An Attempt to Identify Sources that Limit Sustainable Cultivation of Cocoa

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A Need for Sustainability

- **Sustainability**, in the context of continued cultivation of cocoa is of mutual interest to all stakeholders, **which includes growers, manufacturers, promoters of cocoa marketable products and consumers.**

- To aim for **total sustainability**, more than one factor has to contribute, allowing for the development of a sustainable state, **thus attend all.**

- However, to achieve total sustainability, **among the numerous approaches to this end, needs** to be positioned on a solid base **on which, other sustainable wants can be achieved** - and this **base has to be economic sustainability.**
Continued Sustainability

Therefore, it is logical to consider that economic sustainability is rightly positioned at the very start of the productive chain - at farm level.

However, if deficiency exists at farm level and sustainability weakened then it would follow that the very concept of attempting total sustainability could be undermined.

As economic sustainability leads to wider reach in introducing and maintaining this condition, then the means to attain and uphold economic sustainability, at farm level has to be a continual concern to all stakeholders.
Challenges in ensuring Economic Sustainability in Cocoa Cultivation

Over the last 60 years, Brazil’s main cocoa producing State of Bahia, experienced three unsettling situations in the cultivation of cocoa, which triggered serious loss in economic sustainability.
The 1st challenge occurred in the 1950’s

- **Challenge**: a worsening situation in cocoa productivity on farms leading to virtual collapse of the industry, production level dropped and remained at a low 88,000 tons per year.

- **Situation**: equated to subsistence farming, with crop produced derived from a virtual zero input condition.
The 1st challenge occurred in the 1950’s

- **Cause:** a lack of farm support services - scientific research, extension, training, infra-structure and a sound cocoa policy

- **Approach:** Federal Government founded CEPLAC an executive commission for recuperation of farms, through establishing Cocoa Research Center, Extension/Training Centres, also subsidies, rural credit and social services

- **Result:** cultivated area increased to ±600,000 ha and in 1986/87 with production up to 397,000 tons - Thus, Brazil ranked 2nd world’s largest producer
The 2nd challenge occurred in the 1980’s

- **Challenge**: drop in cocoa production/productivity, followed by stagnation in cropping levels.

- **Cause**: an interaction of three main factors: low cocoa prices; comparative elevated cost of production and excessive government taxation.
The 2nd challenge occurred in 1980’s

- **Situation:** abandoned use of any farm practice that entailed cost and discharged farm workers in an attempt to reduce cost to a minimum.

- **Approach:** None

- **Resultado:** A drop to poverty level and bankruptcy
The 3rd challenge occurred in 1989

- **Challenge**: a rapid drop in production to 97,000 tons, similar to the lowest production experienced in the 1950’s

- **Cause**: witches broom disease - occurred at a time when farmers were experiencing financial difficulties in bank debts and total lack of reserves. Originating from periods of low cocoa prices, while ever increasing input cost demanded in cocoa cultivation remained disproportionate
The 3rd challenge occurred in 1989

- **Situation:** disease spread over the whole region at an amazing rate of 2 km / month; and over three years from 1990, the infected area from 1,093 km$^2$ doubled annually, bankrupt farmers and abandoned farms.

- **Approach:** intensive research in disease management strategies

- **Result:** Initial production increased by 84% over the lowest registered level due after the outbreak of witches’ broom
Witches’ Broom \textit{(Monilophthora perniciosa)}
Components in Strategies in Management of Witches’ broom

- Exclusion
- Erradiction

Preventive Management*

- Phytosanitary
- Chemical
- Biological *
- Genetic *

Protective Management
In 1989 Limited Operating Components for Management of Witches’ broom Disease

1. PHYTOSAN
   Reduction in inoculum

2. CHEMICAL
   Protective action on developing pods.

3. BIOLOGICAL
   Reduced development of the pathogen and less viable spores

4. GENETIC
   Introduction of plants with inherent lower levels of disease in the field

Only Operating Components

Non-Operating Components

Only Operating Components

Non-Operating Components
1. What Required to be done to Re-ensure Sustainability

- Intensive research in methods, hitherto not applied in a tropical tree crop, such as cocoa.

- A process that would hasten the selecting for disease resistance incorporating a higher productivity index, and propagation system for early bearing.

- Install a mass-production facility to produce clonal material and rooted seedlings, and ensure easy access and at a cost to the grower.

- Follow-up training in field practices for implementing the new establishment.
2. The Approach and Support

- Conventional breeding methods will require to continue however, the need for hastening the process of selection for genetic improved material. In a relatively short-time period that allows for a high level precise, possible in use of molecular biology techniques.

- Federal, State Government and international organisations supported a program precisely directed mounting a molecular biology laboratory to conduct intensive research and sponsors for higher degree students, accelerating generation of results.

- A mass production large scale nursery complex was installed to produced clonal material.
3. Sustainability though Effective Disease Management

- Continuous releases of material, screened using molecular techniques were approved as sufficiently resistant to witches’ broom. To-date resistant clones number 40 different material, transferred to the mass production facilities and supplied to farmers at a symbolic price.

- A total of about 140,000 ha have been cloned in the cocoa producing of Bahia.

- The introduction of a biological agent for control of the witches’ broom disease, establishes itself in the field and colonises the pathogen.
4. Sustainability through for Higher Productivity

- Years of yield data obtained from the long-established breeding program was used to cross-check the contribution of the production factor to clones that were selected for resistance.

- Material for grafting on existing root-stock and nursery prepared rooted-cutting designed to increase the tree density from about 600 trees/ha to about 1,000 trees/ha.

- Thus, transferred to the field would benefit the less resourceful farmers of small holdings, which today reflect the major part of the cultivated cocoa, and in contributing to world cocoa production.
All the main components of a disease management have been made operative.

1. PHYTOSAN.
   ✅ Reduction in inoculum

2. CHEMICAL
   ✅ Protection or curative action on pods to infection

3. BIOLOGICAL
   ✅ Reduction in development of the pathogen and viable spores

4. GENETIC
   ✅ Plants are infected due to lack of genes of resistance; the level of disease is intrinsically lower in resistant plants.
1. Lack of Sustainability

• The initial increase in production, demonstrated a rise of 84% over the lowest level registered, due to the outbreak of witches’ broom was encouraging and expected to rise at an even higher rate as the new material came into bearing.

• However, this initial increase has not been sustained and over the last four cropping seasons production remained stagnant.
2. Lack of sustainability

- Decades of crop forecasting now analysed, has convincingly shown that the production potential of the trees have been dropping over the decades

- Pods in early stage of fruit set (cherelles) over the period 1978 to 2007, registered a continuous decline.

- From 1978/1987 values of 159.9 cherelles/tree, dropped to 86.5 cherelles in 1987/1996, and then once again a further decrease to 32.4 cherelles per tree in the 1996/2007 years.

- Decline in production, based on these findings suggest over the last 30 years, represent a 79.7% loss of potential fruit-set. may apply in other cocoa producing
Thank you!

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