



# Cocoa and fertilizers in West-Africa

International Supply Management Congress,  
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***“Tell your bosses to bring us fertilizer.  
Our cocoa farms are old and ‘tired’ and  
no longer produce”***

A Baoulé cocoa farmer, centre-west of Côte d'Ivoire, 2011

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Côte d'Ivoire still by far holds its first rank among cocoa producing countries. It produced an all-time record in 2011/12 – albeit with the help of exceptionally good rainfall that year.

But recently, entire cocoa producing regions, such as the famous cocoa belt of Soubre, are suffering from tree mortality and a subsequent decline in yields. Some cocoa farmers have started losing faith in 'their tree', around which they and their families have built their whole lives. Rubber, the new alternative tree crop, is increasingly adopted, which is good in terms of diversification but poses a threat if it becomes a new monoculture erasing cocoa from entire regions. If nothing is done, the 'cocoa belt' of Soubre may well become the next 'rubber belt'.

Among the various measures that could reverse this trend, fertilizer production, and distribution at a reasonable price may well be the most effective and urgently needed solutions. This paper will demonstrate that, more than other solutions, the use of fertilizer by cocoa smallholders makes aging cocoa trees productive once again, boosting cocoa farmers' confidence, as well as entrepreneurship in the cocoa sector of Côte d'Ivoire. Similar results were achieved in Ghana, after implementation of policies that paved the way for the rapid adoption of fertilizers by Ghanaian cocoa producers.

Still, relatively little is known about the impact of fertilizer in cocoa farms - in both countries. How and to which extent does fertilizer affect cocoa farms? How much does it cost, and which returns on investment can be expected? Assuming correct use of fertilizers in West Africa, how much of would be needed?

To answer these questions, CIRAD, the French agriculture research organization, did an experiment from 2008 to 2011 with the NGO 'Agriculture and Life Cycle' and a major fertilizer company, YARA, and some support by MARS to CIRAD missions in Côte d'Ivoire and Ghana.

## The experiment

In 160 farm plots (100 in Côte d'Ivoire, 60 in Ghana), pairs of quadrates of 30 m x 30 m (one quadrate with fertilizer application, one without, to check) were set up. One fertilizer used was a 0-23-19-5 formula, (0% nitrogen, 23% phosphorus, 19% potassium, 5% magnesium) with an application equivalent to 440 kg/ha. In order to bring nitrogen to the tree - especially old trees that were losing foliage - we applied a second fertilizer. This nitrate of calcium (220 kg/ha) was used to support the hypothesis that bringing nitrogen to the tree will also help to fight diseases such as black pod. Both fertilizers were developed by Yara for commercial use and were sold in both countries.

In recent years, in Ghana, owing to subsidies, this amount of fertilizer represented the affordable cost in Ghana of \$125/ha. In Côte d'Ivoire, without any subsidies, the cost was \$420/ha. Nevertheless, a relative decline in world prices of fertilizers and expected increase in competition between fertilizer companies should bring down those costs to \$300/ha each year, or even less. A costly investment, but the output is spectacular.

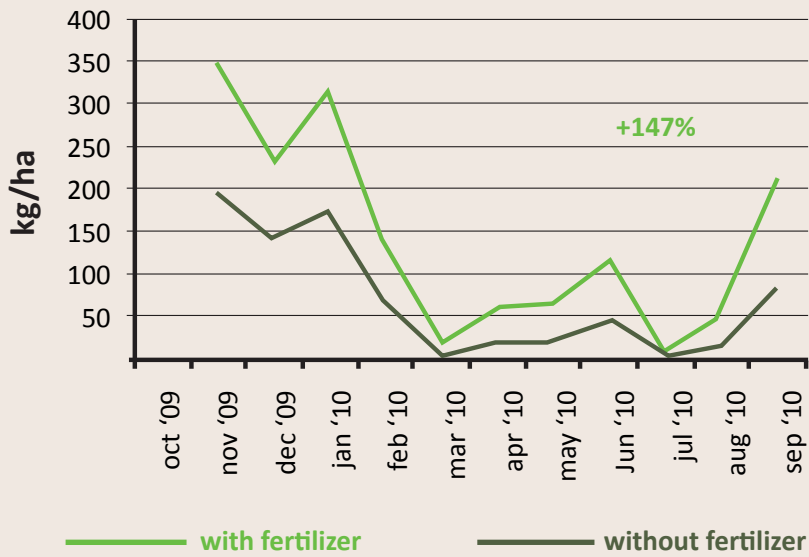
## Spectacular technical results

After one year of application, degraded trees' foliage increased. "You can no longer see the sky," farmers said. The calcium nitrate fertilizer even seemed to slow down infestation of mistletoe ('Loranthus', a vegetal parasite) and swollen shoot, another damaging virus (photos 1 and 2).

In the first year, the gain in production was around a meager 20%. After two years, **production increased** significantly in most regions (photos 3 and 4).

This was for instance the case in Duekué in West Côte d'Ivoire, where average yields were 765 kg/ha without fertilizer, but 1890 kg/ha after 2 years of fertilizer application.

## COCOA YIELD PER MONTH AND FERTILIZER IMPACT. Pinhou (Duekué, Côte d'Ivoire) 2009/10



## COCOA FARM INFESTED BY SWOLLEN SHOOT

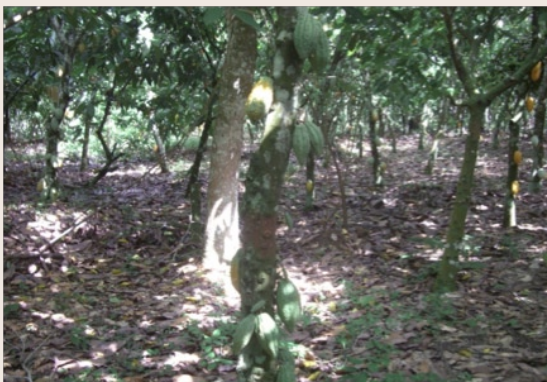


(1) Without fertilizer



(2) With fertilizer

## STANDARD COCOA FARM



(3) Without fertilizer



(2) With fertilizer

## COCOA BEANS, AFTER FLOODING OF THE PLANTATION

Fertilizer also impacts pod quality, hence bean quality and weight, the latter being one of the best criteria to measure cocoa quality in terms of conversion rate from beans to cocoa butter (photos 5 and 6). The calcium nitrate plays a specific role by reducing the rate of diseases, especially black pod.



(2) Without fertilizer



(6) With fertilizer

### Impact of fertilizer by reducing tree mortality

Last but not least, even though it is difficult to quantify; fertilizer also impacts the longer term viability of the farm by reducing the rate of tree mortality. Around Soubré, a few innovative Baoulé migrants in the mid 1980s faced early ageing of their cocoa trees and decline in yields. A high percentage of trees had started withering and dying at the age of 7-15 years, instead of at the usual age of 20-25 years. The effect of poor soils with limited suitability to cocoa was successfully combated by the early adoption of fertilizers.

### Returns on investment

In both Ghana and Côte d'Ivoire, aside the positive average impact, we must admit that there is a wide range of success rates of the use of fertilizer, varying across regions. This is partially explained by different farmers' practices: the higher the level of pesticide application and global maintenance, the better the response to fertilizer.

Other variables such as the type of cocoa, age of the tree and the level of shade also interact. It is also obvious that rainfall patterns and types of soil impact on fertilizer responses.

For instance, in Adubrim, in the new pioneer cocoa district of Nzema, fertilizer reinforced by a nice pruning and 6 rounds per year of pesticides and fungicides under a rainfall of 2500 mm per year can push yields of 10-15 years old farm plots above 4,000kg/ha.

On the other side, ageing cocoa trees north of Ashanti, on which almost no pesticides were sprayed, brought forth hardly one ton per hectare with fertilizer. These variables remain to be studied more in-depth in 2012.

Nevertheless, in Ghana, with a relatively high cocoa price paid to smallholders and subsidized fertilizer, even the lowest responses look profitable.

In Côte d'Ivoire, with heavily taxed cocoa and no fertilizer subsidy, returns on investment were too risky when the fertilizer was sold at 20,000 Fcfa per bag (400F/kg).

It may be no surprise that the level of fertilizer purchase by cocoa farmers was close to nil in Côte d'Ivoire in the mid to late 2000s.

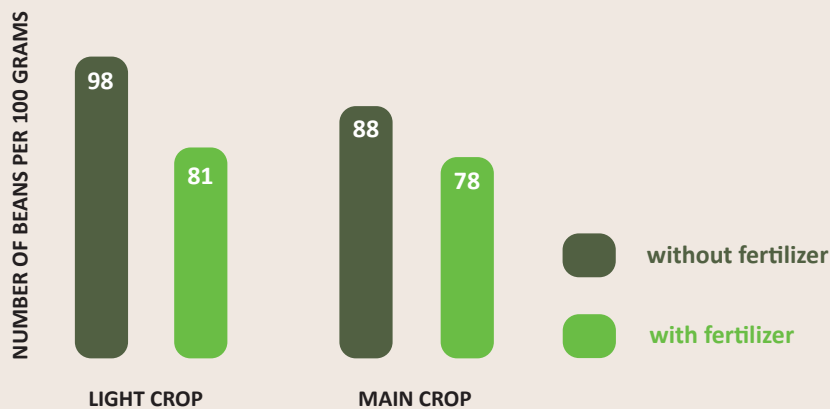
Fertilizer application resumed in 2010, when the price of cocoa was around F900/kg, even close to F1,000/kg while the fertilizer price dropped to F350/kg. Under these price conditions, the risk is minimal. If in 2000, the fertilizer of similar quality can be sold around F240/kg, (12,000 per bag) with a cocoa price close to F1,000/kg, hence a price ratio around 4, the profitability of cocoa fertilizers in Côte d'Ivoire will be guaranteed and the rate of adoption should rise quickly.

### A preliminary attempt of aggregate analysis

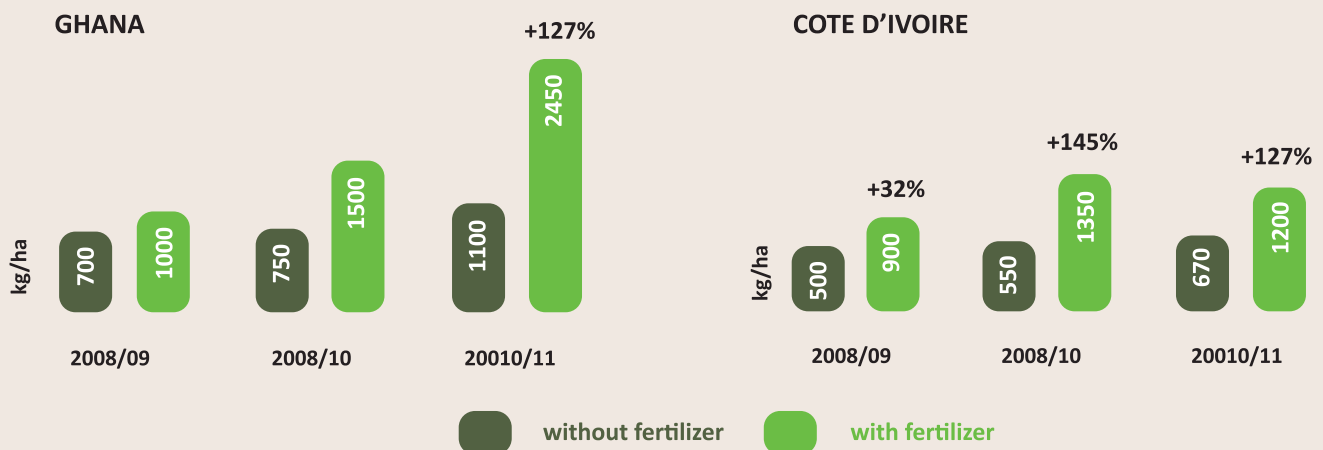
Despite its approximation, a rough calculation through estimates of the surface and number of cocoa farms clearly shows the huge requirements. The combined 1.25 million tons present an opportunity to the fertilizer industry and credit institutions of at least US\$500 million per year.

## GRAINAGE: NUMBER OF DRY BEANS PER 100 GRAMS

This gain in bean weight and weight bean per pod reinforces the effect of fertilizer on the number of pods, generating a very positive average impact on yields per hectare.



## AVERAGE IMPACT OF FERTILIZER ON COCOA PRODUCTION



In Ghana during the 2000s, cocoa policies had an enormous impact on enabling smallholders to operate a 'green revolution' in farming activities by subsidizing fertilizers and by increasing producer prices every year (including through other tools such as mass spraying programmes and inputs availability). In Ghana a comparison of the impact of fertilizer use was conducted across a sample of 60 farms, of which some applied and some did not

apply fertilizer. This test clearly demonstrated, as can be seen from the above table, an average yield increase of 127%. The situation now is that there is a significantly higher yield in Ghana than in Côte d'Ivoire which is contrary to the early 1990's. By 2011, around 70% of farmers in Ghana were buying fertilizers, versus only 15% in Côte d'Ivoire. This comparison is an indication of the role of fertilizers and, more generally, of adopted policies.

## Conclusions

- Use of fertilizer has a clear impact on production but its effect can vary considerably. This variability is partially explained by the amount of rainfall and the degree of maintenance, but there is still a need for solid research.
- In order to overcome the risks related to variability, the price ratio '1 kg of cocoa: 1 kg of fertilizer' should change to at least 3 kg, preferably 4 kg of cocoa against that same amount of fertilizer.
- The impact on production is accompanied by significant impacts on quality - and to a lesser extent on labor productivity. Is the market ready to recognize this quality improvement?
- However, if we follow this model, global needs would be immense. Would fertilizer suppliers be ready to meet such a demand? A reasonable conclusion seems to encourage some organic fertilizer associated with mineral fertilizer, such as chicken manure, as currently adopted by ~3% of the cocoa farmers in both countries.

Villages	Gain in percentage of cash flow		
	2008/09	2009/10	2010/11
ADUBRIM, ASONTE	21%	109%	249%
ABEKANKWANTA, BOBI	29%	75%	86%
ABAAM, TWUM OWUSU	12%	37%	59%
CHICHISO, OBENG	11%	69%	43%
BANKO, TETREM	29%	33%	31%
NKRANKWANTA	13%	45%	77%
ALL	17%	67%	101%
Cocoa:fertilizer price ratio	6,5	4,8	4,6

	Cocoa Price hypothesis (Cfaf/kg)			Gain in revenue		
	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
If the price of fertilizer is 20,000 Cfaf per bag						
Average price paid to the producers	619	854	785	13%	60%	3%
Had the price been at Cfaf/Kg900	900	900	900	33%	65%	13%
If the price of fertilizer is 15,000 Cfaf per bag						
Average price paid to the producers	619	854	785	27%	79%	20%
Had the price been at 900	900	900	900	42%	82%	28%

### Short-term recommendations

In both South-West Côte d'Ivoire and in Ghana, most cocoa farmers are aware now of their need for fertilizer. But their demand creates a paradoxical situation.

In Ghana, where taxation of the cocoa sector is relatively low and where fertilizer is subsidized, the price ratio between cocoa : fertilizer is well above 3, which triggers an enormous farmers' demand for fertilizer, contributing to a truly 'green revolution' and new cocoa success stories such as the one about Nzema district. Unfortunately, this demand cannot be met due to the side-effects of subsidy control. This has taken the shape of disastrous logistics in fertilizer distribution. Most cocoa farmers do not need credit. They just need fertilizers that they can simply buy with cash, especially one preferred brand.

Distribution has become the first constraint to raise, hence the following recommendations:

- Progressively remove the subsidies on fertilizers devoted to producing cocoa farms.
- Liberate the distribution of fertilizers in order to let the companies compete on fertilizer quality, logistic and prices (including foliar fertilizer), which should be sufficient to keep the cocoa : fertilizer price ratio above 3.

In Côte d'Ivoire, the cocoa price is too low, the fertilizer price used to be too high, so the demand is low. The recommendations for public policy focus are obvious:

- A better balance between the heavy taxation of cocoa and the still symbolic taxation of rubber
- If the revised taxation and the world price do not reach a cocoa : fertilizer price ratio of 3 - the minimal condition to make fertilizer profitable - fertilizer should be subsidized. If fertilizer manufacturers can offer a 50kg per bag below 15,000 Cfaf per kg and if cocoa reforms and the market will generate a producer price above 1,000 Cfaf per kg of cocoa, it is not necessary to subsidize the fertilizer adapted to producing cocoa trees, with the possible exception of the calcium of nitrate (see below).
- More broadly, rapid re-investment in totally degraded infrastructure (roads, tracks, bridges) should bring down transportation costs of cocoa and fertilizers.
- Continued multidisciplinary research about fertilizer adoption, impact and variability of impact is needed.

	Estimated consumption of fertilizer in 2010/11 (in tons)	Potential requirements (in tons)	Potential market (in \$)
Ghana	90,000	350,000	165,480,000
Côte d'Ivoire	33,000	800,000	378,240,000
Total	123,000	1,150,000	543,720,000



### For both countries, we would recommend:

- Calcium nitrate, due to its remarkable impact on cocoa tree health, should be considered specific. Its promotion and subsidy should be maintained in Ghana and set up in Côte d'Ivoire, with a competitive distribution.
- Successful replanting is still more important than increasing yields of mature or old farms: priority could be also given to the subsidy of fertilizer adapted to replanting.

All these fertilizer policies could help Ghana and Côte d'Ivoire to replicate the success story experienced by cocoa farmers in Nzema district, where traders currently converge to sell new cars and trucks to smallholders.

### Acknowledgements

There are many persons to thank. Had I been able to mention only one, it would be Joel Joffre, who has played a decisive role in the Yara decision to start these tests. Of all institutions who contributed, my first thanks goes to the NGO 'Agriculture and Life Cycle' but also to the many cocoa farmers who conducted the tests. Finally I would like to express my gratitude to Yara, which provided the fertilizer and funded part of the tests but allowed team total freedom. I am also grateful to MARS which funded the CIRAD missions to West-Africa in 2010, in which the results were evaluated. And of course to The Sustainable Trade Initiative, which greatly helped in achieving this first step in the process of data analysis.