Sub-Regional Workshop on Soil Fertility Management for Cocoa Production

- Workshop held from 26th to 28th February, 2013 in Grand Bassam, Côte d’Ivoire.

- Over 70 representatives participated in the workshop

- Though most farmers in are aware of the benefits in applying fertilizer and other soil fertility practices but do not use them due to:
  - High cost of fertilizer versus low price of cocoa.
  - Fertilizers are general not available and accessible to smallholder farmers.
Workshop Recommendations for Côte d’Ivoire

- Remedial actions on soil fertility:
  - Formulation of a general cocoa fertilizer with higher P and Ca at competitive price and cheaper than old formulations
  - For e.g. a “broad spectrum” formulation like the rock phosphate/super phosphate could be promoted for adoption by farmers right away (with support from IDH, Company members, governments etc.).

- The recommendations are in three (3) parts:
  - Scientific recommendations
  - Commercial recommendations
  - Policy recommendations
# Soil Fertility Management

## Recommendations

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Key Activities to Achieve Recommendations</th>
<th>Responsibility/ Point Organization</th>
<th>Collaborators</th>
<th>Activity Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scientific</strong></td>
<td>Compilation and evaluation of agroforestry experience and recommend a list of key species to be promoted in cocoa cultivation in Côte d'Ivoire.</td>
<td>NARs/ICRAF /National Extension Services</td>
<td>ACI/ WCF members</td>
<td>Jul-13 Dec-14</td>
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<tr>
<td></td>
<td>Conduct an inventory of all agroforestry studies and practices in the cocoa sector in Côte d'Ivoire.</td>
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<td></td>
<td>Incorporating cocoa agroforestry in the farmer training curricula.</td>
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<td></td>
<td>Supporting NARs and other research institutions in continuing with the composting programs</td>
<td>Research Fellows in NARs, Universities etc.</td>
<td>WCF/ Private sector (cocoa exporters, input supply companies etc.)</td>
<td>Jul-13 Dec-14</td>
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<tr>
<td></td>
<td>Scale-up current composting research work using cocoa pod to develop farmer friendly approaches to composting that reduces bulk.</td>
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<td>Updating training tools for the extension services to include soil fertility management</td>
<td>NARs/ National Extension Services</td>
<td>ACI/CLP; Private sector (cocoa exporters, input supply companies etc.)</td>
<td>Jul-13 Feb-14</td>
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<tr>
<td></td>
<td>Soil Scientists in Côte d'Ivoire, Ghana, Nigeria &amp; Cameroon review GAP curriculum using best soil fertility management practices identified from regional workshop</td>
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<td></td>
<td>Master trainers trained to provide training to Extension staff on the updated GAP curriculum.</td>
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<td>Mar-14 Aug-14</td>
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<tr>
<td></td>
<td>Formulation and production of good quality site-specific fertilizer</td>
<td>Conduct studies to determine soil fertility zones to develop soil fertility maps</td>
<td>NARs (Soil Scientists)/ government institutions</td>
<td>National Platform; Private sector</td>
</tr>
<tr>
<td></td>
<td>Using results of the soil mapping work with fertilizer formulation companies to develop and produce site/regional specific cocoa fertilizers in Côte d'Ivoire, Ghana, Nigeria &amp; Cameroon.</td>
<td>NARs (Soil Scientists)/ government institutions</td>
<td>Private sector (input supply companies etc.)</td>
<td>Jan-14 Dec-14</td>
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## Soil Fertility Management

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<td><strong>Commercial</strong></td>
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<td>Developing innovative ways to make the fertilizer available and accessible to small holder cocoa farmers at the right time</td>
<td>Mapping of in-country current distribution chains, constraints and opportunities; and proposed to the fertilizer companies to enhance availability and accessibility of fertilizers to farmers.</td>
<td>Private sector (input supply companies, cocoa exporters, etc.)</td>
<td>IDH/ACI-CLP</td>
<td>Jul-13 Dec-13</td>
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<td></td>
<td>Scale up lessons learnt from IDH Cocoa Fertilizer Initiative pilot in Cote d'Ivoire, Ghana, Nigeria &amp; Cameroon to address fertilizer availability and accessibility issues.</td>
<td>Private sector (input supply companies, cocoa exporters, etc.)</td>
<td>IDH/ACI-CLP</td>
<td>Mar-14 Dec-15</td>
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<tr>
<td>Making fertilizers affordable to farmers by providing credit facilities with requisite arrangements for loan recovery</td>
<td>Scale up lessons from TechnoServe pilot input credit scheme in Côte d'Ivoire, Ghana, Nigeria &amp; Cameroon.</td>
<td>Private sector (input supply companies, cocoa exporters, etc.)</td>
<td>IDH/ACI-CLP</td>
<td>Jul-13 Jun-15</td>
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<td>Facilitate the establishment of guarantee facility by both the public and private sectors to cover potential non-repayment by farmers.</td>
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## Soil Fertility Management

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<td><strong>Policy</strong></td>
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<td>Mainstreaming agroforestry in cocoa research to enhance the planting and utilization of trees and other tree crops in cocoa fields.</td>
<td>A clear policy directive from government to national cocoa research institutes on mainstreaming agroforestry in cocoa research.</td>
<td>NARs and other research institutes</td>
<td>National Platforms</td>
<td>Jul-13 - Dec-14</td>
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<td>Incorporation of agroforestry in training of extension service personnel at the agriculture and forestry faculties in the Universities.</td>
<td>A policy directive from government to national agricultural training institutes to incorporate agroforestry in cocoa training curricula and training modules.</td>
<td>Agricultural Universities; Agricultural Colleges; NARs</td>
<td>National Platforms</td>
<td>Jun-13 - Dec-14</td>
</tr>
<tr>
<td>Setting up or reinforcing the fertilizer regulatory mechanism</td>
<td>Facilitate the enactment (if not in existence) fertilizer policy or law and appropriate regulations to regulate the fertilizer trade (production, supply &amp; distribution) and fertilizer use.</td>
<td>Ministry of Agriculture; input supply companies</td>
<td>National Platforms</td>
<td>Jul-13 - Jun-14</td>
</tr>
<tr>
<td>Establishment of surveillance system for quality control and quality assurance of fertilizers on the market.</td>
<td>Setting up of government approved chemical laboratory (if not in existence) for quality control and assurance purposes.</td>
<td>Ministry of Agriculture</td>
<td>Private sector (input cocoa exporters, etc.)</td>
<td>Aug-13 - Dec-14</td>
</tr>
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<td>Establishment of teams of field inspectors in country to check fertilizers for plant nutrient deficiencies, misbranding, adulteration, short weight, bagging quality etc.</td>
<td>Ministry of Agriculture</td>
<td>Private sector (input supply companies, cocoa exporters, etc.)</td>
<td>Jul-13 - Dec-13</td>
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<tr>
<td>Government support in creating an appropriate environment for the importing and exporting of fertilizers.</td>
<td>Lobby government to reduce or eliminate import tax on fertilizer to help reduce cost.</td>
<td>Private sector (input supply companies, cocoa exporters, etc.)</td>
<td></td>
<td>Aug-13 - Jul-14</td>
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</table>
Professional Farmers for a Sustainable Future

Michiel Hendriksz
Director of Sustainability
We know a lot and do a lot

• We know the situation
• We know the importance
• We know the urgency

• Do we know enough about the small holders decision making process?
Running out of fertile forest soil

Cote d’Ivoire 1955

Cote d’Ivoire 1993
Areas suitable to grow cocoa today

(CATIE, 2011)
Predicted from climatological point of view in 2030

(CATIE, 2011)
Production trending towards West/North-West
Rubber moving in from South-East

Zones de production
Les zones de production du caoutchouc naturel sont :
Dabou, Anguédéou, Bonoua, Aboissso, Tiassalé, Gd Lahou, Gagnoa, Daloa, Bettié, Abengourou, Daoukro, Soubré, Guiglo, Rapides-Grah, Grand-Béréby.
Do we need to get used to this?
(near Meagui)
Growth rubber with smallholders
Fertilizer adoption considerations

1. Macro-level
   - Technical formulations
   - Soil scientific
   - Agronomics

2. Meso-level
   - Distribution / trade

3. Micro-level
   - Farmer decision making
     - Alternatives
     - Economics
     - Psychological
     - Physical labour
Put yourself in their shoes
Economics: Cocoa price in real terms
(base ‘09 in US$)

WCF Oct ‘10
When is it worth the sweat?

<table>
<thead>
<tr>
<th>Bean price farm gate Côte d’Ivoire</th>
<th>725 cfa/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg beans per ha/year in kg</td>
<td>400 kg</td>
</tr>
<tr>
<td>Revenue per ha</td>
<td>290,000 cfa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price fertilizer per bag 50kg farm gate</th>
<th>19,000 cfa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of bags of 50kg per ha</td>
<td>10 bags</td>
</tr>
<tr>
<td>Kg per ha (2 x 250kg)</td>
<td>500 kg</td>
</tr>
</tbody>
</table>

1) Cost per ha on fertilisation            | 190,000 cfa|

2) Cost per ha on phyto package            | 25,500 cfa |

3) Cost on interest (micro) financing      | 21,550 cfa |

Interest: 20%                              |            |

Total input (excl. planting material)      | 237,050 cfa|

| Needed increase in production              | 81.8%      |
| Expected increase in revenue               | 727 kg     |
| Expected revenue                           | 0 kg       |

| Re却ue per ha/year                        | € 442 $574|

| Net additional revenue                    | € 0        |

| Total: 327 kg cocoa beans                 |            |
| Expected revenue                          | 290,170 cfa|
| Revenue per ha/year                       | € 574 $574|

| Expected revenue                          | 290,170 cfa|
| Revenue per ha/year                       | € 442 $574|

Net additional revenue: € 0
Physical farm labour per ha (1200 trees)

- Fertilizer application
  - 2x
- Phyto
  - 2 x 2
- Pod harvest
- Breaking pods
- Fermentation
- Bring to village
- Drying
- Sorting
- Bagging
Soil Fertility and Fertilizer Issues in West Africa

Main Challenges
The most important: the “Last Mileage” ... quite easy to fix
Like all crops, cocoa needs nutrients

Nutrient mass balance requires external inputs: fertilizers
Unfavorable soil conditions mined+native

- Initial favorable soils: mined by extractive cocoa cultivation
- “Unsuitable” more acidic, weathered soils: “forest rent” only

Today most productive areas: less potential and less sustainability without soil correction
Removal by the harvest: soil depletion

- From stock of available mineral nutrients in the soil and these coming from the forest biomass after mineralization

| Nutrients for 1 t/ha cocoa dry beans (7 % moisture) with 1.4 t/ha husks) |
|---|---|---|---|---|
| N | P<sub>2</sub>O<sub>5</sub> | K<sub>2</sub>O | MgO | CaO |
| 36 | 13 | 79 | 11 | 8 |

147 kg

i.e. more than 300 kg of concentrated mineral fertilizer / tonne of cocoa beans

~ 800 000 tonnes of fertilizer / year for Africa
Sustainability: Input / Output balance

### Kg of nutrients in harvested pods per 1 t of cocoa beans

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P$_2$O$_5$</th>
<th>K$_2$O</th>
<th>MgO</th>
<th>CaO</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td>35,1</td>
<td>12,8</td>
<td>79,1</td>
<td>10,5</td>
<td>7,7</td>
</tr>
</tbody>
</table>

### Kg of nutrients in the husk / 1 t beans

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P$_2$O$_5$</th>
<th>K$_2$O</th>
<th>MgO</th>
<th>CaO</th>
</tr>
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<tbody>
<tr>
<td>kg</td>
<td>14</td>
<td>4</td>
<td>68</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

**Recycling** i.e. Husk composting

**The avoidable loss**
From original forest to poor grassland

- Required main nutrients / ha, mature cocoa field 6-7 years

<table>
<thead>
<tr>
<th>Nutrient requirements (whole plant) - kg/ha</th>
<th>N</th>
<th>P$_2$O$_5$</th>
<th>K$_2$O</th>
<th>MgO</th>
<th>CaO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>453</td>
<td>114</td>
<td>788</td>
<td>221</td>
<td>540</td>
</tr>
</tbody>
</table>

Replanting is difficult when no more “forest rent”
i.e. more than 4 tonnes of mineral fertilizer / ha
Ivory Coast, Ghana... cocoa fertilizers

Global situation:
Fertilizer use but not enough
Fertilizer use; farmer behavior

- **Sweat equity**
  - Easy available space: often cheaper to cut the forest
  - Nutrients from the “Forest rent”: biomass consumption… for free!? 

- **Vs. … Cash equity**
  - When there are no other choices and acceptable risks
    - Fertilizer efficiency and profitability
  - **Yield response**: increase thanks to fertilizer
    - Higher if “not too late”; not too depleted soil = higher yield increase
  - **Economic response**: Return on investment the same year
    - Acceptable shade; too much is diluting increase over years
    - **VCR, Value Cost Ratio**: fertilizer prices – cocoa bean prices

We “eat” the rain forest only once
No sustainability without Fertilizers
Cocoa fertilizers Ivory Coast

- Ivory Coast: 2000 to 2003...about 200 000 tons used
  - fertilizer prices – cocoa bean prices
  - i.e. per tonne: beans price / fertilizer price = 3 or higher
  Concentrated fertilizer $0.23\text{P}_2\text{O}_5.19\text{K}_2\text{O}+\text{Ca}+\text{S}+\text{Mg}$ recommended at $350$ kg/ha

- The fertilizer use,
  - Was first to save the plantation
  - But with return on investment with the 1st year yield increase: cost/benefit 1/1 required year 1
  - Just a farmer Pull, cash & carry ... Without push... by projects...!
  - Every year on a different part of the farm

Continuous fertilizer use in same field with continuing yield increase during several years: Not experienced by Ivorian farmers

Yara figures (70% of Ivory Coast cocoa fertilizer market)
Cocoa fertilizers Ghana

- More than 100,000 tons/year, from several years,
  - Favorable VCR Cost/Value Ratio… Also thanks to subsidies
  - Demand > supply
  - Subsidies = quantity quota

- General remark regarding **Subsidies**:
  - Fixed % per bag + No volume limitation = No budget control
    - Feasibility, Sustainability?
  - Fixed % per bag + Fixed subsidies budget = volume QUOTA
    - Ghana quite important budget and impact
  - So required high consideration or equitable smart subsidies

Initiatives in Countries could slow down fertilizer development if
Fixed % of subsidies and too limited Subsidies budget,
as subsidies negatively impact / suppress sales at real market price
Fertilizer efficiency

Economic and environmental sustainability
Part of package, specific for cocoa

- Part of the package of good agricultural practices, with
  - Planting material
  - Plantation maintenance (pruning, not too much shade, etc…)
  - Protection pests & diseases (1/5 vs. fertilizer costs = an insurance)

- Fertilizer specific cocoa reference formulas exist
  (and still country valid)
  - In Ghana and in Ivory Coast, etc… developed with Cocoa National Researchers.
  - Until now with Chemical Phosphorus (TSP) as P raw material,
    P+K about 40, too low Calcium about 10 … at 350 kg/ha
  - New formula with Natural Reactive Phosphate Rock as P source
    P+K about 30, higher Ca at about 25 … at 500 kg/ha
  - new in the market or at Research level
    (cheaper per tonne, similar cost / ha, but with more Calcium for Sustainability, globally same quantity of other nutrients per ha)

Use fertilizer types and doses accordingly!
Needs: fertilizer package + Demo’s

- **Fertilizer package**
  - One complete formula **PKCaMgS**… Except N (as before, in formulas, the only possible chemical N forms were with more adverse effects than positive)
  - Plus a specific N fertilizer, **Calcium Nitrate**, a *non-acidifying* N form as separate product (so more Calcium also; and for less diseases pressure)

- **Coming years: existing formulas and packages**
  - Need of Demonstrations: interest of fertilizer use every year
    - Cumulative yield response, known in GH, but less in I. Coast
  - Needed: a “farm investment model” for the farmer to understand
    - the interest of routine improved input package, on good trees

From pan-territorial to regional formulas: not short term
Will require many years for researchers
(not obvious as intra & inter field variations higher than between regions)
Fertilizer available ...& affordable closer to farm gate

The issue: the last mile
Country availability: not the issue

- Farmers know the importance of fertilizer
  - Very often they know this better than we think!
  - Prone to use fertilizer … when economically sensible
  - Availability close to farm gate for more fertilizer use …

  **Last Mile: the biggest issue**

- Fertilizer suppliers are present
  - Several fertilizer companies per country are producing cocoa formulas (GH, IC), plus, several importers from Overseas
  - But with low inland network: main towns and big villages

- New engagement: Chocolate, beans uptake companies
  - Becoming worried about their future supply: numerous projects
  - Fertilizer supply with credit will be limited or slow to scale up
  - “Cash & Carry” easier to scale up… just like for cocoa beans!!

**LAST MILEAGE**

Biggest possible contributions: by the bean uptakers with Coops, by small business in projects (CVC’s, …) on the top of plant & GAP
Availability close to farmer gate

- Last mileage ...“Return freight”:
  - **The last link** of the fertilizer supply chain **is** the first link of the cocoa beans sourcing chain

  On the way to: fertilizers
  On the way from: Beans

  - **Easy**: Return freight to villages with the small trucks, the “KIA” can deliver fertilizers (harmless plant food – no PBs) instead going empty to collect the cocoa beans

- Based on “Cash and Carry”
  - **Minimum risks, best sourcing prices**
  - **Limited revolving working capital** required as cash all along

  Return freight from port to Warehouse: 1 full truck 40 t of fertilizers
  Required working capital (e.g. 80 tonnes = 40K to 50K USD only)

  - **“Minimum transaction costs”: “one link chain” only**

    Between local-fertilizer-factories/importers and farmers
    Flat distribution system (vs. pyramidal with big/medium wholesalers),

  So arranged by numerous operators: a big leverage for fertilizer use
Conclusion: real service to farmers

- Indeed, fertilizer delivery close to farmer gate
  - Never mind whether at cocoa beans sale period of the year

- Return freight + cash-and-carry =
  - “Right timing”
    - When the farmer receives money
    - even if several months before fertilizer applications
  - “Effective saving”
    - When the farmer receives their money, their cocoa income
    - vs. pocket empty 6 – 3 months later when needed for apply
      (… like a cotton farmer in the North, buys a cow when he is paid)

Projects, Coops, etc… will thus reinforce farmer loyalty
Loyalty relies on provided services (… can be leveraged for more certified cocoa)

Farmers will thus benefit from the equivalent logistics
for their Fertilizer Inputs and Cocoa beans Outputs
PS:

No fertilizers

=  
High negative environmental impact and High negative social impact

= 
No sustainability
Sorry, but:

A cocoa farm
Without fertilizer....

is a rubber farm of the future