water table, whereas very wet periods favour the upland palms, with strongly sloping, draining soils taking away excess water.

The conclusion reached in trial GH ES 02 is confirmed: the soil and topography effect is preponderant in the local context. It is highly likely that in the long term the palms on the alluvial soil in the valley bottom will produce more than the palms on the gravelly ferralitic soil in the sloping zone because, at Okumaning, the periods lacking water will probably be much more frequent and longer than periods of excess water.

Trial GH ES 04 will provide some figures for this difference in oil palm performance between the two geomorphological types.

2.4. GH CP 03

2.4.1. *Reminder of the protocol*

Testing the effect of two cultural practices, subsoiling and gypsum application, on the improvement of soil properties and on the growth and yields of young palms. Statistical design: 2 main treatments x 2 subdivisions x 6 replicates, each unit plot comprising 25 palms (5 rows of 5) of which 9 useful palms (3 rows of 3).

Site: Kwae Nucleus, blocks BS 3 and BS 4. Planting date: April 2007. Planting density: 143 p/ha (9 metre triangles). Planting material: IRHO Pobé, hybrid C1001F. Topography: hilltop and hillside, soils of the Bekwai and Nzima series. Previous cover: oil palm.

2.4.2. *Treatment application*

Subsoiling was carried out on 16 April 2007, using a D8 bulldozer fitted with a 1-metre tine. The machine subsoiled the planting rows.

Gypsum was uniformly applied to the soil surface by broadcasting on 23, 24 and 25 April 2007, at a rate of 12 tonnes of product per hectare.

Apart from the treatments, land preparation was uniform: lining, holing, Flanamat application (1 kg in the planting hole) and manual eradication of the weed *Panicum* spp.

The extra cost of the respective treatments was calculated to subsequently assess their cost-effectiveness (net margin achieved by the additional yields of the palms divided by the extra cost of treatment). The extra cost includes all costs linked to the actual treatment, i.e. in addition to the compulsory land preparation work common to the entire experimental area.

For subsoiling over a total area of 2.1 hectares, this gave: manpower (2 operators, 4 assistants and 1 supervisor) and the cost of using the equipment for the duration of the work (one 8-hour day). This gave an extra cost of 447,000 cedis per hectare, equivalent to 45 euros per hectare.

For gypsum application over a total area of 2.1 hectares, this gave: the cost of the product, cost of transport to the edge of the field (9 hours of tractor use in 3 times 3 hours per day, 1 operator, 1 assistant) and the cost of labour for spreading (28 to 30 labourers, 2 assistants and 1 supervisor each day for 3 days). This gave an additional cost of 17,720,000 cedis per hectare, equivalent to 1,772 euros per hectare.

2.4.3. *Results obtained*

The results are shown in annex 8 and in the following table. There is no trend in treatment effects for the time being. The depressive effect of gypsum application on plant height at 1 month was more than likely an artefact without agronomic significance, given moreover that it was disappearing after 6 months.

Variable	Date	Treatment S-G-	Treatment S-G+	Treatment S+G-	Treatment S+G+
Collar girth (cm)	m 1	23.0	22.1	22.7	22.9
	m 6	34.4	34.0	35.6	36.6
Plant height (cm)	m 1	126	120	127	119
	m 6	148	145	149	148

2.4.4. *Trial status in December 2007*

Young oil palm growth is uniform, the dark green foliage indicates good mineral nutrition. *Pueraria* growth in the interrow is satisfactory. The planting rows have been completely strip weeded, making it easier to inspect the young palms.

Some traces of *Oryctes* attacks can be seen on some palms: damage is significant but in remission. Very fortunately, *Oryctes* pressure, which is not as strong as in other places in the Kwae Nucleus, is decreasing. No deaths have been seen, but the affected palms have been temporarily withdrawn from the list of useful palms, for as long as it takes them to catch up their retarded growth.

The trial is well marked out, with corner poles and clearly marked information panels for each unit plot. However, labelling is too complicated, notably with no clearly visible difference between useful and border palms.

The growth of some of the young palms in replicates 5 and 6 is hindered by the existence of an old oil palm stem too close. There is also a remaining papaya tree.

A topographical map per block on a scale of 1:500 is available. It was seen in the field that the blocks had been judiciously laid out to have both hilltops and hillsides in each block (the maximum hillside slope is roughly constant at around 8%), and the same soil type, with a high percentage of coarse elements (gravels and stones) right from the surface.

The dip left by the subsoiler can also be clearly seen in the planting rows in the S+ plots, and a few patches of gypsum yet to be dissolved in the G+ plots. However, for the time being, there is no visible difference between treatments, in compliance with the measurements taken in October 2007. Any treatment effect is more likely to appear in the current dry season.

2.4.5. Timetable for work and observations in 2008 and 2009

Labelling needs to be simplified to improve it: one colour for border palms, with uniform identification, e.g. 15-B means border palm in plot 15. Another colour for useful palms, numbered from 1 to 9 repeated for each unit plot: e.g. 04-08 means the eighth useful palm in unit plot number 4. Moreover, this is a general rule valid for all the experimental palms in the four ongoing experiments.

As for the useful palms affected by *Oryctes* attacks, they should be given an additional particular marking, so that observers do not take them into account: e.g. (dummy) example, 15-07 / O would mean the seventh useful palm in unit plot number 15, affected by *Oryctes*, temporarily withdrawn.

Old felled palm stems too close to the young palms should be chopped up and the pieces windrowed in the nearest interrow. The remaining papaya tree must be eliminated immediately of course.

The planting row upkeep system is good and should be continued. Fertilizer will be applied uniformly, in two goes, in April and October 2008, in accordance with the standard for the second year after planting, depending on the type of fertilizer available: Flanamat or compound fertilizer.

It is clear that further *Oryctes* attacks cannot be accepted in this trial, given the elimination of useful palms which would then arise. All the necessary steps should therefore be taken to eliminate any adults still present (manual collection), with chemical treatments in the axils of young fronds if necessary.

Vegetative growth measurements on young palms will be carried out strictly respecting the protocol, in April and October 2008.

The fertilizer will be applied in two goes in 2008, in accordance with the standard fertilizer schedule in force for young palms at Kwae.

Depending on how the young palms react to the treatments, soil observations will be considered at the appropriate time.

2.4.6. *Conclusion*

Trial GH CP 03 has got off to a good start. With the few improvements requested, conditions in 2008 will be excellent for detecting and measuring any treatment effects.

3. STATUS OF THE ESTATES IN DECEMBER 2007

3.1. Kwae Nucleus

3.1.1. Estate status

501 hectares have been replanted in 2007, i.e. slightly over forecasts.

Unfortunately, most of the young palms (planted between 2004 and 2007) have been severely attacked by *Oryctes*, and the attacks have spread to the adjacent old palms in the Nucleus and to some neighbouring mature private plantations.

The situation is improving, but there are still some adults in the young palms and larvae in old rotting palm stems. If symptom intensity on the oldest fronds of the young palms and the ubiquitous nature of the attacks are anything to go by (there are sometimes attacks inside the Nucleus, varying in intensity), the situation must have been critical a few months ago.

What was the cause of this *Oryctes* population explosion in 2007, when the pest had been scarce in recent years? As attacks occurred in the Nucleus and adjacent plots, the source is suspected of being inside the Nucleus. A previous document (cf mission report by X. Bonneau in November 2005, doc CP SIC 1924 dated March 2006, section 3.1.1. page 16) reported that if sap extraction from felled palms is complete, the stem tissues dry out and are no longer attractive for *Oryctes* to lay their eggs.

However, it seems that in 2007, in a hurry to fulfil the planting quotas, some young palms were planted in plots where felling and sap extraction had not been completed: there remained too many potential larva sites, and it is possible that the heavy rainfall in the 2007 rainy season helped to increase their attraction. The infernal cycle was triggered, with larva sites near young palms that were attractive to the adult pests. A qualified entomologist could no doubt make out more clearly the sequence of causes and effects that led to this explosion.

Whatever the case, some agronomic lessons can be drawn (most of which are a confirmation of what is already known).

First of all, all the *Oryctes* populations still present must be eradicated by every possible means, as an absolute priority: no arguments (organic status of the plots, labour shortage, etc.) can be allowed to counter this urgency. Chemical control (application of insecticide granules or solution to the axils of young fronds) will be continued, combined where necessary with other techniques: manual collection of adults with hooks, extermination of larvae by spraying an insecticide onto stems split lengthwise.

Then, there should not be any planting until the plot and its immediate vicinity no longer contain any potential breeding sites. For the next felling sites, palm wine producers must be left enough time to carry out sap extraction, and the felled oil palm stems should be inspected to check they have completely dried out.

For the future plantings in 2008 in blocks where the oil palm stems have already been felled, the quantities of larvae still present should be checked and they should be eliminated by all possible means: insecticide spraying onto stems split lengthwise beforehand, and also localized burning of previously chopped stems: this is a lengthy, difficult and costly operation, but in any case less costly than getting rid of an *Oryctes* outbreak after the event.

EFB applications as fertilizer in a ring around young palms, which might run the risk of becoming breeding sites, should also be halted.

To conclude, this strong *Oryctes* pressure in 2007, added to the mishaps to which the same palms were subjected in 2006 (see document 2052 dated March 2007, section 3.1.1., page 17), has considerably retarded the growth of palms planted since 2004 in the Kwae Nucleus: it can roughly be estimated that their growth has fallen behind by a year compared to optimum growth.

As for the old palms planted before 1985, it was seen in one example (blocks BS 8 and BS 9 planted in 1982) that weeded circle upkeep has fallen well behind: the

reasons are perfectly understandable, given the urgent requirements of young immature palms. However, a minimum of upkeep must be ensured, to avoid exaggerated fruit losses when bunches fall, given that this is a net profit on old palms at variable very low production costs, and that the mills have great need of raw material in this period of low production. It is also confirmed that these old palms do not need mineral fertilizer, as they are at the end of their life cycle and also seriously affected by vascular wilt.

*3.1.2. **Mineral nutrition*** (Annex 9)

15 leaf samples were taken in November 2007. Leaf content trends were compared for each nutrient analysed between November 2006 and November 2007, in 9 plots where comparison was possible. The graphs show the linear regression line (continuous black lines), along with the corresponding equation and the square of the coefficient of correlation. The bisectrix (dotted red line) corresponds to content identities from one year to another. For the N / P relation, the dotted blue line describes the ideal line for relation P= aN + b.

Leaf N contents have remained stable in 2007, at satisfactory levels. However, leaf P contents have fallen, though still remaining at acceptable levels, so that the N / P relation is less good, as the P contents in 2007 are below the ideal line.

Leaf K contents are very slightly down on average compared to last year, and still as variable. Note for example the low K content (0.486%) in LSU AS16 planted in 2000, as opposed to the high K content (1.105%) in LSU B3 planted in 2004.

Cl contents are slightly up on average, which is beneficial.

A generalized drop in B contents has been seen in 2007, between 7 and 9 ppm for certain LSUs. It is not necessarily deficient, but a check will have to be made for any boron deficiency symptoms in the corresponding plots. If such were to be the case, corrective borax should be applied immediately.

3.2. Kwae Outgrowers

3.2.1. Status of the plots

96 ha were planted in 2006, whilst 3 hectares planted in 1979 have been eliminated, bringing the total area of the Outgrowers to 13,974 ha, covering a wide range of planting years, from 1981 to 2007. The area of immature palms (planted in 2005, 2006 and 2007) is 1,136 ha.

The system is now routine: each year, new plantings will be established, whilst the oldest palms will be abandoned, following a cycle of 26 years.

This year, around 60% of the Outgrowers (those considered to be good farmers) received Sulpomag fertilizer: 1 to 3 kg per palm, applied by GOPDC over a time period ranging from June to October 2007. That application followed on from the

recommendation made last year (see document 2052 dated March 2007, section 4.3., page 23), after several years running without fertilizer, leading to a gradual drop in potassium contents.

This time, a visit was made to a few plots located in the western section of the perimeter. In general, the palms, which are mostly located on a lower slope and in a valley bottom, in suitable zones, are in good nutritional and phytosanitary condition, with well-loaded bunches suggesting some good yields to come in the first half of 2008.

Two extreme cases can be mentioned. The plantation belonging to Mr Dabra Agyei near the village of Ofoase is a model: the palms, planted in 1998, are well kept: slashing of the interrow, windrowing of dried fronds every other interrow, pruning. The palms are uniform, of the same height, same large collar girth, same frond length with perfect lining in 9 metre triangles, giving a canopy occupying the space in an optimum way, excellent apparent phytosanitary and nutritional condition, and of course an excellent, regular crop of well-loaded bunches in the crowns, and a good balance between male and female inflorescences. Clearly, these palms have been well planted and well maintained, with care and regularity from the outset. Attempts were made to find fault with this plantation, but in vain.

It is concluded from this example that good stable yields can be achieved by the Outgrowers, by selecting motivated farmers with good technical skills and by carefully choosing the land (alluvial or colluvial valley bottom soils) and by distributing good planting material.

Conversely, a plantation set up in 2005 was seen along the road between the villages of Chia and Kwae, where the palms had completely vegetated through lack of upkeep and were completely smothered by weeds, which were being eradicated, but clearly the palms had remained for a long time without upkeep: some of them exhibited nitrogen deficiency symptoms linked to competition from grasses, and all had fallen behind by around a year. That is a waste of such productive planting material.

However, it is unfortunately very difficult to guarantee that a given farmer will be consistent in the work he provides over long periods.

3.2.2. ***Mineral nutrition*** (see Annex 10)

64 leaf samples were taken in November 2007. Leaf content trends were compared for each nutrient analysed between November 2006 and November 2007, in 17 plots (one per age category). The graphs show the linear regression line (continuous black lines), along with the corresponding equation and the square of the coefficient of correlation. The bisectrix (dotted red line) corresponds to content identities from one year to another. For the N / P relation, the dotted blue line describes the ideal line for relation $P = aN + b$.

General stability can be seen in the mineral nutrition of Outgrower palms between 2006 and 2007, notably virtually identical values, with only slight variations,

for N and K. Like last year, leaf P contents are slightly below the ideal line compared to leaf N contents, but they remain acceptable.

The downward trend for leaf K contents seen for the last few years has therefore been stopped, at an average value of around 0.7% on the 17 samples chosen. It is a matter of knowing whether that stabilization of K contents is purely chance, or attributable to the Sulpomag applications carried out in 2007.

As the applications were not identical everywhere, an attempt was made to detect any correlation between changes in K content between November 2006 and November 2007, and the amount of Sulpomag applied in mid-2007.

The following table does not show any clear correlation between these two variables. However, hasty conclusions should not be drawn from that, because this is in no way an experiment with a statistical design and precisely controlled application rates.

Number of plots	Sulpomag rate applied (kg per palm)	Average Delta K% between November 2006 and November 2007
2	0	- 0.025
8	1.5	- 0.075
8	2	+ 0.025
20	2.5	+ 0.030
26	3	- 0.006

3.3. Okumaning

3.3.1. Status of the plots

The areas planted to oil palm at Okumaning now amount to 1,958 hectares, with 5 planting years: 2002 (627 ha), 2003 (518 ha), 2004 (400 ha), 2005 (321 ha) and 2007 (91 ha). There are plans to plant 300 hectares in 2008, expanding the planted areas southwards.

It is very satisfying to see the virtual disappearance of *Panicum* from the entire estate, notably in areas where it was dominant. In addition, *Pueraria* growth is generally satisfactory. Of course, it is necessary to remain vigilant and eliminate the final patches of remaining *Panicum* to get rid of this dangerous weed for good. Likewise for *Mimosa*, another very invasive weed.

There are reasons for optimism: between the assignment of the labour required for manual eradication of the final pockets of *Panicum* and *Mimosa,* and the growth of *Pueraria* which should soon cover the entire soil surface, the Okumaning estate can be perfectly clean in 2008. The sight of young palms planted in the middle of a sea of *Panicum* will be no more than an old memory.

All the palms have dark green foliage, indicating uniform good mineral nutrition, vindicating the fertilizer schedules for young crops at Okumaning. It is clear that the excellent rainy season in 2007 also contributed to that.

Due to an excessively chaotic history in the first and second years after planting, there are many replacements in the palms planted in 2004 and 2005, especially on hilltops. Moreover, growth there is still heterogeneous.

However, a substantial improvement can be seen in the upkeep of weeded circles and interrows, with many labourers assigned to it (seen during the visit on 11-12-07). GOPDC has done what was necessary to rehabilitate these plots in which upkeep rounds had been too infrequent in previous years. The results speak for themselves.

Consequently, if the good fertilization and upkeep practices seen in 2007 are regularly continued, good growth and gradual homogenization everywhere can be expected.

The absence of *Oryctes* was also noted at Okumaning. That argues in favour of a cause internal to Kwae to explain the outbreak there, and not a regional phenomenon.

The palms planted in 2003 got off to a very difficult start, with a severe dry season and weed invasion. They are also recovering, but with many replacements of different ages, hence substantial heterogeneity in the crop cover, even more so than in the 2004 and 2005 plantings.

An example was seen on a hilltop in block H 6, where a large area of *Pueraria* had disappeared, replaced by a mixture of more or less dangerous weeds (other than

Panicum). In that situation, re-establishing a legume cover is recommended: *Pueraria javanica* or *Mucuna brachiata*, opening up a strip down the interrow and sowing in pockets down the weeded strip.

To speed up homogenization of the crop cover, special attention should be paid to all the replacements: weeded circle upkeep, half-rate of fertilizer applied to the original palms (to simplify the procedure) and, where necessary, an additional individual application (e.g., 200 g of urea on a slightly yellow replacement).

3.3.2. Mineral nutrition (see Annex 11)

23 leaf samples were taken in November 2007. Leaf content trends were compared for each nutrient analysed between November 2006 and November 2007, in 14 plots where comparison was possible. The graphs show the linear regression line (continuous black lines), along with the corresponding equation and the square of the coefficient of correlation. The bisectrix (dotted red line) corresponds to content identities from one year to another. For the N / P relation, the dotted blue line describes the ideal line for relation P= aN + b.

In general, the leaf contents have remained relatively stable in 2007.

A slight average increase can be seen in leaf N contents (from 2.81% in 2006 to 2.93% in 2007), which may be at least partly due to successful *Pueraria* establishment and *Panicum* eradication. The N and P contents are well correlated, a little under the ideal line for P = f(N).

However, a slight drop in leaf K and Cl contents should be noted between November 2006 and November 2007: 0.849 to 0.797%, and 0.438 to 0.378% respectively. This is not catastrophic, particularly as the excellent rainy season in 2007 did not favour the effect of nutrients involved in resistance to water stress. However, it has to be made sure that K and Cl contents at Okumaning remain at satisfactory levels: by first of all applying the recommended rates in their entirety and then by increasing the rates if necessary (i.e., if they are not enough to stabilize K and Cl contents at satisfactory levels).

Also worth noting is that the standard deviation for Cl contents between the lowland and upland LSUs is maintained in 2007: 0.426% Cl in the lowland LSUs and 0.330% Cl in the upland LSUs. It is therefore confirmed that palms planted in the upland position are naturally less rich in chlorine, and therefore more exposed to a depressive effect of water stress.

4. FERTILIZATION

4.1. General

Structuring of the plantation in LSUs is continuing with the plots reaching maturity, based on the criteria established in the previous years. It is confirmed that the most discriminant variable is soil type, linked to topography. The future LSUs will therefore continue to be defined according to the two major types: upland topographical position (hilltops and slopes with soils of the Nzima and Bekwai types) or lowland topographical position (foot of slopes and valley bottoms with soils of the Temang or Oda and Kokofu type).

The 2007 season has provided a great deal of information that strengthens the conclusions reached in the previous seasons and adds some new prospects.

-Flanamat organic fertilizer is confirmed to be a good fertilizer, especially for potassium, and well suited to the local context. Trial GH ES 04, intended to optimize rates on young palms, was planted as planned in 2007, and extrapolatable results will be available starting next year.

-Sulpomag natural mineral fertilizer is proving to be a promising potassium fertilizer in the two trials GH ES 02 and GH ES 03. Pending confirmation of its performance in 2008 and 2009, it is preferable to recommend Flanamat in the estate as its worth has been more effectively demonstrated compared to Sulpomag.

-The susceptibility of palms planted in an upland position to chlorine deficiency, an aggravating factor in the event of water stress. Specific chlorine fertilization is strongly recommended for those palms (cf section 4.4.).

-The good performance of NaCl as a chlorine fertilizer, measured in trial GH ES 03: this fertilizer offers the advantage of being a good source of chlorine that can be taken up by young palms, but in addition it has so far not caused any severe depression in leaf K contents, through excessive sodium uptake. The advantage for GOPDC of using NaCl for supplemental chlorine in palms with a low Cl content is therefore highlighted.

4.2. Kwae Nucleus

Given the explosion in the *Oryctes* population seen in 2007, and the potential egg-laying site of EFB applied in a ring around the stem of young palms, the recommendation to apply EFB to young palms is suspended, at least for the duration of the 2008 season, until the infestation level has been brought back to below an acceptable limit.

There is no experimental proof of the harmfulness of EFB as a privileged egg-laying site, but as some assistants have reported seeing larvae in the EFB layer around young palms, and in view of the priority given to *Oryctes* control at Kwae (see section 3.1.1.), no risks will be taken.

Consequently, the young palms in the Nucleus will only receive Flanamat or the compound fertilizer in accordance with the young palm fertilizer schedule in force at GOPDC (see section 4.4.).

On the other hand, EFB application on mature palms can be continued, by increasing age range: the older the palms, the fewer EFB will be applied, and nothing at all for those due to be felled in the coming three years.

For upland LSU palms, supplemental chlorine fertilizer is also proposed, as at Okumaning (cf section 4.4.).

4.3. Kwae Outgrowers

A stabilization in K content has been seen, without it being possible to prove that it was caused by the Sulpomag applications in 2007.

Year	K content (%) average of 14 then 16 plots
2004	0.768
2005	0.711
2006	0.687
2007	0.701

As a precaution, it is proposed that Sulpomag continue to be supplied to the best farmers. For simplicity and practicality, 2 kg of Sulpomag per palm in 2008 if K was over 0.7% in November 2007, and 3 kg of Sulpomag per palm if K was lower than 0.7% in November 2007.

Plots in which there will be no fertilizer applications in 2008 should be clearly recorded (though of course without encouraging it, but experience has shown that there are always a few farmers who do not wish to benefit from the fertilizer provided by GOPDC) so as to have control plots without Sulpomag.

4.4. Okumaning

The generalization of Flanamat 3-2-13 is recommended, as explained in section 4.1., which will make it possible to achieve organic plot status, unlike with compound fertilizer.

For one to three-year-old palms, apply the schedule as defined in the report on the mission by X. Bonneau in November 2004, doc CP SIC 1808, March 2005, section 5.1. page 17, i.e.:

Planting year	Semester	kg Flanamat per palm
Y1	1	1
	2	1.5
Y2	1	2
	2	3
Y3	1	3.5
	2	4

For palms aged 4 years or more, the schedule will now be based on leaf contents: firstly for K, then it will be seen later whether it is necessary to apply a nitrogen or phosphate fertilizer supplement.

K content (%) in 11/07, leaf 17	Flanamat rate (kg / palm)
	4.5
1.1	7
1.0	9
0.9	11.5
0.8	14
0.7	16
0.6	18.5
0.5	20

The recommendation to apply 1 kg of NaCl per palm per year when the Cl content is under 0.4% (i.e. mostly on palms in upland LSUs) is also confirmed.

Unfortunately, this was not done in 2007, resulting in a substantial general drop in leaf Cl contents, without any immediate negative consequence due to excellent rainfall in 2007. However, it would be a pity to deprive the palms of this chlorine fertilizer supplement, which can be very useful in the event of severe drought. And it is known that recurring severe droughts are highly likely in the region.

ANNEX 1

GH ES 02

Vegetative growth

R.P. CIRAD-IRHO INDONESIE 14-01-08

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
collar girth (cm)
DATE DE MESURE :12-07 (M 66)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	4432.35	35	126.64			
TRAITEMENTS	709.87	5	141.97	1.16	3.86	2.61
BLOCS	671.43	5	134.29	1.10	3.86	2.61
ERREUR	3051.06	25	122.04			

COEFFICIENT DE VARIATION : 4.0 %

MOYENNES

TRAITEMENT T	:	267.8
TRAITEMENT C	:	278.2
TRAITEMENT SP 1	:	271.5
TRAITEMENT SP 3	:	274.4
TRAITEMENT F 1	:	281.6
TRAITEMENT F 3	:	275.5
MOYENNE GENERALE	:	274.8

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
collar girth (cm)
DATE DE MESURE :07-07 (M 61)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	4513.29	35	128.95			
TRAITEMENTS	469.53	5	93.91	0.70	3.86	2.61
BLOCS	692.32	5	138.46	1.03	3.86	2.61
ERREUR	3351.43	25	134.06			

COEFFICIENT DE VARIATION : 4.3 %

MOYENNES

TRAITEMENT U	:	266.3
TRAITEMENT C	:	273.7
TRAITEMENT P	:	267.9
TRAITEMENT Ps	:	268.7
TRAITEMENT F	:	270.9
TRAITEMENT Fs	:	276.9
MOYENNE GENERALE	:	270.7

ANNEX 2

GH ES 02

Leaf analysis

US49 - ANALYSES

Demande: **08001** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**

Objet: **GH ES 02** Date DF: **11/2007** Rang: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Traitment	Bloc	Parcelle	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00001	F1	1	1	2,927	0,168	0,849	0,833	0,327	0,355	14,8
08-CP-00002	SP3	1	2	3,057	0,166	0,766	0,790	0,336	0,291	16,5
08-CP-00003	SP1	1	3	2,983	0,165	0,785	0,702	0,381	0,348	12,2
08-CP-00004	F3	1	4	3,051	0,171	0,866	0,801	0,253	0,382	13,5
08-CP-00005	C	1	5	2,947	0,168	0,743	0,796	0,344	0,569	9,8
08-CP-00006	T	1	6	2,739	0,144	0,526	0,764	0,440	0,451	14,3
08-CP-00007	T	2	7	2,969	0,157	0,686	0,785	0,353	0,246	19,1
08-CP-00008	C	2	8	3,161	0,176	0,726	0,911	0,346	0,611	16,7
08-CP-00009	SP3	2	9	3,014	0,172	0,826	0,738	0,313	0,320	15,1
08-CP-00010	SP1	2	10	3,079	0,167	0,750	0,838	0,345	0,248	15,8
08-CP-00011	F3	2	11	2,970	0,168	0,871	0,840	0,299	0,369	15,3
08-CP-00012	F1	2	12	2,874	0,163	0,830	0,890	0,324	0,256	16,5
08-CP-00013	C	3	13	3,146	0,178	**0,785**	**0,906**	0,310	0,518	19,5
08-CP-00014	F3	3	14	2,919	0,167	0,925	0,835	0,292	0,395	18,5
08-CP-00015	F1	3	15	2,944	0,164	0,831	0,767	0,290	0,376	13,2
08-CP-00016	T	3	16	2,933	0,165	0,901	0,786	0,294	0,297	16,9
08-CP-00017	SP1	3	17	2,953	0,162	0,695	0,755	0,333	0,351	11,5
08-CP-00018	SP3	3	18	2,892	0,163	0,774	0,709	0,335	0,337	12,5

Résultats exprimés par rapport à la matière sèche

US49 - ANALYSES

Demande:	**08001**	Série:	**1**	Pays:	**Ghana**	Société:	**GOPDC**	Plantation:	**Okumaning**
Objet:	**GH ES 02**	Date DF:	**11/2007**	Rang:	**17**	Calcination:	**Double**		

CIRAD-PERSYST/UPR34

No Labo	Traitment	Bloc	Parcelle	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00019	SP3	4	19	3,118	0,171	0,765	0,862	0,308	0,277	**24,9**
08-CP-00020				*3,182*	*0,190*	*0,974*	*0,779*	*0,325*	*0,669*	*18,4*
08-CP-00021	SP1	4	20	3,086	0,170	0,735	0,805	0,374	0,358	20,2
08-CP-00022	F3	4	21	2,996	0,173	0,902	0,825	0,229	0,329	18,2
08-CP-00023	F1	4	22	2,938	0,165	0,796	0,775	0,330	0,447	10,7
08-CP-00024	T	4	23	2,776	0,154	0,717	0,712	0,350	0,385	12,8
08-CP-00025	C	4	24	2,981	0,167	0,631	0,833	0,371	0,632	10,6
08-CP-00026	SP1	5	25	2,949	0,160	0,606	0,778	0,436	0,547	13,3
08-CP-00027	T	5	26	2,780	0,156	0,529	**0,746**	0,452	0,362	10,6
08-CP-00028	C	5	27	3,066	0,173	0,675	0,770	0,413	0,658	9,4
08-CP-00029	SP3	5	28	2,943	0,167	0,585	0,727	0,473	0,430	13,4
08-CP-00030	F1	5	29	2,921	0,165	0,756	0,793	0,351	0,570	9,4
08-CP-00031	F3	5	30	2,824	0,161	0,740	0,751	0,377	0,427	11,6
08-CP-00032	F3	6	31	3,012	0,172	0,747	0,759	0,383	0,435	13,0
08-CP-00033	F1	6	32	2,843	0,163	0,729	0,783	0,371	0,493	10,4
08-CP-00034	T	6	33	2,844	0,160	0,606	0,723	0,417	0,430	12,0
08-CP-00035	C	6	34	2,933	0,166	0,574	0,800	0,468	0,578	10,2
08-CP-00036	SP3	6	35	2,895	0,168	0,574	0,813	0,493	0,476	12,9
08-CP-00037	SP1	6	36	2,629	0,153	0,588	**0,716**	0,502	0,534	12,0

Résultats exprimés par rapport à la matière sèche

EXPERIENCE GHANA GOPDC GH-ES 02 — 08:26 Friday, February 29, 2008

ANALYSE DF 11/07 Variable : N

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
2.95	3.01	2.96	2.98	2.91	2.86	2.95	3.2

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.168)	% Temoin
1. TEMOIN	2.84	100.000
2. C	3.04	107.001
3. SP3	3.00	105.510
4. SP1	2.94	103.386
5. F3	2.96	104.290
6. F1	2.91	102.382

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.4545680			
BLOCS	5	0.0868967	0.0173793	1.95	0.1209
TRAITEMENTS	5	0.1453017	0.0290603	3.27 *	0.0209
ERREUR	25	0.2223697	0.0088948		

Test Duncan 5%

C : a
SP3 : ab
F3 : abc
SP1 : abc
F1 : bc
T : c

ANALYSE DF 11/07 Variable : P

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.164	.167	.167	.167	.164	.164	.165	3.1

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.009)	% Temoin
1. TEMOIN	.156	100.000
2. C	.171	109.829
3. SP3	.168	107.479
4. SP1	.163	104.487
5. F3	.169	108.120
6. F1	.165	105.556

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.0016042			
BLOCS	5	0.0000886	0.0000177	0.69	0.6364
TRAITEMENTS	5	0.0008729	0.0001746	6.79 ***	0.0004
ERREUR	25	0.0006428	0.0000257		

Test Duncan 5%

C : a
F3 : a b
SP3 : a b
F1 : b
SP1 : b
T : c

EXPERIENCE GHANA GOPDC GH-ES 02 08:26 Friday, February 29, 2008
ANALYSE DF 11/07 Variable : K

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.756	.782	.819	.758	.649	.636	.733	8.6

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.113)	% Temoin
1. TEMOIN	.661	100.000
2. C	.689	104.262
3. SP3	.702	106.204
4. SP1	.706	106.885
5. F3	.842	127.390
6. F1	.799	120.832

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.4137939			
BLOCS	5	0.1636619	0.0327324	8.15 ***	0.0001
TRAITEMENTS	5	0.1497686	0.0299537	7.46 ***	0.0002
ERREUR	25	0.1003634	0.0040145		

Test Duncan 5 %

F3	:	a
F1	:	a
SP3	:	b
SP1	:	b
C	:	b
T	:	b

ANALYSE DF 11/07 Variable : CA

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.781	.834	.793	.802	.761	.766	.789	5.6

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.079)	% Temoin
1. TEMOIN	.753	100.000
2. C	.836	111.072
3. SP3	.781	103.742
4. SP1	.758	100.709
5. F3	.802	106.532
6. F1	.807	107.197

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.1007723			
BLOCS	5	0.0214868	0.0042974	2.19	0.0874
TRAITEMENTS	5	0.0302325	0.0060465	3.08 *	0.0266
ERREUR	25	0.0490530	0.0019621		

Test Duncan 5%

C	:	a
F1	:	ab
F3	:	ab
SP3	:	b
SP1	:	b
T	:	b

ANALYSE DF 11/07 Variable : MG

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.347	.330	.309	.327	.417	.439	.361	9.3

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.060)	% Temoin
1. TEMOIN	.384	100.000
2. C	.375	97.658
3. SP3	.376	97.832
4. SP1	.396	102.905
5. F3	.306	79.488
6. F1	.332	86.427

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.1503490			
BLOCS	5	0.0854421	0.0170884	15.01 ***	<.0001
TRAITEMENTS	5	0.0364525	0.0072905	6.41 ***	0.0006
ERREUR	25	0.0284544	0.0011382		

Test Duncan 5%

SP1	:	a
T	:	a
SP3	:	a
C	:	a
F1	:	b
F3	:	b

ANALYSE DF 11/07 Variable : CL

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.399	.342	.379	.405	.499	.491	.419	14.8

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.111)	% Temoin
1. TEMOIN	.362	100.000
2. C	.594	164.256
3. SP3	.357	98.802
4. SP1	.395	109.258
5. F3	.390	107.646
6. F1	.416	115.016

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	0.4504176			
BLOCS	5	0.1185396	0.0237079	6.14 ***	0.0008
TRAITEMENTS	5	0.2353822	0.0470764	12.20 ***	<.0001
ERREUR	25	0.0964958	0.0038598		

Test Duncan 5%

C	:	a
F1	:	b
SP1	:	b
F3	:	b
T	:	b
SP3	:	b

ANALYSE DF 11/07 Variable : B

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
13.5	16.4	15.4	16.2	11.3	11.8	14.1	21.9

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 5.494)	% Temoin
1. TEMOIN	14.3	100.000
2. C	12.7	88.915
3. SP3	15.7	110.035
4. SP1	14.3	100.350
5. F3	15.0	105.134
6. F1	12.5	87.515

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	35	438.4275000			
BLOCS	5	151.6591667	30.3318333	3.18 *	0.0234
TRAITEMENTS	5	48.3691667	9.6738333	1.01	0.4301
ERREUR	25	238.3991667	9.5359667		

			T	C	SP3	SP1	F3	F1	Prob. de F
N	11/07	17	2.84 c	3.04 a	3.00 ab	2.94 abc	2.96 abc	2.91 bc	.021
P	11/07	17	.156 c	.171 a	.168 ab	.163 b	.169 ab	.165 b	.000
K	11/07	17	.661 b	.689 b	.702 b	.706 b	.842 a	.799 a	.000
Ca	11/07	17	.753 b	.836 a	.781 b	.758 b	.802 ab	.807 ab	.027
Mg	11/07	17	.384 a	.375 a	.376 a	.396 a	.306 b	.332 b	.001
Cl	11/07	17	.362 b	.594 a	.357 b	.395 b	.390 b	.416 b	.000
B	11/07	17	14.3	12.7	15.7	14.3	15.0	12.5	.430

ANNEX 3

GH ES 02

Production

number of bunches per palm

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :NOMBRE DE REGIMES PAR ARBRE
DATE DE MESURE :1er SEMESTRE 2007

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	211.48	35	6.04			
TRAITEMENTS	38.00	5	7.60	2.10	3.86	2.61
BLOCS	83.13	5	16.63	4.60**	3.86	2.61
ERREUR	90.35	25	3.61			

COEFFICIENT DE VARIATION : 27.6 %

MOYENNES

TRAITEMENT U	:	5.4
TRAITEMENT C	:	8.5
TRAITEMENT P	:	6.4
TRAITEMENT Ps	:	7.1
TRAITEMENT F	:	6.2
TRAITEMENT Fs	:	7.7
MOYENNE GENERALE	:	6.9

BLOC	1:	6.0
BLOC	2:	6.0
BLOC	3:	4.6
BLOC	4:	7.2
BLOC	5:	8.9
BLOC	6:	8.6

mean weight of bunch (kg)

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS MOYEN DE REGIME (kg)
DATE DE MESURE :1er SEMESTRE 2007

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	36.99	35	1.06			
TRAITEMENTS	4.26	5	0.85	0.97	3.86	2.61
BLOCS	10.88	5	2.18	2.49	3.86	2.61
ERREUR	21.86	25	0.87			

COEFFICIENT DE VARIATION : 14.2 %

MOYENNES

TRAITEMENT U	:	6.0
TRAITEMENT C	:	6.8
TRAITEMENT P	:	6.5
TRAITEMENT Ps	:	6.3
TRAITEMENT F	:	6.8
TRAITEMENT Fs	:	7.1
MOYENNE GENERALE	:	6.6

total weight of bunches per palm (kg)

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS DE REGIMES PAR ARBRE (kg)
DATE DE MESURE :1er SEMESTRE 2007

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	12042.92	35	344.08			
TRAITEMENTS	2900.21	5	580.04	2.11	3.86	2.61
BLOCS	2263.38	5	452.68	1.65	3.86	2.61
ERREUR	6879.33	25	275.17			

COEFFICIENT DE VARIATION : 36.2 %

MOYENNES

TRAITEMENT U	:	31.8
TRAITEMENT C	:	60.1
TRAITEMENT P	:	41.6
TRAITEMENT Ps	:	44.8
TRAITEMENT F	:	43.0
TRAITEMENT Fs	:	53.3
MOYENNE GENERALE	:	45.8

R.P. CIRAD-IRHO INDONESIE 18-07-07

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :NOMBRE DE REGIMES PAR ARBRE
DATE DE MESURE :CAMPAGNE 2006 / 2007

NBT
season 06/07

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	482.17	35	13.78			
TRAITEMENTS	47.94	5	9.59	0.86	3.86	2.61
BLOCS	156.65	5	31.33	2.82*	3.86	2.61
ERREUR	277.58	25	11.10			

COEFFICIENT DE VARIATION : 24.7 %

MOYENNES

TRAITEMENT U	:	12.1
TRAITEMENT C	:	14.9
TRAITEMENT P	:	12.5
TRAITEMENT Ps	:	13.6
TRAITEMENT F	:	12.9
TRAITEMENT Fs	:	15.1
MOYENNE GENERALE	:	13.5

BLOC	1:	12.9
BLOC	2:	12.2
BLOC	3:	10.1
BLOC	4:	13.8
BLOC	5:	15.8
BLOC	6:	16.2

R.P. CIRAD-IRHO INDONESIE 18-07-07

AWB (kg)
season 06/07

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS MOYEN DE REGIME (kg)
DATE DE MESURE :CAMPAGNE 2006 / 2007

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	21.09	35	0.60			
TRAITEMENTS	4.13	5	0.83	1.64	3.86	2.61
BLOCS	4.36	5	0.87	1.73	3.86	2.61
ERREUR	12.60	25	0.50			

COEFFICIENT DE VARIATION : 13.4 %

MOYENNES

TRAITEMENT U	:	4.9
TRAITEMENT C	:	5.7
TRAITEMENT P	:	5.1
TRAITEMENT Ps	:	4.9
TRAITEMENT F	:	5.5
TRAITEMENT Fs	:	5.7
MOYENNE GENERALE	:	5.3

VBT (kg)
saison 06/07

ESSAI :GH ES 02
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS DE REGIMES PAR ARBRE (kg)
DATE DE MESURE :CAMPAGNE 2006 / 2007

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	22794.98	35	651.29			
TRAITEMENTS	3879.99	5	776.00	1.28	3.86	2.61
BLOCS	3724.01	5	744.80	1.23	3.86	2.61
ERREUR	15190.98	25	607.64			

COEFFICIENT DE VARIATION : 33.9 %

MOYENNES

TRAITEMENT U	:	59.4
TRAITEMENT C	:	87.7
TRAITEMENT P	:	64.3
TRAITEMENT Ps	:	67.5
TRAITEMENT F	:	71.9
TRAITEMENT Fs	:	84.9
MOYENNE GENERALE	:	72.6

ANNEX 4

GH ES 03

Vegetative growth

R.P. CIRAD-IRHO 18-04-07

ESSAI :GH ES 03
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
DATE DE MESURE :03-07 (M 36)

collar girth (cm)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	1245.92	23	54.17			
TRAITEMENTS	244.49	3	81.50	1.54	5.42	3.29
BLOCS	206.06	5	41.21	0.78	4.56	2.90
ERREUR	795.37	15	53.02			

COEFFICIENT DE VARIATION : 3.3 %

MOYENNES

TRAITEMENT M : 224.7
TRAITEMENT F : 223.3
TRAITEMENT S : 216.3
TRAITEMENT S+ : 222.1

MOYENNE GENERALE : 221.6

ANNEX 5

GH ES 03

Leaf analysis

US49 - ANALYSES

Demande: **08002** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**

Objet: **GH ES 03** Date DF: **11/2007** Rang: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Traitment	Sols	Bloc	Parcelle	N %	P %	K %	Ca %	Mg %	Cl %	Na %	B ppm
08-CP-00038	F	TO	1	1	3.050	0.173	0.862	0.989	0.299	0.280	0.007	17.6
08-CP-00039	S+	TO	1	2	2.824	0.152	0.752	1.021	0.339	0.504	0.007	16.8
08-CP-00040	*T10*				*3.196*	*0.188*	*0.970*	*0.780*	*0.323*	*0.665*	*0.012*	*16.4*
08-CP-00041	M	TO	1	3	3.091	0.166	0.838	0.928	0.275	0.513	0.006	14.3
08-CP-00042	S	TO	1	4	3.130	0.168	0.855	0.864	0.315	0.246	0.006	18.0
08-CP-00043	F	TO	2	5	3.135	0.175	0.806	1.096	0.297	0.238	0.006	20.5
08-CP-00044	M	TO	2	6	3.144	0.171	0.801	0.864	0.329	0.582	0.007	13.8
08-CP-00045	S	TO	2	7	3.127	0.162	0.908	0.794	0.311	0.342	0.007	15.1
08-CP-00046	S+	TO	2	8	3.023	0.158	0.706	0.812	0.336	0.526	0.008	11.5
08-CP-00047	S+	TO	3	9	3.133	0.165	0.680	0.969	0.345	0.497	0.007	15.1
08-CP-00048	F	TO	3	10	3.106	0.169	0.689	1.135	0.344	0.222	0.006	18.9
08-CP-00049	M	TK	3	11	3.168	0.168	0.772	1.015	0.282	0.536	0.006	14.2
08-CP-00050	S	TO	3	12	3.131	0.164	0.837	0.851	0.299	0.233	0.005	16.7
08-CP-00051	F	TO	4	13	3.009	0.168	0.888	**1.027**	0.254	0.202	0.006	17.8
08-CP-00052	S+	TO	4	14	3.110	0.170	**0.782**	0.892	0.290	0.483	0.007	16.7
08-CP-00053	S	TO	4	15	2.966	0.159	0.838	0.924	0.281	0.233	0.006	15.5
08-CP-00054	M	TO	4	16	3.149	0.165	0.784	0.948	0.318	0.487	0.007	13.1
08-CP-00055	S+	TO	5	17	2.989	0.161	0.739	0.912	0.321	0.507	0.007	14.3
08-CP-00056	F	TO	5	18	3.049	0.167	0.687	1.068	0.314	0.236	0.006	19.1
08-CP-00057	M	TO	5	19	2.961	0.163	0.729	0.877	0.304	0.466	0.007	12.8

Résultats exprimés par rapport à la matière sèche

US49 - ANALYSES

Demande: **08002** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**

Objet: **GH ES 03** Date DF: **11/2007** Rang: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Traitment	Sols	Bloc	Parcelle	N %	P %	K %	Ca %	Mg %	Cl %	Na %	B ppm
08-CP-00058	S	TO	5	20	2.935	0.149	0.750	1.001	**0.350**	0.405	0.008	10.3
08-CP-00059	S	TK	6	21	2.900	0.158	**0.787**	1.000	**0.260**	**0.214**	0.006	15.1
08-CP-00060	*T10*				*3.215*	*0.189*	*0.996*	*0.785*	*0.324*	*0.671*	*0.017*	*16.3*
08-CP-00061	M	TO	6	22	2.911	0.159	**0.702**	0.848	0.313	**0.506**	0.008	16.2
08-CP-00062	S+	TO	6	23	2.948	0.159	0.742	0.927	0.337	0.558	0.008	14.7
08-CP-00063	F	TO	6	24	3.031	0.171	0.820	1.037	0.269	0.220	0.006	19.6

Résultats exprimés par rapport à la matière sèche

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : N

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
3.02	3.11	3.13	3.06	2.98	2.95	3.04	2.6

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.129)	% S
0. S+	3.00	99.109
1. S	3.03	100.000
2. M	3.07	101.292
3. F	3.06	101.050

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.2106280			
BLOCS	5	0.1030805	0.0206161	3.41 *	0.0296
TRAITEMENTS	3	0.0167543	0.0055848	0.92	0.4537
ERREUR	15	0.0907932	0.0060529		

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : P

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.165	.167	.167	.166	.160	.162	.164	3.1

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.008)	% S
0. S+	.161	100.521
1. S	.160	100.000
2. M	.165	103.333
3. F	.171	106.563

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.0009533			
BLOCS	5	0.0001448	0.0000290	1.12	0.3926
TRAITEMENTS	3	0.0004197	0.0001399	5.40 *	0.0101
ERREUR	15	0.0003888	0.0000259		

Test Duncan 5%

F	a
M	ab
S+	b
S	b

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : K

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
0.827	0.805	0.745	0.823	0.726	0.763	0.781	6.1

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.079)	% S
0. S+	0.734	88.462
1. S	0.829	100.000
2. M	0.771	92.985
3. F	0.792	95.518

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.0990758			
BLOCS	5	0.0364278	0.0072856	3.23 *	0.0356
TRAITEMENTS	3	0.0287795	0.0095932	4.25 *	0.0232
ERREUR	15	0.0338685	0.0022579		

Test Duncan 5%

S	a
F	ab
M	ab
S+	b

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : CA

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.951	.892	.993	.948	.965	.953	.950	7.3

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.115)	% S
0. S+	.922	101.822
1. S	.906	100.000
2. M	.913	100.847
3. F	1.06	116.894

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.1894190			
BLOCS	5	0.0218122	0.0043624	0.91	0.5029
TRAITEMENTS	3	0.0953581	0.0317860	6.60 **	0.0046
ERREUR	15	0.0722486	0.0048166		

Test Duncan 5%

F	a
S+	b
M	b
S	b

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : MG

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.307	.318	.318	.286	.322	.295	.308	8.3

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.043)	% S
0. S+	.328	108.370
1. S	.303	100.000
2. M	.304	100.275
3. F	.296	97.852

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.0176978			
BLOCS	5	0.0042758	0.0008552	1.30	0.3169
TRAITEMENTS	3	0.0035282	0.0011761	1.78	0.1935
ERREUR	15	0.0098938	0.0006596		

EXPERIENCE GOPDC GH-ES 03

ANALYSE DF 11/07 Variable : NA

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.007	.007	.006	.007	.007	.007	.007	10.2

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.001)	% S
0. S+	.007	115.789
1. S	.006	100.000
2. M	.007	107.895
3. F	.006	97.368

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.0000153			
BLOCS	5	0.0000033	0.0000007	1.43	0.2704
TRAITEMENTS	3	0.0000050	0.0000017	3.57 *	0.0396
ERREUR	15	0.0000070	0.0000005		

Test Duncan 5%

S+	a
M	ab
S	b
F	b

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : CL

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
.386	.422	.372	.351	.404	.375	.385	12.0

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 0.077)	% S
0. S+	.513	183.802
1. S	.279	100.000
2. M	.515	184.698
3. F	.233	83.562

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	0.4497393			
BLOCS	5	0.0125198	0.0025040	1.17	0.3676
TRAITEMENTS	3	0.4051890	0.1350630	63.25 ***	<.0001
ERREUR	15	0.0320305	0.0021354		

Test Duncan 5%

M	a
S+	a
S	b
F	b

EXPERIENCE GOPDC GH-ES 03
ANALYSE DF 11/07 Variable : B

MOYENNE REP_1	MOYENNE REP_2	MOYENNE REP_3	MOYENNE REP_4	MOYENNE REP_5	MOYENNE REP_6	MOYENNE GENERALE	CV (%)
16.7	15.2	16.2	15.8	14.1	16.4	15.7	11.4

MOYENNES PAR TRAITEMENT

TRAITEMENTS	MOYENNES (ds tukey= 2.994)	% S
0. S+	14.9	98.236
1. S	15.1	100.000
2. M	14.1	93.054
3. F	18.9	125.138

ANALYSE DE LA VARIANCE

SOURCE DE VARIATION	D.D.L.	SOMME DES CARRES	CARRE MOYEN	F CALCULE	PROBABILITE DE F
TOTALE	23	150.6562500			
BLOCS	5	17.6787500	3.5357500	1.09	0.4043
TRAITEMENTS	3	84.4312500	28.1437500	8.70 **	0.0014
ERREUR	15	48.5462500	3.2364167		

Test Duncan 5%

F	a
S	b
S+	b
M	b

			S Sulpomag	M KCl	F Flanamat	S+ Sulpomag + NaCl	Prob. de F
N	11/06	17	2.94 b	2.92 b	3.03 a	2.90 b	.030
N	11/07	17	3.03	3.07	3.06	3.00	.454
P	11/06	17	.167 b	.168 b	.176 a	.167 b	.001
P	11/07	17	.160 b	.165 ab	.171 a	.161 b	.010
K	11/06	17	.892	.838	.902	.813	.089
K	11/07	17	.829 a	.771 ab	.792 ab	.734 b	.023
Ca	11/06	17	.895 b	1.01 a	1.03 a	.955 ab	.009
Ca	11/07	17	.906 b	.913 b	1.06 a	.922 b	.005
Mg	11/06	17	.334	.323	.313	.359	.055
Mg	11/07	17	.303	.304	.296	.328	.194
Na	11/06	17	.011	.011	.011	.012	.646
Na	11/07	17	.006 b	.007 ab	.006 b	.007 a	.040
Cl	11/06	17	.397 b	.725 a	.385 b	.719 a	.000
Cl	11/07	17	.279 b	.515 a	.233 b	.513 a	.000
B	11/06	17	12.9 b	12.0 c	15.6 a	12.6 bc	.000
B	11/07	17	15.1 b	14.1 b	18.9 a	14.9 b	.001

ANNEX 6

GH ES 03

Production

NBT
YOP3

ESSAI :GH ES 03
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :NOMBRE DE REGIMES PAR ARBRE
DATE DE MESURE :01-07 A 03-07 (3eme ANNEE)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	51.01	23	2.22			
TRAITEMENTS	17.83	3	5.94	5.25*	5.42	3.29
BLOCS	16.18	5	3.24	2.86	4.56	2.90
ERREUR	16.99	15	1.13			

COEFFICIENT DE VARIATION : 14.6 %

MOYENNES

TRAITEMENT M : 7.3
TRAITEMENT F : 8.6
TRAITEMENT S : 6.3
TRAITEMENT S+ : 6.9

MOYENNE GENERALE : 7.3

P.P.D.S. TRAITEMENT

P.P.D.S. 5% : 1.3

CLASSEMENT ET TEST DE DUNCAN A 5%

TRAITEMENT F a : 8.6 DIFFERENT DE S+
TRAITEMENT M ab : 7.3
TRAITEMENT S+ b : 6.9
TRAITEMENT S b : 6.3

AWB (kg)

YOP 3

ESSAI :GH ES 03
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS MOYEN DE REGIME (kg)
DATE DE MESURE :01-07 A 03-07 (3eme ANNEE)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	1.16	23	0.05			
TRAITEMENTS	0.15	3	0.05	1.23	5.42	3.29
BLOCS	0.41	5	0.08	2.01	4.56	2.90
ERREUR	0.61	15	0.04			

COEFFICIENT DE VARIATION : 7.8 %

MOYENNES

TRAITEMENT M : 2.6
TRAITEMENT F : 2.6
TRAITEMENT S : 2.4
TRAITEMENT S+ : 2.6

MOYENNE GENERALE : 2.6

WBT (kg)
Yop 3

ESSAI :GH ES 03
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :POIDS TOTAL DE REGIMES PAR ARBRE (kg)
DATE DE MESURE :01-07 A 03-07 (3eme ANNEE)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	501.14	23	21.79			
TRAITEMENTS	173.07	3	57.69	5.72**	5.42	3.29
BLOCS	176.79	5	35.36	3.51*	4.56	2.90
ERREUR	151.28	15	10.09			

COEFFICIENT DE VARIATION : 16.9 %

MOYENNES

TRAITEMENT M : 19.1
TRAITEMENT F : 22.8
TRAITEMENT S : 15.2
TRAITEMENT S+ : 18.2

MOYENNE GENERALE : 18.8

BLOC 1: 24.2
BLOC 2: 16.1
BLOC 3: 20.1
BLOC 4: 18.0
BLOC 5: 16.5
BLOC 6: 18.1

P.P.D.S. TRAITEMENT

P.P.D.S. 5% : 3.9
P.P.D.S. 1% : 5.4

CLASSEMENT ET TEST DE DUNCAN A 5%

TRAITEMENT F a : 22.8 DIFFERENT DE S+
TRAITEMENT M ab : 19.1
TRAITEMENT S+ b : 18.2
TRAITEMENT S b : 15.2

ANNEX 7

GH ES 04

Vegetative growth

R.P. CIRAD-IRHO INDONESIE 18-07-07

ESSAI :GH ES 04
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
DATE DE MESURE :05-07 (M 1)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	64.36	23	2.80			
TRAITEMENTS	1.18	3	0.39	0.66	5.42	3.29
BLOCS	54.21	5	10.84	18.14**	4.56	2.90
ERREUR	8.97	15	0.60			

COEFFICIENT DE VARIATION : 4.2 %

MOYENNES

TRAITEMENT A : 18.0
TRAITEMENT B : 18.4
TRAITEMENT C : 18.7
TRAITEMENT D : 18.5

MOYENNE GENERALE : 18.4

BLOC 1: 20.5
BLOC 2: 20.0
BLOC 3: 18.9
BLOC 4: 17.3
BLOC 5: 16.6
BLOC 6: 17.0

R.P. CIRAD-IRHO INDONESIE 23-11-07

ESSAI :GH ES 04
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :CIRCONFRENCE AU COLLET (cm)
DATE DE MESURE :10-07 (M 6)

collar girth (cm)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	190.65	23	8.29			
TRAITEMENTS	10.69	3	3.56	1.42	5.42	3.29
BLOCS	142.44	5	28.49	11.39**	4.56	2.90
ERREUR	37.52	15	2.50			

COEFFICIENT DE VARIATION : 4.5 %

MOYENNES

TRAITEMENT A : 34.5
TRAITEMENT B : 35.1
TRAITEMENT C : 34.6
TRAITEMENT D : 36.2

MOYENNE GENERALE : 35.1

BLOC 1: 37.3
BLOC 2: 38.3
BLOC 3: 35.3
BLOC 4: 35.3
BLOC 5: 30.8
BLOC 6: 33.7

R.P. CIRAD-IRHO INDONESIE 18-07-07

ESSAI :GH ES 04
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :HAUTEUR DU PLANT (cm)
DATE DE MESURE :05-07 (M 1)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	10095.82	23	438.95			
TRAITEMENTS	240.98	3	80.33	0.94	5.42	3.29
BLOCS	8575.89	5	1715.18	20.12**	4.56	2.90
ERREUR	1278.94	15	85.26			

COEFFICIENT DE VARIATION : 7.2 %

MOYENNES

TRAITEMENT A : 122.3
TRAITEMENT B : 130.7
TRAITEMENT C : 129.0
TRAITEMENT D : 128.4

MOYENNE GENERALE : 127.6

BLOC 1: 151.5
BLOC 2: 151.3
BLOC 3: 132.9
BLOC 4: 113.0
BLOC 5: 103.9
BLOC 6: 113.1

R.P. CIRAD-IRHO INDONESIE 23-11-07

ESSAI :GH ES 04
DISPOSITIF STATISTIQUE:BLOCS DE FISHER SIMPLES
VARIABLE :HAUTEUR DU PLANT (cm)
DATE DE MESURE :10-07 (M 6)

weight of palm (cm)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	1960.46	23	85.24			
TRAITEMENTS	56.27	3	18.76	0.44	5.42	3.29
BLOCS	1258.45	5	251.69	5.85**	4.56	2.90
ERREUR	645.74	15	43.05			

COEFFICIENT DE VARIATION : 4.3 %

MOYENNES

TRAITEMENT A	:	150.1
TRAITEMENT B	:	152.7
TRAITEMENT C	:	149.0
TRAITEMENT D	:	152.3
MOYENNE GENERALE	:	151.0

BLOC	1:	157.3
BLOC	2:	161.1
BLOC	3:	155.0
BLOC	4:	145.8
BLOC	5:	140.4
BLOC	6:	146.7

ANNEX 8

GH CP 03

Vegetative growth

ESSAI :GH CP 03
DISPOSITIF STATISTIQUE: BLOCS SUBDIVISES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
DATE DE MESURE :05-07 (M 1)

collar girth

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	34.89	23	1.52			
TOTAL TRT.PCP.	19.87	11	1.81			
TRT.PCP.	0.37	1	0.37	0.58	16.26	6.61
BLOCS	16.24	5	3.25	4.99	10.97	5.05
ERREUR TRT.PCP.	3.26	5	0.65			
SUBDIVISIONS	0.67	1	0.67	0.55	10.04	4.96
INTERACTION	2.28	1	2.28	1.89	10.04	4.96
ERREUR SUBDIV.	12.07	10	1.21			

C.V. TRAITEMENTS PRINCIPAUX : 3.6 %
C.V. SUBDIVISIONS : 4.8 %

MOYENNE GENERALE : 22.7

MOYENNES TRAITEMENTS PRINCIPAUX

TRAITEMENT PRINCIPAL S- : 22.5
TRAITEMENT PRINCIPAL S+ : 22.8

MOYENNES SUBDIVISIONS

SUBDIVISION G- : 22.8
SUBDIVISION G+ : 22.5

ESSAI :GH CP 03
DISPOSITIF STATISTIQUE: BLOCS SUBDIVISES
VARIABLE :CIRCONFERENCE AU COLLET (cm)
DATE DE MESURE :10-07 (M 6)

collar girth (cm)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	109.96	23	4.78			
TOTAL TRT.PCP.	72.39	11	6.58			
TRT.PCP.	22.23	1	22.23	3.04	16.26	6.61
BLOCS	13.64	5	2.73	0.37	10.97	5.05
ERREUR TRT.PCP.	36.52	5	7.30			
SUBDIVISIONS	0.92	1	0.92	0.28	10.04	4.96
INTERACTION	3.30	1	3.30	0.99	10.04	4.96
ERREUR SUBDIV.	33.34	10	3.33			

C.V. TRAITEMENTS PRINCIPAUX : 7.7 %
C.V. SUBDIVISIONS : 5.2 %

MOYENNE GENERALE : 35.2

MOYENNES TRAITEMENTS PRINCIPAUX

TRAITEMENT PRINCIPAL S- : 34.2
TRAITEMENT PRINCIPAL S+ : 36.1

MOYENNES SUBDIVISIONS

SUBDIVISION G- : 35.0
SUBDIVISION G+ : 35.4

ESSAI :GH CP 03
DISPOSITIF STATISTIQUE: BLOCS SUBDIVISES
VARIABLE :HAUTEUR DU PLANT (cm)
DATE DE MESURE :05-07 (M 1)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	754.67	23	32.81			
TOTAL TRT.PCP.	296.29	11	26.94			
TRT.PCP.	0.01	1	0.01	0.00	16.26	6.61
BLOCS	279.23	5	55.85	16.38**	10.97	5.05
ERREUR TRT.PCP.	17.05	5	3.41			
SUBDIVISIONS	238.15	1	238.15	11.13**	10.04	4.96
INTERACTION	6.19	1	6.19	0.29	10.04	4.96
ERREUR SUBDIV.	214.04	10	21.40			

C.V. TRAITEMENTS PRINCIPAUX : 1.5 %
C.V. SUBDIVISIONS : 3.8 %

MOYENNE GENERALE : 123.0

BLOC 1: 117.6
BLOC 2: 124.3
BLOC 3: 119.1
BLOC 4: 125.2
BLOC 5: 125.9
BLOC 6: 126.2

MOYENNES TRAITEMENTS PRINCIPAUX

TRAITEMENT PRINCIPAL S- : 123.0
TRAITEMENT PRINCIPAL S+ : 123.0

MOYENNES SUBDIVISIONS

SUBDIVISION G- : 126.2
SUBDIVISION G+ : 119.9

P.P.D.S. SUBDIVISIONS

P.P.D.S. 5% : 4.2
P.P.D.S. 1% : 6.0

CLASSEMENT ET TEST DE DUNCAN A 5%

SUBDIVISIONS

SUBDIVISION G- a : 126.2 DIFFERENT DE G+

ESSAI :GH CP 03
DISPOSITIF STATISTIQUE: BLOCS SUBDIVISES
VARIABLE :HAUTEUR DU PLANT (cm)
DATE DE MESURE :10-07 (M 6)

height of palm (cm)

ANALYSE DE VARIANCE

SOURCE DE VARIATION	SOMMES DES CARRES	D.D.L.	VARIANCE	F.CAL.	F.THEORIQUE 1%	F.THEORIQUE 5%
TOTAL	1360.21	23	59.14			
TOTAL TRT.PCP.	1059.80	11	96.35			
TRT.PCP.	23.81	1	23.81	0.61	16.26	6.61
BLOCS	840.39	5	168.08	4.30	10.97	5.05
ERREUR TRT.PCP.	195.60	5	39.12			
SUBDIVISIONS	19.27	1	19.27	0.70	10.04	4.96
INTERACTION	4.76	1	4.76	0.17	10.04	4.96
ERREUR SUBDIV.	276.39	10	27.64			

C.V. TRAITEMENTS PRINCIPAUX : 4.2 %
C.V. SUBDIVISIONS : 3.6 %

MOYENNE GENERALE : 147.8

MOYENNES TRAITEMENTS PRINCIPAUX

TRAITEMENT PRINCIPAL S- : 146.8
TRAITEMENT PRINCIPAL S+ : 148.8

MOYENNES SUBDIVISIONS

SUBDIVISION G- : 148.7
SUBDIVISION G+ : 146.9

ANNEX 9

Kwae Nucleus

Leaf analysis

Demande: **08004** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Nucleus Estate**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Bloc pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00088	A14	TK	1	13-14	17	85	2,701	0,161	0,759	0,605	0,250	0,638	8,9
08-CP-00089	AS12	T	2	7-8	17	85	2,742	0,162	0,723	0,615	0,281	0,606	8,9
08-CP-00090	AS15	TK	3	5-6	17	85	2,978	0,169	0,974	0,645	0,265	0,610	13,6
08-CP-00091	AS13	NB	4	37-38	17	85	2,920	0,169	**0,966**	**0,683**	0,238	0,547	13,5
08-CP-00092	AS10	NB	5	13-14	17	85	3,046	0,171	0,908	0,547	0,278	0,559	13,2
08-CP-00093	LMC051CL	TK	6	13-14	17	88	2,507	0,153	0,627	0,761	**0,254**	0,599	**8,1**
08-CP-00094	TC74CL	TK	7	46-47	17	90	2,741	0,163	**0,746**	0,701	0,371	0,699	8,4
08-CP-00095	AS11-12	OD	8	33-34	17	99	2,824	0,162	0,621	0,855	0,370	0,458	8,5
08-CP-00096	AS16	OD	9	27-28	17	00	2,732	0,158	0,486	0,707	0,342	0,577	7,6

Résultats exprimés par rapport à la matière sèche

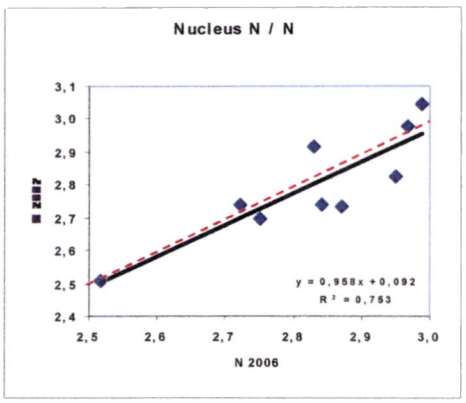
Demande: **08005** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Nucleus Extension**

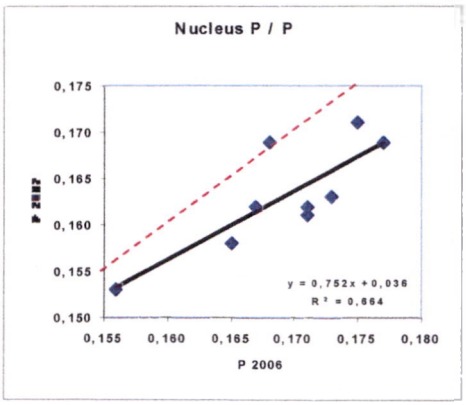
Objet: **IND** Date: **11/2007** Rangs: **9/17** Calcination: **Double**

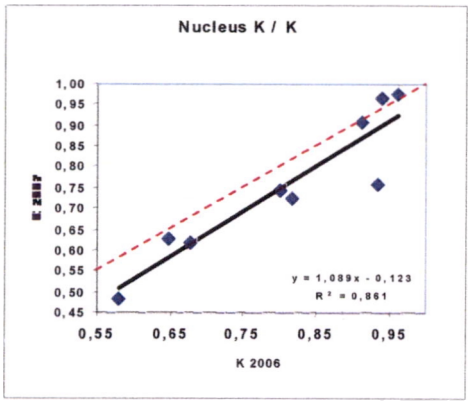
CIRAD-PERSYST/UPR34

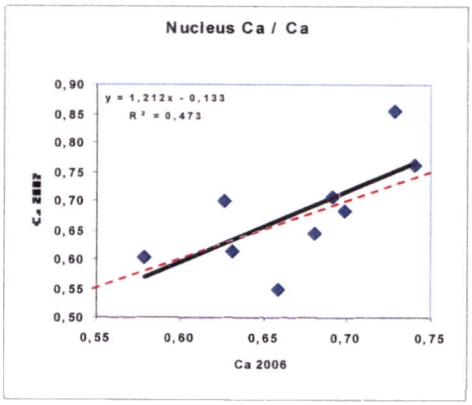
No Labo	Blec. pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00097	B3	NB	1	17-18	9	04	3,075	0,186	1,105	0,875	0,276	0,309	12,8
08-CP-00098	B7	TO	2	13-14-15	17	04	3,063	0,176	0,730	1,081	0,289	0,572	12,4
08-CP-00099	C2	NB	3	6-7-8-9	17	04	**3,074**	0,174	0,774	1,126	0,338	0,492	12,5
08-CP-00100	*T10*						*3,211*	*0,189*	*0,978*	*0,783*	*0,324*	*0,665*	*16,2*
08-CP-00101	D2	NB	4	5-6-7	9	05	2,986	0,181	1,056	0,948	0,266	0,837	11,2
08-CP-00102	C9	NB	5	9-10-11	9	05	3,190	0,181	**1,124**	0,757	**0,289**	0,735	10,1
08-CP-00103	C6	TK	6	25-26-27	9	05	3,092	0,183	1,034	0,713	0,266	0,572	11,9

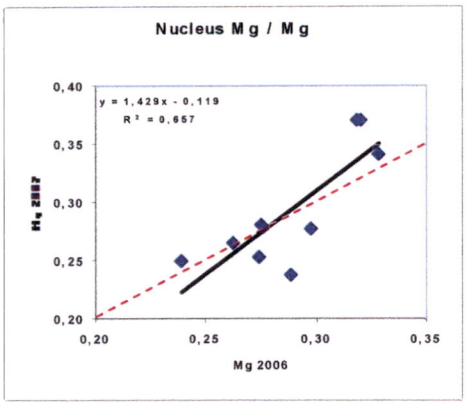
Résultats exprimés par rapport à la matière sèche

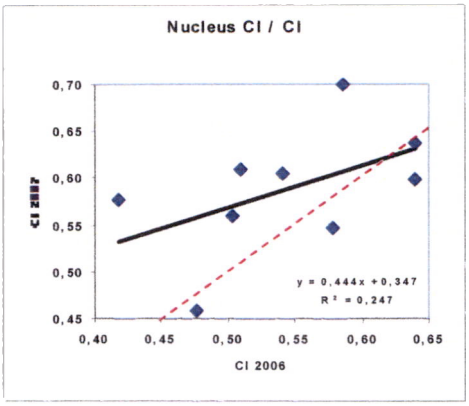

Nucleus N / N
3,1
3,0
2,9
2,8
2,7
2,6
2,5
2,4
2,5
2,6
2,7
2,8
2,9
3,0
N 2006
y = 0,958x + 0,092
R² = 0,753

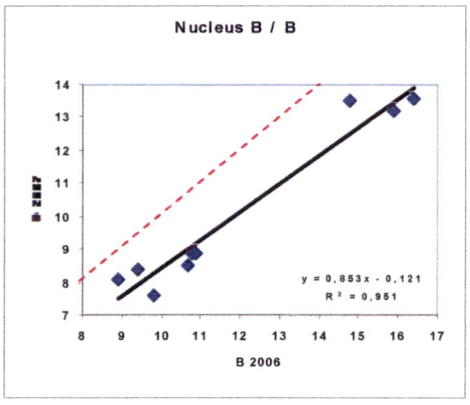

Nucleus P / P
0,175
0,170
0,165
0,160
0,155
0,150
0,155
0,160
0,165
0,170
0,175
0,180
P 2006
y = 0,752x + 0,036
R² = 0,664

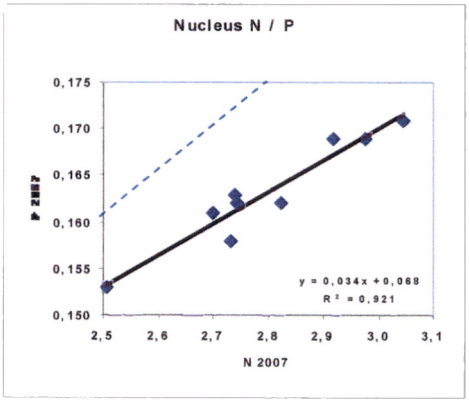

Nucleus K / K
1,00
0,95
0,90
0,85
0,80
0,75
0,70
0,65
0,60
0,55
0,50
0,45
0,55
0,65
0,75
0,85
0,95
K 2006
y = 1,089x - 0,123
R² = 0,861


Nucleus Ca / Ca
0,90
0,85
0,80
0,75
0,70
0,65
0,60
0,55
0,50
0,55
0,60
0,65
0,70
0,75
Ca 2006
y = 1,212x - 0,133
R² = 0,473


Nucleus Mg / Mg
y = 1,429x - 0,119
R² = 0,657
0,40
0,35
0,30
0,25
0,20
0,20
0,25
0,30
0,35
Mg 2007
Mg 2006


Nucleus Cl / Cl
0,70
0,65
0,60
0,55
0,50
0,45
0,40
0,45
0,50
0,55
0,60
0,65
Cl 2007
y = 0,444x + 0,347
R² = 0,247
Cl 2006


Nucleus B / B
14
13
12
11
10
9
8
7
8
9
10
11
12
13
14
15
16
17
B 2007
y = 0,853x - 0,121
R² = 0,951
B 2006


Nucleus N / P
0,175
0,170
0,165
0,160
0,155
0,150
2,5
2,6
2,7
2,8
2,9
3,0
3,1
P 2007
y = 0,034x + 0,068
R² = 0,921
N 2007

ANNEX 10

Kwae Outgrowers

Leaf analysis

CIRAD - PERSYST
US49 - ANALYSES

Dossier : 08V007 27/02/2008

Demande: **08007** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Outgrowers**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Blx pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00106	AS060	T	1	10-11	17	87	2,220	0,131	0,726	0,605	0,395	0,491	11,0
08-CP-00107	AF021	T	2	6-7	17	87	2,474	0,147	0,627	0,774	0,300	0,594	11,8
08-CP-00108	NA016	TK	3	10-11	17	87	2,373	0,143	0,702	0,648	0,355	0,584	10,5
08-CP-00109	NA003	T	4	7-8	17	87	2,362	0,151	0,672	0,801	0,447	0,654	13,9
08-CP-00110	NA029	T	5	6-7	17	88	2,401	0,148	0,684	0,639	0,297	0,590	9,5
08-CP-00111	KA003	T	6	7-8	17	88	2,317	0,150	0,773	0,692	0,349	0,719	9,8
08-CP-00112	OT001	T	7	3-4	17	88	2,620	0,155	0,724	0,735	0,310	0,668	9,6
08-CP-00113	NA014	T	8	11-12	17	88	2,548	0,157	0,727	0,704	0,304	0,631	8,9
08-CP-00114	AF016	T	9	5-6	17	89	2,046	0,127	0,648	0,749	0,360	0,528	12,8
08-CP-00115	AS033	T	10	3-4	17	89	2,251	0,128	0,680	0,710	0,356	0,557	11,9
08-CP-00116	AK001	T	11	7-8	17	89	2,188	0,134	0,622	0,659	0,402	0,540	**7,5**
08-CP-00117	OT009	T	12	10-11	17	89	2,467	0,143	0,646	0,709	0,403	0,595	8,5
08-CP-00118	AS035	T	13	3-4	17	90	2,274	0,140	0,624	0,713	0,341	0,465	10,0
08-CP-00119	AS091	T	14	8-9	17	90	2,371	0,138	0,670	0,687	0,350	0,630	8,5
08-CP-00120	*T10*						*3,190*	*0,187*	*0,968*	*0,779*	*0,324*	*0,668*	*16,0*
08-CP-00121	KA006	T	15	3-4	17	90	2,439	0,151	0,842	0,698	0,315	0,652	8,8
08-CP-00122	NA026	T	16	10-11	17	90	2,227	0,144	0,654	0,698	0,413	0,676	9,7
08-CP-00123	AF001	T	17	3-4	17	91	2,438	0,143	0,471	**0,731**	0,443	0,499	9,1

Résultats exprimés par rapport à la matière sèche

Demande: **08007** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Outgrowers**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Bloc pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00124	NA057	T	18	5-6	17	91	2,507	0,143	0,688	0,727	0,340	0,601	10,9
08-CP-00125	AK015	T	19	3-4	17	91	2,508	0,145	0,543	0,774	0,364	0,539	9,6
08-CP-00126	NK009	TK	20	10-11	17	91	2,560	0,145	0,731	0,800	0,358	0,512	13,8
08-CP-00127	AS029	T	21	6-7	17	92	2,456	0,146	0,647	0,657	0,414	0,468	8,0
08-CP-00128	AK013	T	22	6-7-8	17	92	2,560	0,154	0,547	0,662	0,367	0,463	**8,3**
08-CP-00129	AS002	T	23	10-11	17	92	2,398	0,145	0,620	0,703	0,418	0,641	9,3
08-CP-00130	OT015	T	24	10-11	17	92	2,347	0,139	0,564	0,740	0,389	0,713	9,4
08-CP-00131	OF015	T	25	6-7	17	93	**2,432**	0,164	0,548	0,758	0,503	0,616	9,9
08-CP-00132	NT012	T	26	14-15	17	93	2,357	0,143	0,767	0,796	0,305	0,729	9,8
08-CP-00133	AO013	T	27	3-4	17	93	2,271	0,142	0,577	0,687	0,421	0,528	8,1
08-CP-00134	AO140	T	28	8-9	17	93	2,525	0,151	0,778	0,675	0,323	0,523	11,5
08-CP-00135	OF038	T	29	5-6	17	94	2,531	0,148	0,660	0,800	0,336	0,611	9,4
08-CP-00136	NT075	T	30	8-9	17	94	2,432	0,147	0,672	0,780	0,370	0,624	13,7
08-CP-00137	AO074	T	31	4-5	17	94	2,288	0,127	0,706	0,704	0,309	0,464	8,9
08-CP-00138	AO112	T	32	10-11	17	94	2,459	0,153	0,862	0,743	0,272	0,629	9,1
08-CP-00139	OF091	T	33	3-4	17	95	2,358	0,149	0,887	0,740	0,300	0,828	9,9
08-CP-00140	*T10*						*3,165*	*0,193*	*0,944*	*0,766*	*0,327*	*0,668*	*16,2*
08-CP-00141	NT096	T	34	6-7	17	95	2,554	0,157	0,611	0,882	0,358	0,718	9,7

Résultats exprimés par rapport à la matière sèche

Demande: **08007** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Outgrowers**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Bloc pilote	Sol	; LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00142	AO012	T	35	5-6	17	95	2,683	0,156	0,753	0,810	0,310	0,561	10,1
08-CP-00143	AO058	T	36	5-6	17	95	2,728	0,150	0,952	0,691	0,276	0,623	13,6
08-CP-00144	AS030	T	37	5-6	17	96	2,237	0,142	0,654	0,705	0,383	0,605	9,4
08-CP-00145	AK021	T	38	6-7	17	96	2,731	0,160	0,890	0,660	0,326	0,580	13,2
08-CP-00146	KA022	T	39	10-11	17	96	2,551	0,157	0,880	0,727	0,282	0,318	14,0
08-CP-00147	AO007	T	40	3-4	17	96	2,405	0,148	0,869	0,667	0,335	0,613	10,6
08-CP-00148	AK007	TK	41	6-7	17	97	2,591	0,163	1,079	**0,864**	0,286	0,294	14,3
08-CP-00149	NA098	T	42	8-9	17	97	2,503	0,154	0,866	0,738	0,402	0,621	12,7
08-CP-00150	NA041	T	43	5-6	17	97	2,549	0,151	0,803	0,747	0,325	0,466	11,4
08-CP-00151	OT001	T	44	10-11	17	97	2,498	0,156	0,678	0,959	0,338	0,623	12,2
08-CP-00152	NA015	T	45	5-6	17	98	2,296	0,150	0,668	0,949	0,333	0,686	9,5
08-CP-00153	AS020	T	46	5-6	17	98	2,454	0,145	0,549	0,835	0,350	0,381	10,7
08-CP-00154	AO071	T	47	3-4	17	98	2,673	0,155	0,715	0,873	0,372	0,394	15,4
08-CP-00155	OF022	T	48	10-11	17	98	2,508	0,142	0,646	0,924	0,310	0,739	13,7
08-CP-00156	NA014	T	49	7-8-9	17	99	2,717	0,166	**1,084**	**0,854**	0,287	0,259	17,5
08-CP-00157	KA001	T	50	10-11	17	99	2,643	0,159	0,575	0,838	0,330	0,568	13,0
08-CP-00158	OF033	T	51	5-6	17	99	2,567	0,156	0,633	0,973	0,390	0,443	9,1
08-CP-00159	NT009	T	52	4-5	17	99	2,570	0,158	0,938	0,835	0,285	0,349	15,4

Résultats exprimés par rapport à la matière sèche

US49 - ANALYSES

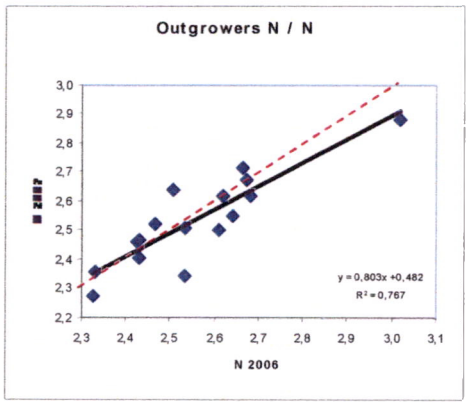
Demande: **08007** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Outgrowers**

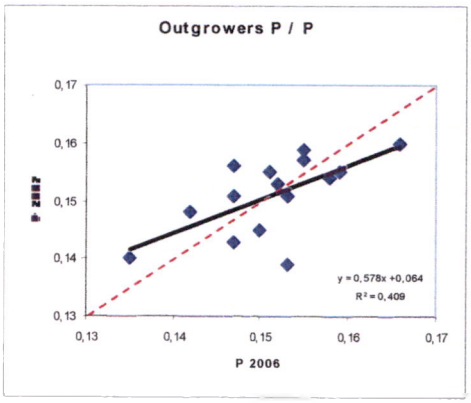
Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

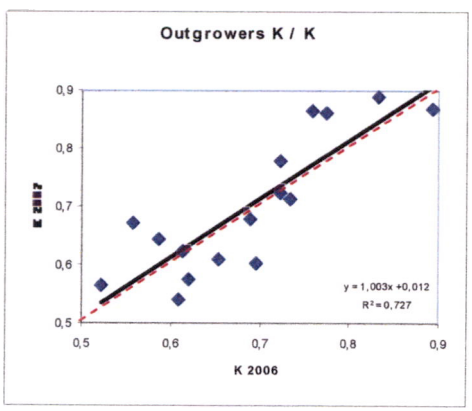
CIRAD-PERSYST/UPR34

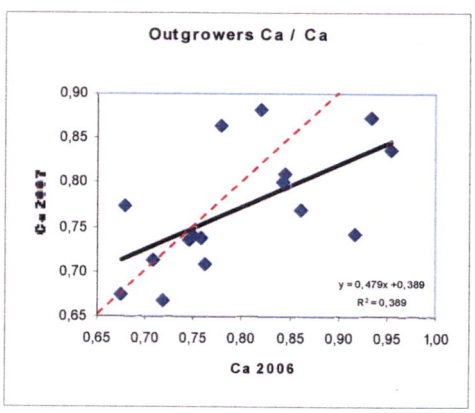
No Labo	Bloc pilote	Sol			Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00160	*T10*						*3,195*	*0,191*	*0,960*	*0,775*	*0,325*	*0,666*	*16,7*
08-CP-00161	AO043	T	53	4-5	17	00	2,619	0,151	0,604	0,864	0,342	0,414	15,6
08-CP-00162	AF019	T	54	6-7	17	00	2,591	0,152	0,684	0,811	0,308	0,540	13,3
08-CP-00163	AS041	T	55	4-5	17	00	2,745	0,151	0,680	0,845	0,337	0,334	20,4
08-CP-00164	AS044	T	56	4-5	17	00	2,758	0,157	0,802	0,865	0,322	0,301	21,9
08-CP-00165	NT009	T	57	7-8	17	02	2,871	0,159	0,836	0,826	0,327	0,493	17,0
08-CP-00166	AS017	T	58	7-8	17	02	2,744	0,161	**1,024**	**0,948**	0,331	0,287	19,4
08-CP-00167	OF004	T	59	7-8	17	02	2,727	0,162	0,671	1,067	0,354	0,466	22,1
08-CP-00168	AO034	T	60	4-5	17	02	2,719	0,156	0,889	0,769	0,362	0,298	12,0
08-CP-00169	AS013	T	61	5-6	17	03	2,772	0,173	0,891	0,500	0,395	0,490	10,9
08-CP-00170	AS010	T	62	6-7	17	03	2,886	0,160	0,680	0,809	0,384	0,457	11,7
08-CP-00171	AK004	T	63	4-5	17	03	2,958	0,172	0,900	0,803	0,312	0,195	15,6
08-CP-00172	KA003	T	64	6-7	17	03	2,976	0,178	0,878	0,662	0,388	0,431	11,4

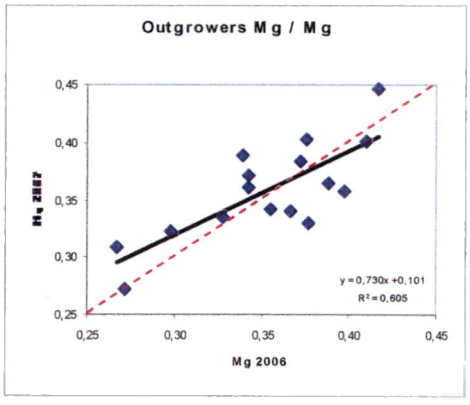
Résultats exprimés par rapport à la matière sèche

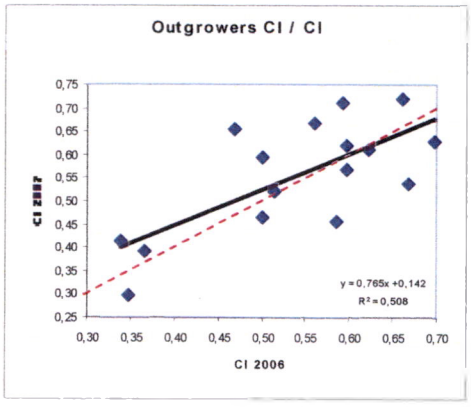

Outgrowers N / N
N 2007
N 2006
y = 0,803x +0,482
R² = 0,767
3,0
2,9
2,8
2,7
2,6
2,5
2,4
2,3
2,2
2,3
2,4
2,5
2,6
2,7
2,8
2,9
3,0
3,1

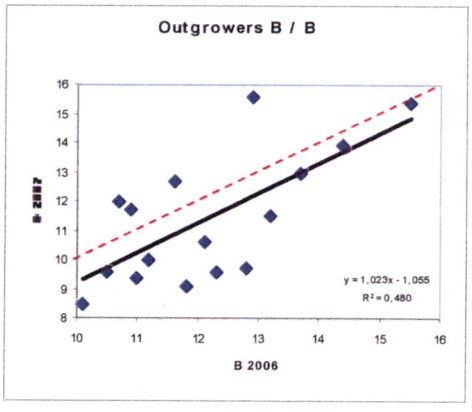

Outgrowers P / P
P 2007
P 2006
y = 0,578x +0,064
R² = 0,409
0,17
0,16
0,15
0,14
0,13
0,13
0,14
0,15
0,16
0,17

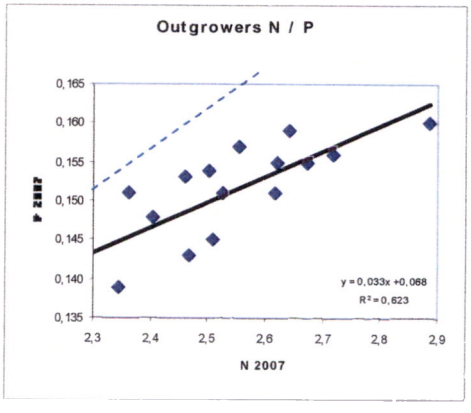

Outgrowers K / K
K 2007
K 2006
y = 1,003x +0,012
R² = 0,727
0,9
0,8
0,7
0,6
0,5
0,5
0,6
0,7
0,8
0,9


Outgrowers Ca / Ca
Ca 2007
Ca 2006
y = 0,479x +0,389
R² = 0,389
0,90
0,85
0,80
0,75
0,70
0,65
0,65
0,70
0,75
0,80
0,85
0,90
0,95
1,00


Outgrowers Mg / Mg
0,45
0,40
0,35
0,30
0,25
0,25
0,30
0,35
0,40
0,45
Mg 2006
y = 0,730x +0,101
R² = 0,605


Outgrowers Cl / Cl
0,75
0,70
0,65
0,60
0,55
0,50
0,45
0,40
0,35
0,30
0,25
0,30
0,35
0,40
0,45
0,50
0,55
0,60
0,65
0,70
Cl 2006
y = 0,765x +0,142
R² = 0,508


Outgrowers B / B
16
15
14
13
12
11
10
9
8
10
11
12
13
14
15
16
B 2006
y = 1,023x - 1,055
R² = 0,480


Outgrowers N / P
0,165
0,160
0,155
0,150
0,145
0,140
0,135
2,3
2,4
2,5
2,6
2,7
2,8
2,9
N 2007
y = 0,033x +0,068
R² = 0,623

ANNEX 11

Okumaning

Leaf analysis

Demande: **08003** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**
Objet: **IND** Date: **11/2007** Rangs: **9/17** Calcination: **Double**
CIRAD-PERSYST/UPR34

No Labo	Bloc pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00064	A2	NB	1	28-29	17	02	3,284	0,184	1,130	0,761	0,318	0,459	18,7
08-CP-00065	B3	NB	2	26-27	17	02	3,198	0,177	**1,035**	**0,975**	0,256	0,290	19,7
08-CP-00066	A7	TK	3	14-15	17	02	2,907	0,160	0,835	0,935	0,298	0,347	19,0
08-CP-00067	C3	TK	4	2-3	17	02	2,755	0,154	0,678	0,794	0,387	0,448	9,2
08-CP-00068	D4	TK	5	15-16	17	02	2,774	0,150	0,583	0,871	0,391	0,541	10,6
08-CP-00069	D1	NB	6	13-14	17	02	3,205	0,174	0,976	0,920	0,319	0,329	18,5
08-CP-00070	E3	NB	7	18-19	17	02	2,777	0,153	0,687	1,131	0,368	0,397	21,7
08-CP-00071	E7	TK	8	116-117	17	02	2,994	0,161	0,721	0,979	0,314	0,466	15,2
08-CP-00072	F4	NB	9	60-61	17	02	2,974	0,162	0,735	1,098	0,355	0,362	21,4
08-CP-00073	G4	NB	10	26-27	17	03	2,878	0,168	0,945	0,867	0,328	0,365	16,6
08-CP-00074	H1	TK	11	159-160	17	03	2,636	0,144	0,555	0,854	0,449	0,434	9,0
08-CP-00075	H5	TK	12	72-73	17	03	3,057	0,162	0,886	0,898	0,303	0,378	14,4
08-CP-00076	I2	NB	13	47-48	17	03	2,734	0,145	0,668	0,978	0,424	0,262	19,5

Résultats exprimés par rapport à la matière sèche

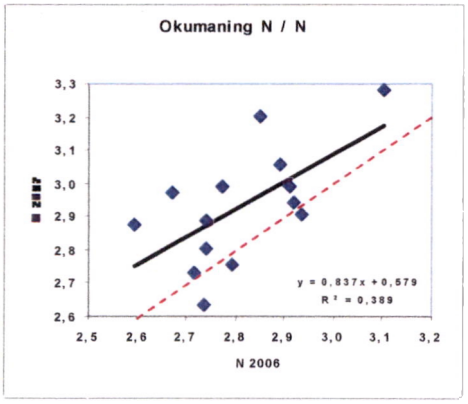
Demande: **08003** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**

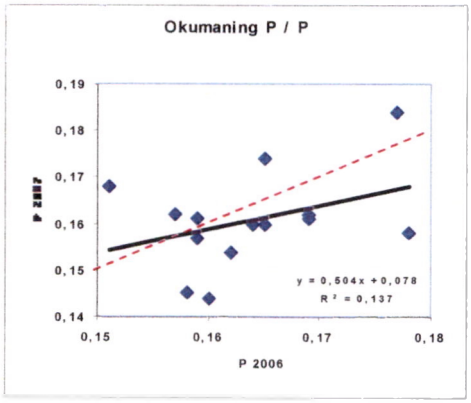
Objet: **IND** Date: **11/2007** Rangs: **9/17** Calcination: **Double**

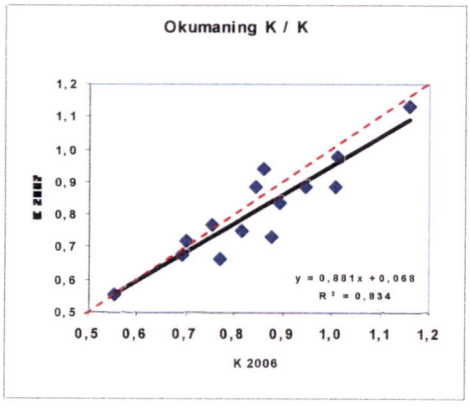
CIRAD-PERSYST/UPR34

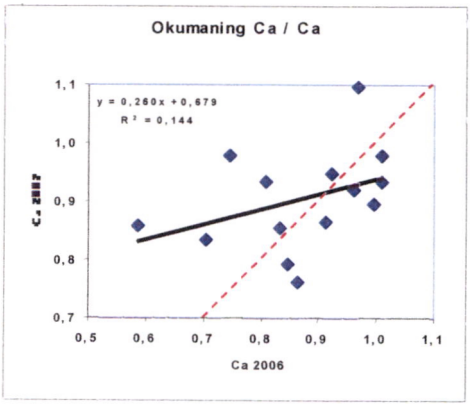
No Labo	Bloc pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00077	L5	NB	14	20-21	17	04	2,806	0,160	0,888	0,834	0,328	0,283	12,6
08-CP-00078	K2	TK	15	37-38	17	04	2,995	0,161	0,768	0,936	0,324	0,405	14,0
08-CP-00079	L2	TK	16	16-17	17	04	2,889	0,157	0,749	0,947	0,340	0,361	14,9
08-CP-00080	*T10*						*3,204*	*0,188*	*0,958*	*0,778*	*0,322*	*0,667*	*16,0*
08-CP-00081	J1	TK	17	49-50	17	04	2,876	0,151	0,591	0,947	0,412	0,456	12,5
08-CP-00082	J2	NB	18	15-16	17	04	2,945	0,158	0,887	0,859	0,322	**0,232**	14,1
08-CP-00083	M1	TK	19	12-13	9	05	2,764	0,171	0,958	0,594	0,311	0,389	8,6
08-CP-00084	M2	NB	20	51-52	9	05	3,001	0,183	1,194	0,664	0,270	0,376	10,5
08-CP-00085	L7	NB	21	36-37	9	05	3,051	0,171	0,895	0,815	0,324	0,489	10,4
08-CP-00086	L8	TK	22	63-64	9	05	2,769	0,161	0,758	0,945	0,345	0,605	9,9
08-CP-00087	L9	NB	23	132-133	9	05	3,063	0,186	1,178	0,586	0,276	0,409	10,6

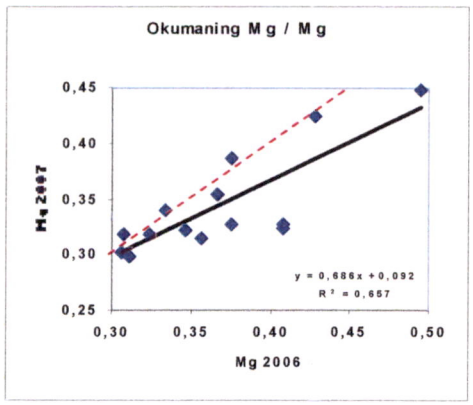
Résultats exprimés par rapport à la matière sèche

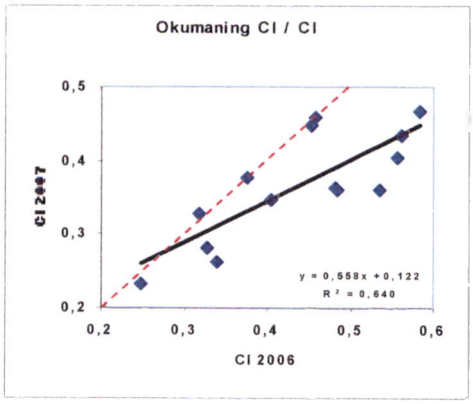

Okumaning N / N
3,3
3,2
3,1
3,0
2,9
2,8
2,7
2,6
2,5
2,6
2,7
2,8
2,9
3,0
3,1
3,2
N 2006
y = 0,837x + 0,579
R² = 0,389

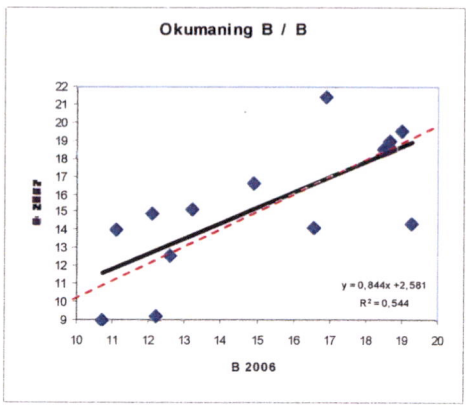

Okumaning P / P
0,19
0,18
0,17
0,16
0,15
0,14
0,15
0,16
0,17
0,18
P 2006
y = 0,504x + 0,078
R² = 0,137

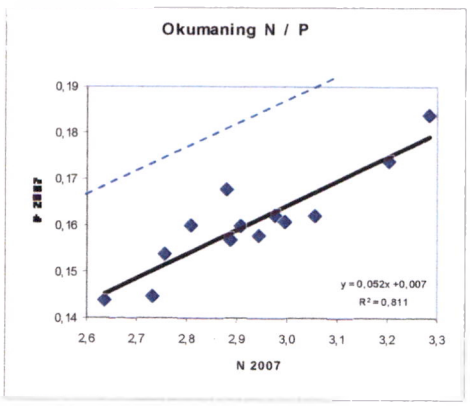

Okumaning K / K
1,2
1,1
1,0
0,9
0,8
0,7
0,6
0,5
0,5
0,6
0,7
0,8
0,9
1,0
1,1
1,2
K 2006
y = 0,881x + 0,068
R² = 0,834


Okumaning Ca / Ca
1,1
1,0
0,9
0,8
0,7
0,5
0,6
0,7
0,8
0,9
1,0
1,1
Ca 2006
y = 0,260x + 0,679
R² = 0,144


Okumaning M g / M g
0,45
0,40
0,35
0,30
0,25
Mg 2007
y = 0,686x + 0,092
R² = 0,657
0,30
0,35
0,40
0,45
0,50
Mg 2006


Okumaning Cl / Cl
0,5
0,4
0,3
0,2
Cl 2007
y = 0,558x + 0,122
R² = 0,640
0,2
0,3
0,4
0,5
0,6
Cl 2006


Okumaning B / B
22
21
20
19
18
17
16
15
14
13
12
11
10
9
B 2007
y = 0,844x +2,581
R² = 0,544
10
11
12
13
14
15
16
17
18
19
20
B 2006


Okumaning N / P
0,19
0,18
0,17
0,16
0,15
0,14
P 2007
y = 0,052x +0,007
R² = 0,811
2,6
2,7
2,8
2,9
3,0
3,1
3,2
3,3
N 2007

Demande: **08008** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Okumaning**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Localite	Sol	Code	Bloc	Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00173	D1	NB	1	Mucuna-up	17	02	3,150	0,172	0,968	0,977	0,302	0,200	18,8
08-CP-00174	D1	NB	2	Pueraria-up	17	02	2,991	0,168	0,890	1,016	0,302	0,263	22,5
08-CP-00175	D1	TK	3	Mucuna-low	17	02	3,112	0,173	0,845	0,917	0,313	0,328	22,1
08-CP-00176	C3	TK	4	Pueraria-low	17	02	2,937	0,169	0,848	0,840	0,288	0,358	16,6

Résultats exprimés par rapport à la matière sèche

ANNEX 12

Smallholders

Leaf analysis

CIRAD - PERSYST
US49 - ANALYSES

Demande: **08006** Série: **1** Pays: **Ghana** Société: **GOPDC** Plantation: **Smallhoders**

Objet: **IND** Date: **11/2007** Rangs: **17** Calcination: **Double**

CIRAD-PERSYST/UPR34

No Labo	Bloc.pilote	Sol	LSU		Rang	DP	N %	P %	K %	Ca %	Mg %	Cl %	B ppm
08-CP-00104	053	TK	1	8-9-10-11	17	98	2,729	0,154	0,728	0,809	0,326	0,357	15,7
08-CP-00105	050	TK	2	12-13-14-15	17	98	2,787	0,155	0,627	0,765	0,366	0,444	10,0

Résultats exprimés par rapport à la matière sèche