

Global Research On Cocoa - working with and for farmers

What is Sustainability?

The term 'sustainable' has become indivisible from development, but what does it mean? Is 'sustainable cocoa' achievable and, if so, how? These topics are dealt with in various ways in this issue.

From Jan Vingerhoets of the ICCO comes an analysis of why cocoa has not been economically sustainable, and what has to be done to make this an achievable goal.

Rob Lockwood's analysis of the history of cocoa growing in Ghana reveals that problems facing the industry have remained largely unchanged over 80 years or more. He suggests what needs to be addressed if West African cocoa is to provide a sustainable livelihood for farmers.

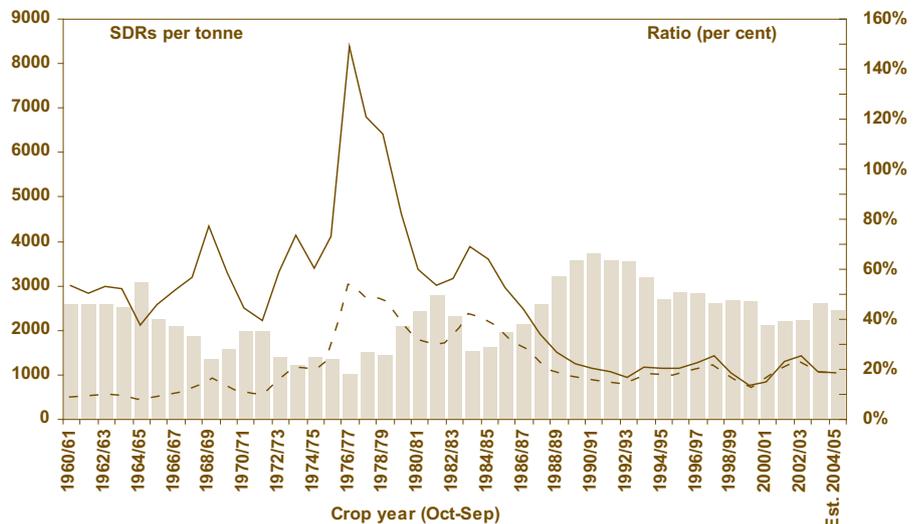
In contrast, cocoa is a new crop in Vietnam. Ross Jaax reports how SUCCESS Alliance is introducing smallholders to sustainable cocoa production principles and practices through extension and training.

The cocoa industry has become increasingly aware of the importance of growing sustainability at the farmer level. Bill Guyton describes how WCF and industry partnerships are sponsoring community-based initiatives in West Africa aimed at improving the well-being of cocoa farmer families.

Sustainable control means first understanding your pest or disease, and its taxonomic identity is the starting point. The final article describes how the latest molecular tools have ended the long-running debate on the identity of the pathogen causing frosty pod rot.

Sustainability Means Making Cocoa Pay

Nowadays, it is common practice to distinguish between economic, social and environmental sustainability; all three have to be satisfied to achieve full sustainability. However, in a presentation to the Malaysian International Cocoa Conference in July¹, Jan Vingerhoets, Executive Director of the International Cocoa Organization (ICCO) made it clear that he believes economic sustainability to be the pre-condition for achieving the others. Poverty may pressure people into a-social or anti-social behaviour. If a farmer is going through difficult



ICCO average daily price of cocoa beans and stocks-to-grindings ratio. Contemporary price (dashed line) and price adjusted for inflation to 2004/05 figure (solid line). SDR (Special Drawing Right): unit of the International Monetary Fund determined on the basis of a basket of currencies to best represent world prices. Stocks-to-grindings ratio: industry measure of relative supply and demand. (ICCO, adapted)

economic times, he can ill-afford the 'luxury' of worrying about the environment.

Dr Vingerhoets defined economic sustainability of cocoa production by smallholder farmers thus: "Cocoa production is economically sustainable when it is at all times sufficiently attractive for smallholder farmers to properly maintain their farms, to rejuvenate their farms as required and to buy the necessary production tools and inputs to achieve optimal (from the point of view of yields and longevity of the cocoa trees) yields." Given this, he argued, cocoa production has not been economically sustainable during the past decades. He cited as the main reason sharp fluctuations in prices, around a declining trend in real terms (prices corrected for inflation; the solid line in the figure above), which have characterized the world cocoa market. Take recent years: following all-time low prices in the late 1990s, a production deficit in 2000/01 led to price recovery; but when world cocoa production reached 3.5 million tonnes in 2003/04, prices fell again. Farmer behaviour has been a key factor fuelling the instability.

Over the past 25 years, farmers have responded quickly to price increases by increasing production, despite the declining trend in real prices over this period. There have been limited increases in yields and labour productivity, so more

production means farmers have planted more cocoa (or brought it back into production). But with a tree crop there is an inevitable delay, measured in years, between action and result. Each time there has been a production shortfall, and consequent price rise, it has been followed several years later by over-production, and falling prices. Cocoa production has thus grown in 'jumps', in 1984/85, 1988/89 and 1995/96, and most recently in 2003/04. For many farmers there are no good alterna-

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- ICCO on commercial sustainability
- Can West African cocoa be sustainable?
- Building a sustainable cocoa sector in Vietnam
- WCF community initiative in West Africa
- Taxonomy solves pathogen puzzle



Healthy Cocoa Research

Jan Vingerhoets called for health aspects of cocoa to be promoted. Here are three recent positive studies^[*].

Blood Pressure and Sugar Benefits

Flavanols, plant polyphenols found in cocoa, are thought to have direct and indirect positive effects on cardiovascular health and, via insulin sensitivity, on sugar regulation. This was borne out in tests with volunteers who ate dark or white chocolate (with and without flavanols, respectively) for 15 days. Dark (but not white) chocolate decreased blood pressure and improved insulin sensitivity in these healthy individuals.

Grassi, D., Lippi, C., Necozione, S., Desideri, G. & Ferri, C. (2005) Short-term administration of dark chocolate is followed by a significant increase in insulin sensitivity and a decrease in blood pressure in healthy persons. *American Journal of Clinical Nutrition* 81(3), 611–614. www.ajcn.org

Coughs Calmed

Another study observed that theobromine, found in cocoa, inhibits coughing induced by capsaicin (a pungent extract of red pepper widely used in testing as it induces reproducible and dose-dependent coughing).

Usmani, O.S., Belvisi, M.G., Patel, H.J., Crispino, N., Birrell, M.A., Korbonits, M., Korbonits, D & Barnes, P.J. (2005) Theobromine inhibits sensory nerve activation and cough. *FASEB Journal* 19(2), 231–233. www.fasebj.org

Fat Burned Not Stored

A third study looked at why (in rats) cocoa prevented the obesity normally resulting from a high-fat diet. Gene expression profiles and DNA microarray analysis indicated that inclusion of cocoa in the diet decreased fatty acid synthesis and transport systems, and enhanced part of the heat-generating mechanism in liver and fatty tissues.

Matsui, N., Ito, R., Nishimura, E., Yoshikawa, M., Kato, M., Kamei, M., Shibata, H., Matsumoto, I., Abe, K. & Hashizume, S. (2005) Ingested cocoa can prevent high-fat diet-induced obesity by regulating the expression of genes for fatty acid metabolism. *Nutrition* 21(5), 594–601. www.sciencedirect.com/science/journal/08999007

[*] From CAB Abstracts.

See: www.cabi-publishing.org

tives to cocoa farming, so oversupply is a continuing threat.

Dr Vingerhoets commented that it is difficult to assess whether current prices (around a very modest US\$1400/tonne on the New York market) are sustainable. He suspects, however, that they are not sufficiently attractive to presage a return to the 2003/04 production level of 3.5 million

tonnes, and by his reasoning this is a good thing. Even if increases in production are modest, prices are not expected to rise. If production were to reach the 2003/04 level again, prices would decline sharply, to levels at which farmers would suffer and cocoa production would certainly not be sustainable. He hopes production increases in the coming years will be modest to prevent such price falls.

Consumption has continued to increase satisfactorily, with world consumption of cocoa beans growing at an average of 2.3% per year over the past decade. Some two-thirds of the increase has been in the traditional mature markets of the industrialized countries, but the most rapid growth has been in the emerging markets. There are also threats to consumption from health concerns, particularly obesity (including among children) in the mature markets, with chocolate generally considered to be one of the culprits. However, research is making more and more clear that there are very positive health and nutrition properties of cocoa and chocolate.

What Hope for Economic Sustainability?

If we accept that cocoa production has not been sustainable until now, what can be done to make it sustainable in the future?

With respect to prices, Dr Vingerhoets said, the main challenge is to find ways of avoiding a repetition of past long periods of low, and very low, cocoa prices. With the ever-present danger of supply exceeding demand, corrective measures from both the production and consumption sides of the market can play a part in forestalling an imbalance.

For consumption, he placed an emphasis on making sure that people eat more chocolate, which will translate into a more rapid growth in demand for cocoa. If that can be achieved, any problem of temporary oversupply will disappear quickly and prices will remain stable at a relatively high level, instead of plummeting as they have done historically. He called for a campaign in the mature markets to overcome the impact on the cocoa sector of obesity issues (the ICCO Promotion Committee is planning one). Furthermore, particularly in emerging markets, promotion of cocoa products is needed. This has been done in Japan and is planned for Russia, but the large markets of China and India are enticing, for success in these with their enormous potential could very substantially increase the demand for cocoa beans.

Turning to production, Dr Vingerhoets stressed that even with consumption grow-

ing at a steady rate, cocoa production must not grow too fast. He identified two important instruments for ensuring this: market information and production programmes.

It is widely agreed that farmers are the most important people in the cocoa sector. They are ultimately responsible for decisions on crop sales, production and investment, yet they are typically the least informed about the market. In most cocoa producing countries, market information systems for smallholder farmers are poorly developed or non-existent. Moves, some involving the ICCO, are underway to change this. The public sector needs to provide information to smallholder farmers about the current situation in the market, i.e. the prices in his/her own district and region; in the country; and on the world market. Furthermore, as the farmer has to make decisions about production, including the use of inputs, and about investments, notably the planting of new cocoa trees, he/she needs good information on market prospects. It will not be easy to properly package information on price projections for farmers, but it is necessary to try.

From time to time, programmes are initiated by cocoa producing countries to fight the incidence of pests and diseases, to stimulate the use of inputs, to produce and distribute better planting material, etc. These are laudable, but are too often presented as efforts to increase production as quickly as possible and as much as possible. Sometimes new initiatives are announced in several countries almost concurrently. Such policy objectives give the wrong signal to the market. Nonetheless, it is understandable that production programmes are formulated in this way, because most countries lack the necessary basic information to formulate more specific policies and programmes. Most countries do not know what cocoa resources they have; how many cocoa farmers there are in the country, how many hectares are planted with cocoa, etc. Estimates can be made, but there is no systematic knowledge and this must change. Cocoa producing countries must know what their cocoa resources are so they can formulate programmes and policies which aim at specified and realistic targets. When taking such action, countries must also look at the world market, and assess the impact of their activities on the world market. And at the same time, each country must take into account the activities taken or planned in other producer countries. No country functions in isolation.

Dr Vingerhoets underlined he was not advocating a formally co-ordinated production policy by the cocoa producing countries. Rather, each country should acquire



the basic information to allow it to formulate realistic policies and programmes. Secondly, each producing country should inform other producer countries of its plans and objectives. And thirdly, each country should take account of the production policies and programmes of all other cocoa producing countries.

In this way, he concluded, the combined action of cocoa producing countries could contribute to a measured increase in cocoa production over time, and one in line with the increase in world consumption. In this way, the threat of oversupply could perhaps be avoided or at least mitigated. This would contribute to the economic sustainability of cocoa production, to the benefit of farmers and cocoa producing countries alike.

¹ This article is adapted from: Vingerhoets, J. (2005) The world cocoa market and a sustainable world cocoa economy. Presentation to the 4th Malaysian International Cocoa Conference, Kuala Lumpur, 18–19 July 2005.

Cocoa Sustainability: The Case of Ghana

The idea of sustainable agriculture has been around for a long time. We all agree that it is a good thing but are we agreed on what it means and what its achievement entails for development generally and cocoa specifically? Do we start our thinking with what farmers need - a secure livelihood - or with our own agenda?

What is Sustainable Cocoa?

In cocoa 'sustainability' captures four ideas:

- The risk-reward balance for cocoa compares favourably with alternative crops
- The soil, biological and physical environments are managed in ways that do not compromise the agricultural options of future generations
- Production practices are acceptable to consumers
- Markets are maintained through long-term continuity of supply of the required quality

Farmers will not produce cocoa unless it offers the best risk-reward balance among crop options, taking into account natural competitive advantages including traditional skills in its cultivation. With this understanding 'bottom-up' approaches can work but without it 'top-down' ones usually fail.

Are Current West African Cocoa Production Practices Sustainable?

Cocoa as a tree crop is usually thought of as being permanent and so sustainable. However, all the evidence from Ghana is

that once a planting completes its natural cycle of some 30 years, it is the exception rather than the rule for the same land to be replanted to cocoa that performs well. Trees can be replanted successfully following cutting out because of swollen-shoot virus infection, but they replace ones that have not completed their cycle. Can a crop that lasts only one full cycle be described as sustainable? The answer may depend on the reasons for cocoa's apparent behaviour as a tramp crop and the potential for remediation. The reasons may include changes to both the fertility and vegetative cover of the land on which the crop is cultivated as well as changes in climate.

A Brief History of Cocoa Sustainability in Ghana

In June 1921 Organ¹ summed up the dangers facing the Ghana cocoa industry as:

- "Deterioration in the fecundity of the trees owing to too close planting, careless methods and, lack of attention to the soil.
- "The abandonment of plantations owing to the present low prices.
- "The falling off in humidity owing to too great clearance of the forest.
- "The grave risk of serious disease."

In 1939, Voelcker², then with the Agricultural Department in Nigeria, reported on his first visit to Ghana, where in due course he was to become the Director of the West Africa Cacao Research Station with West as his deputy:

"There is a feeling that in Nigeria the native farmer knows best - so why worry? Mr. West and myself have seen thousands of acres of land in the Gold Coast, which we were told was once flourishing cacao, and is now abandoned land with scattered derelict



Amelonado cocoa in Ghana, mid 1940s. (A.F. Posnette)

trees. The same is beginning to happen in Nigeria. If we can't even attempt to improve on a method of cultivation to which that is the answer, we might as well pack up being an Agricultural Department."

The problems were well understood by the authorities, as shown by the 1938 Commission on the Marketing of West African Cocoa³:

"The measures that are standard on a well-conducted plantation - draining, pruning, manuring, and pest control are unknown. There may be some casual overhead shade from surviving or intrusive forest trees: we saw little attempt at its ordered provision"

Soil Fertility: the Key Issue

In 1953 Charter⁴ wrote:

"As unfavourable environmental conditions, pests and diseases killed out the earlier established cocoa, the deficiency was made up by fresh plantings in untouched forest coming into bearing. This process will continue until the untouched forest is exhausted and then decline in production will set in.... The only way that this decline can be arrested is by the Gold Coast people learning to cultivate their cocoa instead of letting the trees exploit



The Tafo Cacao Research Building at the West African Cocoa Research Institute (WACRI). This is now the A.F. Posnette Building, Cocoa Research Institute of Ghana (CRIG). It was Stockdale's analysis⁵ (see Box, What is New in Cocoa) that led to the establishment of the Cocoa Research Institute. (A.F. Posnette)



What is New in Cocoa?

Sir Frank Stockdale (later Colonial Agricultural Advisor) provided a far-sighted analysis of the Ghanaian cocoa industry in 1929.

"Increasing knowledge in regard to permanent tropical crops indicates that periods of maximum vitality and production exist for various types of soils and conditions and that after those periods have elapsed a decline of vitality and productiveness occurs unless cultural operations are improved and heavier manuring resorted to. Pests and diseases may become noticeable when the period of declining vitality sets in, and their incidence can often be reduced and their damage mitigated by improved agricultural methods. Can the *Sahlbergella* pest of cacao in the Gold Coast be met by improvements in agricultural operations? This is a problem of considerable importance for cacao in the Gold Coast, which receives, in general, no cultivation or manuring. There are many areas in which the period of maximum productivity and vitality has been reached and passed and these areas may be assisted by attention to cultivation and manuring"⁵.

fertility for which the farmers have not been responsible."

The truth of Charter's analysis was borne out when Ahenkorah *et al.*⁶ quantified the impact of cocoa cultivation on soil nutrient content (Table 1). Within 15 years, Amelonado cocoa had reduced available soil phosphate to negligible levels, even under shade. The decline of the cocoa is inevitable unless soil nutrient content is maintained through use of appropriate ameliorants.

Amelonado at Tafo	Available P ₂ O ₅ (p.p.m.)	
	1957	1972
Shade, no fertilizer	24.1	0.7
Shade, with fertilizer	25.5	21.2
No shade, no fertilizer	27.3	0.9
No shade, with fertilizer	22.5	19.3

Table 1. Available phosphate before and after cocoa cultivation.

The Role of Fire

Once the forest is disturbed, its deterioration but not destruction follows, because many species are sensitive to exposure of their crowns. Two other factors are:

- Cocoa farmers require food; that means food farming, and in turn fire to clear debris, destroy weed seeds and release a flush of nutrient. Many of the forest

trees that survive with cocoa die once they are burned.

- The seed bearing trees are lost over time.

In 1997 Appiah *et al.*⁷ argued that unless farmers apply fertilizer to their cocoa, the demise of the remaining forest is inevitable: "Vast areas of the country's forests could be saved and protected if the cocoa farmer would be advised to use suitable soils and adopt appropriate agronomic practices for cocoa production". Profitable responses to applied fertilizer on farmers' cocoa in Ghana are now well documented, e.g. Appiah *et al.*⁸. There is anecdotal evidence that farmers advised by the fertilizer company Wienco are using fertilizers.

There is a striking contrast between the vegetative cover of the experimental area at the Cocoa Research Institute of Ghana and the Cocoa Stations and the surrounding farmland. On the former, serious food farming has never been allowed, so there have been relatively few fires, and the forest cover has survived except where clear felling was practised for experimental reasons. On the farmland, few trees remain, and many of those that do have little economic value. On the hills of southern Ghana, where cocoa cultivation started 100 years ago, there are extensive areas of fire-maintained grassland.

The danger of fire is recognised in Ghana, with a strong government policy to discourage burning.

What Next?

Will other areas with medium or better rainfall convert to grassland? The evidence is that they will not. Ghana's population has trebled in the last 30 years so there is much more pressure on the land. In areas that have gone out of cocoa production since say 1970, a mosaic of crops is developing - oil palm, mango, citrus, teak, food crops, etc. (but not cocoa). Possibly they will repeat the experience of the Machakos District, where a once derelict landscape became a well-treed and diverse agricultural scene⁹, although many would argue that changes in land tenure systems and rights over trees would be required to achieve this. The end point would not necessarily be high forest in Ghana, but perhaps that is an unreasonable aim anyway.

Will shade be as important as part of future cocoa systems as it was said to have been in the past with those based on Amelonado? Again the evidence is that it will not. The late Peter Posnette described how the great Amelonado belt of southern Ghana was effectively unshaded: he dismissed shade trees as

Restoring a Landscape

In the 1930s the semi-arid Machakos District in Kenya was considered to be an environmental disaster. Overgrazing and intermittent drought had reduced the land to red, bare hillsides stripped of vegetation and soil, and gullies of sand where rivers had once flowed. Famine relief was required over a 20-year period. Subsequently the population has increased five-fold while simple agricultural techniques, especially terracing and tree planting, have stabilized the soil and restored a richly treed landscape with high agricultural productivity. This was not an aid effort: the funding came from family members who migrated to salaried jobs in Nairobi.

water pumps. Modern varieties are much more tolerant of exposure in the immature phase than Amelonado was - indeed in much of West Africa the variety is effectively impossible to establish under today's soil conditions. Perhaps more decisively, if cocoa farmers are going to use fertilizers to maintain soil fertility and still have satisfactory incomes higher output systems will be required, and this means the cocoa carrying less shade. Cocoa does benefit from windbreaks, so it would fit into a mosaic of small farms, some of them planted with other tree crops, as is seen increasingly in Ghana.

Critical Gaps in Knowledge

Most agriculturalists would agree that soil ameliorants are required to maintain soil fertility. Why then do Ghanaian farmers not fertilize? The reason usually given is that they lack credit and/or supply. However, neither is strictly true today and a third possibility should be considered: the value:cost ratio is too small. Yanggen *et al.*¹⁰ argued that sub-Saharan farmers require much higher value:cost ratios than their Southeast Asian counterparts. There are two sides to the cost equation and it is true that fertilizers are more expensive in Ghana than elsewhere in the world, so the value:cost ratio could benefit from improvements to the supply chain.

Fifty years ago Charter⁴ argued that "using traditional methods, it is difficult or impossible to establish cocoa economically on land that has previously been exploited". We need a much better understanding of the effect of the transition from forest through cocoa to food farms and perhaps beyond to grassland on the nutrient content of the soil and more profoundly its structure. Such understanding is prerequisite to the possibility of cost-effective soil amelioration.



Conclusion

In the business-as-usual scenario, long-term decline of Ghana's cocoa industry seems inevitable. Soils will become exhausted in most existing cocoa areas unless their fertility is maintained by applying nutrients. There is no new forest to plant and even if there were, its exploitation would be unacceptable.

Routine application of fertilizers will increase production costs. Ghana's cocoa producers will have to become more efficient if they are to compete with those who continue to exploit natural fertility. One simple measure of their success will be whether cocoa becomes a truly permanent crop, in other words that it becomes sustainable. It is also a measure of the success of the cocoa research community.

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Transport of cocoa seedlings in the Mekong Delta. (Nguyen Huu Dinh)

Introducing Cocoa as a New Smallholder Crop in Vietnam

If you had the opportunity to start a smallholder cocoa industry from scratch, what would you do? That is the question that the Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance^[*] asks itself every day as it pursues the challenge of introducing sustainable cocoa production to 17,000 smallholder farmers in Vietnam. The government of Vietnam has a target to become a new cocoa producer and exporter of 10,000 tonnes annually by 2010. To help accomplish this goal the SUCCESS Alliance is bringing international expertise and investment to Vietnam.

Implemented by ACDI/VOCA, a U.S.-based non-profit development organization, the Alliance is assisting Vietnam to build its new smallholder cocoa sector on a foundation of sustainable cocoa production principles and practices. The main activities of the SUCCESS Alliance are to introduce these to smallholders through extension and training. Cocoa is a new crop for the Vietnamese farmers, and a new industry to Vietnam, so all aspects from farm level production to export standards must be addressed at the same time. This raises some interesting issues.

In developing a new smallholder industry, it is critical to stay focused on the market. Past attempts in the 1980s to establish cocoa in Vietnam succeeded at the farm level in terms of trees bearing fruit, but failed nationally when farmers could not find a market for their beans. Today, Vietnam successfully exports a number of crops to the global markets and is even making a bid to enter the World Trade Organization. However, this new access to the world market does not necessar-

ily extend down to the farmer level. And it is to the farmer level where the cocoa market needs to extend, or the farmer will not have any incentive to plant cocoa and care for it.

Reaching Farmers

In its 3-year scope, the SUCCESS Alliance is working in small geographic areas within four provinces. In cooperation with local partners, the provincial Departments of Science and Technology, Agriculture, and Extension, the SUCCESS Alliance identifies target communes, the smallest administrative unit in Vietnam, and hamlets within the communes for cocoa development. Next, consultations are held with the commune leaders to introduce them to the crop, the markets, and the potential benefits it can bring to farmers through crop diversification and increased income. Next, the commune leaders organize a community consultation meeting, where cocoa as a crop and the project dimensions are introduced to interested farmers in each hamlet. Usually, farmers are most concerned about the market, the prospects for cocoa as an economically viable crop. To address this, traders and exporters are on hand. Cargill and ED&FMann have been especially active in introducing the cocoa market to farmers and setting up modest buying centres in production areas to stimulate market development.

Interested farmers then register themselves to participate in the project. The



Farmer training facilitator demonstrating pruning technique in Farmer Field School. (Nguyen Huu Dinh)

[*] The SUCCESS Alliance is a public-private partnership comprised of ACDI/VOCA, Mars Inc., USAID, USDA, and the World Cocoa Foundation.



Farmer explaining to other farmers proper shade management for young cocoa. (Nguyen Huu Dinh)

commune extension officer and People's Committee make a final selection of farmers based upon their ability to meet certain criteria, such as land sufficiency, available shade crops, access to water for irrigation, and commitment to attend training and follow recommendations. The selected farmers are organized into cocoa clubs of approximately 40–50 farmers each. Each cocoa club then democratically selects a member to be their training facilitator. The candidate is interviewed by the project and local partner staff to confirm his or her suitability and capability to perform this function. The successful candidates from the screening then attend a 2-week training-of-trainers (TOT) course at the leading cocoa development centre in Vietnam, the University of Agriculture and Forestry in Ho Chi Minh City, where the new cocoa club training facilitator receives an intensive introduction to cocoa botany, cocoa planting and production methods, and training and group facilitation skills. Upon successful completion of the TOT, the training facilitator returns to his or her hamlet to begin to organize and train the club members to prepare for cocoa seedling planting.

Participating farmers, of whom over 95% have never cultivated cocoa before, receive 100–150 seedlings from the project. These seedlings fulfil the following project purposes in the following order of importance: (1) in the immediate term, farmers learn-by-doing how to grow cocoa on their own farm, (2) a future source of quality bud wood and planting material for vegetative grafting is readily available to each farmer, and (3) in a few years, the trees will begin to produce pods for the farmers' economic benefit and also to stimulate local market development. Often, farmers and local partners request more trees to be distributed to each farmer, but this has proved to be less desirable.

It was a project concern that too many trees at the outset would require too much of the new farmers, in terms of their land and labour. Rather, it is expected that once participating farmers successfully establish the limited number of seedlings provided by the project and those seedlings begin producing beans, farmers will then choose to expand their planting with their own investment. In fact, after only 2 years, this is starting to occur in most project areas.

The SUCCESS Alliance considers quality cocoa planting material to be the key-stone in building a new, sustainable smallholder cocoa industry. For that reason, the Alliance has invested considerable time and effort to develop the capacity of Vietnam nurseries to produce and distribute high-quality cocoa seedlings to farmers in the programme. To date, approximately 1.35 million cocoa seedlings have been produced. About 70% of these are from seven lines of proven, commercially viable clones. The remaining 30% are F1 hybrids. In 2006, the final planting year of this project, another 1.5 million seedlings will be planted, of which approximately 90% will be clones.

Once the farmers receive and plant the seedlings, or the hardware portion of the technology transfer, the software – training and extension – portion of the technology transfer begins in earnest. The training facilitator has a key role to play here. He or she organizes monthly meeting and training sessions of the cocoa club. The training format is referred to as Farmer Field School (FFS). It emphasizes observation of the cocoa agroecosystem, farmers' analysis of problems they observe and then recommendations of solutions. Many of the observations on the early planting involve the effects of shade, companion crops, and soil conditions on the health and growth of early cocoa seedlings.

Problems with pests and diseases emerge early, so classic exercises such as pest zoos demonstrate to farmers the nature of the pest attacks and possible ways to overcome those.

The SUCCESS Alliance, through its local partners, provides each training facilitator with a training manual. Included in that manual is information on natural predators and beneficial insects for cocoa, such as the black ant (*Dolichoderus thoracicus*) and weaver ants (*Oecophylla* spp.), and also ingenious ways of treating the cocoa tree systemically against *Phytophthora palmivora* by using a trunk injection of potassium phosphonate.

These training sessions take place on the farms of club farmers, so that the farmers can observe the actual on-farm field cocoa performance under different field conditions. Also, by rotating the location of the FFS from farm to farm, month to month, member-farmers engage in healthy competition amongst themselves to prove who is taking the best care of their cocoa crops.

In addition, some more mature farms are developed and maintained by the project as model farms and demonstration plots, where new farmers visit to see how cocoa grows to maturity and the effects and benefits of good farm management practices on tree health, growth, and pod production.

Quality Focus in the Supply Chain

The Ford Motor Company has long had the motto that "Quality is Job #1". Likewise, the SUCCESS Alliance emphasizes quality at every link in the Vietnam cocoa supply chain to achieve its ambitions of a sustainable smallholder industry. This begins with quality planting material, continues with quality technical transfer and training, and ends with quality emphasis in post-harvest processing and grading. The goal is that Vietnam will become a new origin of high-quality, fermented beans in East Asia.

The SUCCESS Alliance, through USAID funding, is establishing farmer management fermentory sites in key cocoa growing areas. These have the functions of (1) verifying the results of recommended fermentation procedures, (2) demonstrating to and training farmers in fermentation, and (3) providing an immediate buying point for fresh pods and beans from neighbouring farmers who may not yet have the volume to consistently ferment beans themselves. The next step in the process is the development of Vietnam's cocoa bean quality standards, which did not exist before. To be finalized in early



2006, these standards will guide the success of Vietnam's fermented cocoa beans in the world market.

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WCF Initiative for African Cocoa Communities

The Initiative for African Cocoa Communities (IACC) by the WCF (World Cocoa Foundation) represents a significant expansion of the cocoa industry's support for West African cocoa growing communities.

The WCF was founded in 2000, with the goal of strengthening cocoa sustainability in all of the world's cocoa growing regions. The mission of the organization, whose membership now includes more than 40 leading chocolate and cocoa companies worldwide^[*], is to promote a sustainable cocoa economy through economic and social development and environmental conservation in cocoa growing communities.

A centrepiece of the WCF approach is its support of responsible sustainable cocoa growing. The organization sees cocoa as a powerful economic development tool that can improve the quality of life in cocoa growing regions. Bill Guyton, the Foundation's president, describes cocoa sustainability as a win-win for the chocolate industry and for local farmers and communities who produce cocoa.

Along the way the Foundation's governing board was concerned that additional emphasis needed to be placed on efforts to assist West African cocoa farming families and their communities. West Africa produces 70% of the world's cocoa and the crop can be an engine for economic opportunity and community development. In the Côte d'Ivoire, for example,

[*] World Cocoa Foundation Members

Organizations: APROCAFA; Anecacao; CAOBISCO; Chocolate Manufacturers Association; National Confectioners Association.

Companies: ADM Cocoa; Armajaro; Barry Callebaut; Blommer Chocolate Company; Cacao Real S.A.; Cargill; Chocolat Frey AG; Chocolive; CI Caacao; Cloetta Fazer; Compañía Nacional de Chocolates S.A.; Continaf; Corigins; Ferrara Pan Candy Company; Ferrero; Ghiradelli Chocolate Company; Godiva Chocolatier, Inc.; Guittard Chocolate Company; Jelly Belly Candy Company; Kraft; Lindt & Sprüngli; Machu Picchu Coffee Trading S.A.C.; Mars Incorporated; Nestlé; Nidar AS; nSpired Natural Foods; Olam; Promotion in Motion Companies, Inc.; Quality Candy; R.C. Purdy Chocolates Ltd.; R.M. Palmer; Scharffen Berger; See's Candies, Inc.; Starbucks Coffee Company; The Hershey Company; Toms Confectionery Group; Touton; World's Finest Chocolate.

cocoa provides more than 50% of household income for the five million people living on that country's 600,000 farms.

IACC Programmes Build on Efforts Already Underway

In May of 2005 members of the WCF launched the IACC, a new public-private partnership that is a significant expansion of the chocolate and cocoa industry's commitment to bring about positive, meaningful change in the West African cocoa sector.

IACC brings together industry, farmer groups, NGOs, development groups and others committed to the future of West Africa. This public-private partnership approach already forms the basis for efforts underway in the West African sector to help cocoa farmers and their families. One unique feature is that individual WCF member companies or groups of member companies can sponsor and fund specific projects through IACC. To ensure that such IACC programmes fit the WCF's overall mission, the WCF Executive Board agreed that any IACC programme must have as its goal at least one of the following:

- Increasing farm family incomes
- Improving the health, safety and well-being of cocoa farmers and their families
- Supporting improved access to quality, relevant education
- Strengthening biodiversity and wildlife conservation
- Building stronger, more prosperous cocoa farming communities

Each IACC project undergoes an extensive review process by the WCF West African Committee to ensure it fits one or more of these goals. After the West Africa Committee review, the WCF Executive Board must review and approve the project before it can move ahead as part of IACC.

Cargill, The Hershey Company, Mars Incorporated and Nestle USA are among those providing initial support.

Many of the initial IACC projects address education and training – either traditional education for children or education and training for older children and adults so that they have the skills to improve the health, safety and well being of their families and communities. IACC programmes include:

IFESH/Hershey: Teacher Training in Côte d'Ivoire and Ghana

The Hershey Company has partnered with the International Foundation for Education and Self-Help (IFESH) on a



Kwesi Dzidzienyo (country Representative, IFESH - Ghana), Dave Stuart (The Hershey Company), An-njeannette Jones (IFESH Volunteer Teacher, Ghana), Djama Egueh Elmi (Country Representative, IFESH - Djibouti), Pamela Fisk (IFESH Volunteer Teacher, Côte d'Ivoire), Sierra Hutchinson (IFESH Volunteer Teacher, Côte d'Ivoire), Robert Peck (Program Manager, WCF), and Julie Sullivan (Director and CEO, IFESH) at the IFESH teacher training in Phoenix, Arizona

programme to enhance education by providing teacher training for primary and secondary school teachers in the cocoa growing regions of Côte d'Ivoire and Ghana. IFESH, founded by the late Reverend Leon H. Sullivan, has two decades of experience in providing successful, sustainable education in sub-Saharan Africa. Volunteers participating in the IFESH programme are working with local teachers to improve the school curriculum and teaching techniques, thereby benefiting nearly 20,000 students per year. The teachers also will work with adult cocoa farmers to improve functional literacy. Initial commitment: 2 years.

Winrock/Mars: Enhancing Educational Opportunities in Côte d'Ivoire

The Mars Inc. partnership with development agency Winrock International focuses on economic and social issues in cocoa growing communities of Côte d'Ivoire including initiating community support for schools and providing fundamental agricultural education. The initiative is an expansion of the successful CLASSE (Child Labor Alternatives through Sustainable Systems in Education) programme, funded by the US Department of Labor. Initial commitment: 2 years.

Winrock/Norwegian Chocolate Manufacturers: Setting up a Future Farmers Club in Côte d'Ivoire

The Norwegian Association of Chocolate Manufacturers has made a 3-year commitment to Winrock's CLASSE project which will focus on training older children on improved farm techniques while setting up a future farmers club to develop leadership and communication skills. The project's aim is to begin development of a new generation of farmers with skills and opportunities to ensure the well being of cocoa farm families in Côte d'Ivoire. Initial commitment: 3 years.



Representatives from STCP, Côte d'Ivoire Ministry of Education and Winrock CLASSE Project during an educational exchange programme in Brazil

Mars/NCA/WCF: Expansion of STCP's Farmer Field Schools

Mars Inc., NCA and WCF are supporting an expansion of the highly successful Farmer Field Schools coordinated by STCP (the Sustainable Tree Crops Program) in Côte d'Ivoire, Ghana, Nigeria and Cameroon. These classrooms without walls in the rural areas of West Africa can mean the difference between a good year and bad, between a marginal business and a thriving cocoa farm. Family incomes for the 10,000 farmers who have already graduated from the schools have increased by 20–50%.

A Great Start: Future Success Depends on Support

In the months ahead, WCF hopes to announce additional initiatives focused on the broad range of issues affecting the well being of cocoa farming communities. Guyton notes that building stronger, more prosperous cocoa farming communities won't happen overnight, but with the vision and long-term commitment of the IACC's public and private partnerships, WCF can make a real difference.

For more information on WCF and the IACC, go to www.WorldCocoaFoundation.org

Long-Lost Relatives

Molecular tools have confirmed what some pathologists have long surmised: *Crinipellis perniciosa* and *Moniliophthora roreri*, the pathogens causing witches' broom and frosty pod rot disease respectively, are not only closely related but belong in the same genus.

Similarities in disease symptomatology and host preference were noted as long ago as 1918. Nonetheless, at that time they were placed in different fungal phyla. *Crinipellis perniciosa* belongs in the order Agaricales of the Basidiomycota; it produces the mushroom fruiting bodies characteristic of agarics. Taxonomic placement for *Moniliophthora roreri* has been more difficult to determine, in large part because this fungus does not undergo any known sexual fructification (fungi are clas-

sified by their sexual fruiting bodies).

In 1981 Harry Evans and various collaborators began a long campaign, aided over the years by technological advances, to establish the true identity of *M. roreri*. They suggested that the two cocoa pathogens might be closely related but had no hard proof. At that time the causal agent of frosty pod rot was classified (as *Monilia roreri*) within the Ascomycota as an anamorphic (or asexual) fungus, believed to be related to brown rot of stone fruit.

The first ripple came in 1978 when TEM (transmission electron microscopic) studies revealed the presence of so-called dolipore septa – the hallmark of a basidiomycete – within the hypha of the frosty pod rot pathogen. The genus *Moniliophthora* was erected by Evans and co-authors to accommodate this presumably anamorphic fungus within the Basidiomycota, but its placement within that phylum remained uncertain. Additional cytological studies tantalizingly hinted that *M. roreri* might be undergoing a cryptic form of sexual reproduction.

The work of Cathie Aime of the US Department of Agriculture - Agricultural Research Service in Beltsville, Maryland, has provided a definitive answer. Detailed molecular phylogenetic analysis of five variable gene loci, including ribosomal and protein-coding DNA regions, provided statistically significant evidence of a sister-species relationship between the two pathogens – but also indicated, surprisingly, that neither belongs in the genus *Crinipellis* – a large genus of otherwise saprotrophic (decomposer) mushrooms. Mycologists must follow the rules of the International Code of Botanical Nomenclature whenever the name for a fungus is changed or a new name erected. Thus, by following the Code, Aime has proposed a new name change – this time not for the frosty pod rot pathogen, but for *Crinipellis perniciosa*. In order to have the fungal taxonomy reflect the nature of the biological relationships between these two pathogens, the causal agent of witches' broom of cocoa will be changed to *Moniliophthora perniciosa*.

While this work ends the long-running mystery about the taxonomic identity of the frosty pod pathogen, as always in research there are still questions to answer: especially about the biology and reproduction of frosty pod rot. The good news is that the relatedness of the diseases allows common methods of control to be explored.

Main source: Peabody, E.K. Fungal threats to cocoa share an ancient history. *Agricultural Research* 53(10) October 2005.

www.ars.usda.gov/is/AR/archive/oct05/



Flower cushion on cocoa stem infected by witches' broom pathogen (swollen shoots, above) and frosty pod pathogen (on pod, below), western Ecuador. (H.C. Evans)

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