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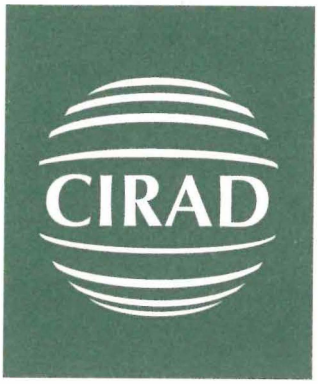

Innovation in West African smallholder cocoa: some conventional and nonconventional measures of success

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Innovation in West African smallholder cocoa: some conventional & nonconventional measures of success

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L'Innovation dans les cacaocultures ouest-africaines: quelques constatations conventionnelles et nonconventionnelles de leur succès

Résumé

Deux enquêtes menées parallèlement à la fin de l'année 1994 auprès de planteurs de cacao du Ghana et de Côte d'Ivoire, importants producteurs, ont permis d'évaluer leur niveau de performance dans le domaine de l'innovation. Contrairement à certaines hypothèses pessimistes, on assiste dans les deux pays, à une large échelle, à une intensification partielle, alors que l'adoption de l'ensemble du paquet technologique préconisé par la recherche ne se retrouve pas. En outre, aucune des deux cacaocultures semble bloquée par la raréfaction des réserves forestières. Cependant, ces innovations ne se traduisent pas toutes par des gains de rendement. D'un autre côté, ni l'âge, ni la scolarisation--critères souvent invoqués--sont à leur origine; de même, les relations avec les organismes de vulgarisation ne sont qu'une explication partielle. La clé de l'utilisation de pesticides serait à rechercher dans la taille des exploitations et le statut de migrant du planteur. A l'inverse, le renouvellement du verger (c'est à dire sur des précédents non forestiers), au moins dans sa phase initiale, serait le fait de planteurs disposant de peu de ressources en terres et en numéraire.

Mots clés: innovation, cacao, adoption, durabilité, Ghana, Côte d'Ivoire

Innovation in West African smallholder cocoa: some conventional & nonconventional measures of success

Abstract

Parallel surveys of cocoa farmers in Ghana and Côte d'Ivoire in late 1994 permit a reexamination of the record on innovations for this important cash crop.Contrary to various pessimistic hypotheses, partial intensification is fairly widespread and on the rise, though adoption of the complete package recommended by research virtually nil. Nor do the systems appear blocked by the rarefaction of forest reserves. Yet not all innovations register the anticipated yield gains. Neither age nor schooling are determinants of adoption, and contact with extension only partially so. Rather, scale and migrant origin are key for pesticide use. By contrast, renewal (planting on non-forest lands) may be associated with resource-poor farmers in the initial stages.

Key Words: innovation, cocoa, adoption, sustainability, Ghana, Côte d'Ivoire

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1. Introduction

For large regions of the West African humid tropics, smallholder cash cropping is synonymous with cocoa. This is especially true in Côte d'Ivoire and Ghana, neighboring countries which, at roughly 800,000 t and 300,000 t production annually, account for over 40% of world supply. The rapid diffusion of cocoa-growing, in Ghana in the early part of this century, in Côte d'Ivoire following Independence, can be considered one of the more profound innovations in local production systems in modern times (Chauveau). Yet the received wisdom--within the cocoa profession, in government circles, and among many agricultural scientists--is that innovation stops here. West African cocoa farms are often likened to systems of hunting and gathering (*"culture de cueillette"*), on grounds that they are barely less extensive. Such perceptions are based on conventional indicators of innovation. Although country-wide farm-level surveys are rare, both casual observation and more localized studies suggest that adoption rates for the intensive package recommended by research are low, and the industry estimates yields well below the 2 to 3 t/ha obtained on station.

Relatedly, concerns are increasingly raised concerning the sustainability of cocoa production systems. As acreage expansion along the extensive margin leads to the disappearance of forest reserves, there are doubts as to farmers' willingness to move toward cocoa systems based on reconversion of old plantations and fallow lands (Ruf). If the pessimists are right, the days of West African cocoa are numbered, and with it an important source of income for both farmers and the economy at large. If not, there may nevertheless be the need for research and complementary policy measures to accompany the transition to more stable production systems.

These are among the questions posed by a project examining the competitiveness of West African cocoa in relation to the new sources of supply in South-East Asia. In this context, we surveyed 482 cocoa farmers across Côte d'Ivoire and 356 in Ghana in late 1994, on a parallel basis, concerning agronomic and labor management practices at the plot level and socio-economic conditions of the household. The juxtaposition is of interest because the cocoa farming systems have a great deal of similarity in terms of social organization and agro-ecological conditions of production, and yet a quite different history of incentive structures in the post-Independence period. Following a brief

background to the comparison, we summarize the preliminary results on innovation patterns and the estimated impact on yields, and the socio-economic and institutional factors associated with innovation.

2. Some background to the cross-country comparisons

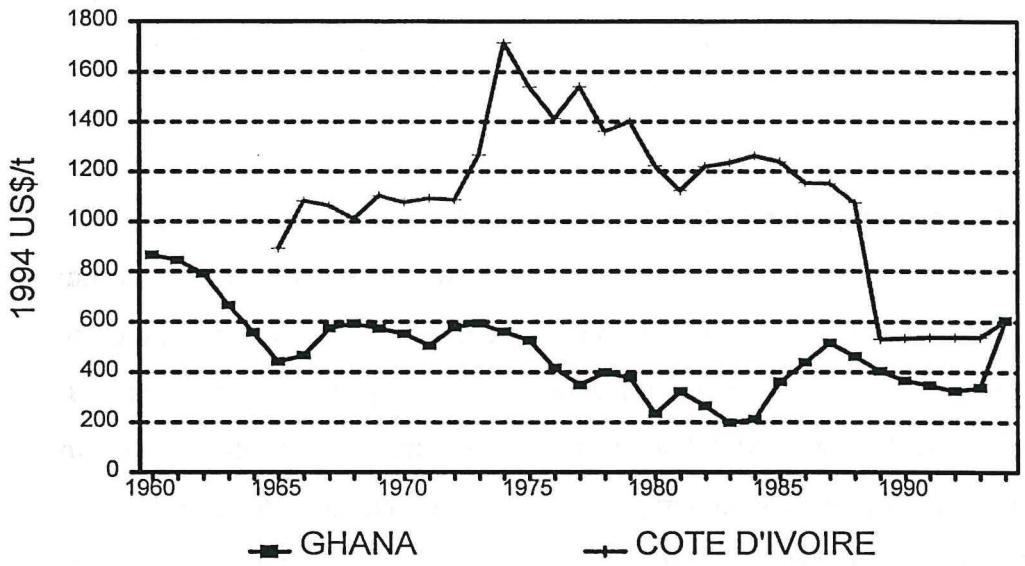
Cocoa in both countries began in the more densely populated and better-traveled eastern regions, and expanded along a westward path, waves of migrant farmers leading the way. Farmers today typically own several cocoa plots, and over 40% of households use sharecroppers to manage some of these (1/3 of plots surveyed). Labor hiring is also frequent: only 1/4 of Ghanaian and 1/3 of Ivorian households surveyed use only family labor. An overwhelming majority (90%) of farmers consider cocoa their first source of agricultural revenue, coffee taking an important second place in eastern and central Côte d'Ivoire. Food crop sales are the only agricultural alternative in Ghana, but a higher proportion of farmers there (10% versus 3%) declare non-agricultural revenue sources to be more important than cocoa. Ivorian farms are somewhat larger (average total holdings of 17 ha, of which 7.5 ha cocoa, versus 10 ha of which 5.5 ha cocoa), and the ratio of the household labor force to farmland somewhat lower (roughly 2 ha cultivated/active person vs. 1.5 ha in Ghana). Ghanaian heads of household are a bit older (54 years versus 47 on average).

From an agro-ecological point of view, the only major difference is the disproportionate impact of the Cocoa Swollen Shoot Virus Disease (CSSVD), detected in Ghana in the late 1930s and soon afterwards in Côte d'Ivoire. In Ghana the virus caused major losses over the next two decades, although its current impact on output is uncertain. Hypotheses vary as to the reasons (CSSVD, poorer husbandry, older trees), but converge on the conclusion that average yield levels are lower in Ghana. At 240 kg/ha in Ghana and 380 kg/ha in Côte d'Ivoire (values close to the official figures) our survey is no exception.

Agricultural services have also been quite similar in nature, consisting of seed distribution, extension advice, and, at various times, incentive-oriented policies including chemical and equipment subsidies and bonuses for planting or rehabilitation. Financial and institutional reforms since the late 1980s have led to the virtual disappearance of

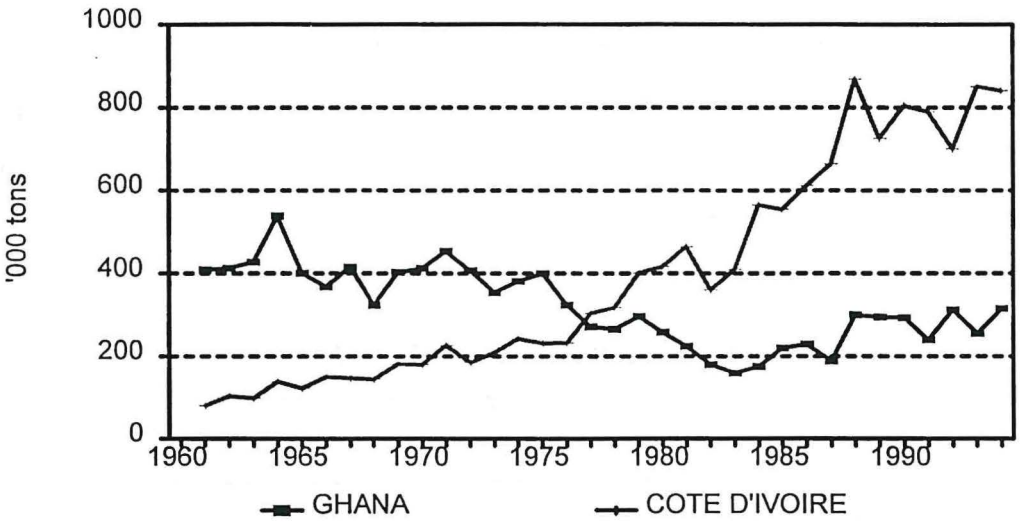
services in Côte d'Ivoire, and to major cutbacks in Ghana, albeit with a continuation of input subsidies there. The overwhelming difference in incentive policies concerns levels of output prices, in both cases administered in regulated marketing systems. Fiscal and exchange rate policies combined to produce a situation where, for the 30 years preceding the 1994/95 season, Ghanaian farmers received a lower real price than their neighbors, by as much as a factor of five (Graph 1).

Graph 1. Real producer prices
(using local consumer price indices)



The consequences on output have been commensurate, with 20 years of boom and bust, respectively (Graph 2). The past ten years have seen some improvement in Ghana's case, following macro-economic reforms, and then stagnation in both countries. While this plateau could be taken as evidence of the onset of ecological decline, it coincides with a decline in real producer prices, by dramatic proportions in Côte d'Ivoire, an outcome of the prolonged crisis in the world cocoa market.

Graph 2. Cocoa production trends



3. Innovation patterns: the "package" and its components

Cocoa in this region is generally grown in association with various food crops during the first few years, and then in single stand once the canopy closes. In Ghana these associations are quite similar across farms (plantains for shade, associated with maize and then cassava), while in Côte d'Ivoire there is substantial variation, essentially according to ethnic and geographical origin: yam-based systems (Akan groups), maize-based systems (groups from the north), and rice-based systems (groups from the western forest zone). Primary processing--fermenting and drying--is done by farmers prior to sale. The basic "package" of recommendations concerns the establishment phase and annual care of the adult cocoa farms, both important for productivity of the trees, and post harvest handling, which affects bean quality. The survey did not focus on the latter techniques, cocoa quality being high by world standards.

Principal recommendations for the establishment phase concern varieties, planting methods, and shade levels. For seeds, the innovation concerns the switch from the original "amelonado" type towards varieties selected for higher yields, precocity, and better tolerance against CSSVD. Selected upper amazonian strains began to be released in Ghana in the 1950s, and hybrid varieties in both countries in the 1960s. Although adoption rates of certified seed are not high (roughly 20% of the surveyed plots in Ghana

and 10% of those in Côte d'Ivoire), use of their descendants has been widespread, with the result that only 1/4 of current area in Côte d'Ivoire is planted to amelonado alone or as the dominant type in mixtures, and just over 15% in Ghana.

Planting methods for cocoa run from direct seeding, generally at densities well above recommended levels, to the considerably more labor-intensive transplanting of seedlings, either in bare earth or polybags. For both yield and precocity, research recommends the polybag system, followed by the bare earth transplants, followed by direct seeding at recommended spacing. Transplanting, particularly with polybags, also cuts down considerably on losses of young cocoa in harsh environments. Here, the rates of adoption of the recommended techniques are far higher in Côte d'Ivoire, with over 1/2 of the plots at least partly transplanted, and nearly 1/4 with the polybag method. In Ghana, 3/4 were seeded directly, and only 15% transplanted with polybags. In both cases, there is some association of transplanting with more hostile environments.

Shade concerns the density of forest trees left in the plots (or planted) to protect adult cocoa trees. Recommendations have changed over time, and differ between the two countries. In Ghana, the earlier view that cocoa thrives best under heavy shade gave way in the post-war period to a prescription of mild shade, for both yield levels and precocity. In Côte d'Ivoire this mild shade prescription shifted to one with none at all, *as long as cocoa is grown with fertilizers*, full exposure to sunlight raising the risk of soil degradation. The data suggest that changes in shade management practices have been commensurate with these shifts. While "mild shade" represents the norm (over half the area) in both countries, it is the innovation in Ghana (where heavy shade still accounts for nearly 30% of total area), and the older practice in Côte d'Ivoire (where "no shade" comprises nearly 40% of total area). In Ghana, no shade situations have also increased, but more timidly, and generally in association with a non-forest precedent rather than as a result of deliberate removal of shade trees.

Fertilizer applications on cocoa at whatever shade level (or on other crops, for that matter) are rare in Côte d'Ivoire (where 10% of farmers have tried fertilizers at least once) and practically nonexistent in Ghana (2% of farmers). Although part of the maintenance package for adult cocoa in full exposure, fertilizers have not been a major focus of diffusion efforts. The same might be said of fungicide treatments against the

mild strain of black pod (*phytophtora palmivora*), virtually absent from farmer practices. (The survey did not cover the areas in Ghana--still marginal--where the more virulent *phytophtora megakarya* has begun to make inroads, and for which treatment issues are quite different). By contrast, insecticide treatments against capsids, which defoliate cocoa trees, have been considered a central element of the package in both countries. The adoption patterns are strikingly similar. Roughly half of the farmers treated in 1994, but well below the recommended 4 times per year, with most Ghanaians treating once, and most Ivorians twice. Of the non-adopters, roughly a quarter had never treated, and most of the remaining quarter had abandoned treatment in the wake of recent price events: in Ghana, the temporary removal of input subsidies in 1990, and in Côte d'Ivoire, the halving of the producer price in that year and the near doubling of input prices in early 1994 with the devaluation of the CFA franc.

The rest of the maintenance package consists of labor-based tasks: weeding, pruning, removal of parasitic plants, filling in gaps left by dead trees. The available indicators suggest roughly similar overall patterns, perhaps with a slight edge in Côte d'Ivoire. Two weedings per year is the norm in both countries (just over 1/2 of the surveyed plots), but a higher share of Ivorian plots fall above that value (36% versus 23% in Ghana). A majority of farmers indicate that they fill in holes with seedlings where needed. Almost all farmers indicate that they do some pruning (most often at the time of weeding), though few own pruning shears (10% in Côte d'Ivoire, next to none in Ghana). A similar proportion (20%) own or borrow the specialized knives for cutting mistletoe, and roughly the same number (12-14%) indicate this to be their major problem. Yet indirect evidence suggests that Ivorian farmers may do more grooming, as they appear to spend more time in the field: owner visits of plots managed by sharecroppers are five times more frequent than in Ghana.

To go beyond these individual practices to a cumulative indicator of adoption, we constructed a simplified typology, measuring gradients of intensification in the establishment phase by planting method and seed type, and in the maintenance phase by the number of anti-capsid treatments. As Graph 3 illustrates, the intersection of the two axes yields 5 basic categories of conduct, moving from extensive modes in both phases (class 1A) to the most intensive (class 4). It shows the distribution of adult cocoa plots

and, in parentheses, farm households, classified according to their "best" plot.

Aggregated across groups, the data show the roughly similar share of farmers who treat against capsids (classes 2, 3, and 4) and the higher rate of transplanting in Côte d'Ivoire (classes 1B, 3, and 4). In Ghana, those who do transplant have a stronger tendency to associate intensive maintenance (only 1/3 of transplanted plots fall into class 1B, versus nearly 2/3 in Côte d'Ivoire). Overall, more than 1/2 of farmers in Ghana and 3/4 of those in Côte d'Ivoire show some signs of intensification in relation to the package, even if the small numbers in class 4 (itself less stringent than the full package of recommendations) suggest that the limits are reached fairly quickly. In both countries, the average ages of plots by class suggest a progression toward more intensive techniques over time.

Graph 3. Typology of intensification of mature cocoa plots (households)

<table>
<tr><th rowspan="3">MAINTENANCE LEVEL (anti-capsid treatments)</th><th colspan="3">ESTABLISHMENT METHOD</th></tr>
<tr><th rowspan="2">DIRECT SEEDING, uncertified seed</th><th colspan="2">TRANSPLANTING</th></tr>
<tr><th>BARE EARTH METHOD, any seed (no amelonado in 3)</th><th>POLYBAG METHOD, certified seed only</th></tr>
<tr><td>NO TREATMENTS</td><td>CLASS 1A:
GHANA: 44% (43%), 22yrs
COTE D'IVOIRE: 23% (20%), 23yrs</td><td colspan="2">CLASS 1B:
GHANA: 7% (9%), 16yrs
COTE D'IVOIRE: 32% (34%), 19yrs</td></tr>
<tr><td>AT LEAST 1 TREATMENT</td><td rowspan="2">CLASS 2:
GHANA: 35% (32%), 24yrs
COTE D'IVOIRE: 22% (21%), 15yrs</td><td colspan="2" rowspan="2">CLASS 3:
GHANA: 10% (11%), 14yrs
COTE D'IVOIRE: 20% (20%), 16yrs</td></tr>
<tr><td>AT LEAST 2 TREATMENTS</td><td>CLASS 4:
GHANA: 5% (5%), 16yrs
COTE D'IVOIRE: 3% (4%), 16yrs</td></tr>
</table>

4. Innovation patterns: sustainability issues

Although certain elements of the package (fertilizer, anti-capsid treatments, grooming for mistletoe) are intended to enhance not only yields, but also the longevity of cocoa trees, the long-term dynamics of these systems depend on at least two factors outside the package itself: the age profile of the area planted to cocoa, and, relatedly, the availability of suitable land for new plantings. It is commonly assumed--particularly in Ghana--that farmers keep their plots in activity well beyond the age of prime yields (25 to 30 years). While the reasons could be socio-economic in nature (unfavorable

prices, aging of the farm population--Nyanteng), reluctance to renew orchards could also stem from difficulties encountered in replanting on less fertile non-forest precedents, the only option left for farmers as the forest recedes (Ruf). In addition to necessitating more time for weeding and replacement of dead seedlings in the establishment phase, planting on non-forest precedents is presumed to tax yields.

Contrary to such hypotheses, the survey findings suggest considerable dynamism regarding both the age profile of cocoa and the management of post-forest lands. A sizeable proportion (20%) of cocoa area in Ghana is indeed "past prime" (over 30 years old), but a much greater share (over 40%) has been planted in the past 10 years. Although the expansion areas in the Western Region have led the way in new plantings, renewal in the older regions, and particularly the original production zone of Eastern Region, has been significant. In Côte d'Ivoire, the smaller share of old cocoa (6%) is not surprising, given the more recent history of expansion. At just under a quarter of total area, new plantings are also important. Here, the role of renewal is even more pronounced: the share of new plantings in the East, the oldest region, is as high as in the areas being opened up in the South-West. The net result is that today's "oldest" regions (as measured by average age of plots) are those established in the intermediate phase of expansion--Ashanti Region in Ghana, and the Ivorian Central-West.

The majority of cocoa is indeed planted on lands cleared of forest trees: 88% of the area in Côte d'Ivoire, 68% in Ghana. But the evolution of precedents indicates two major innovations in land use. First, within the "forest" category, there is a decline in the share of virgin forest and a rise in secondary forest, i.e. cultivated lands which have been let go back to bush for 15 to 20 years. In Ghana, twice as densely populated as its neighbor at Independence, management of secondary forest lands has been a longstanding activity. They have steadily accounted for roughly 40% of plantings over the past 25 years, and represent over 1/2 of the total area under forest precedent. In Côte d'Ivoire, where many cocoa areas were sparsely inhabited before the arrival of migrants, virgin forest still accounts for 90% of the total forest precedent. But the trend toward use of secondary forest seems well established, moving from only 5% of new plantings 25 years ago to 30% in the last 5 years.

The second innovation is the steady increase in the use of the non-forest

precedents which currently account for the remaining third and tenth of cocoa area in Ghana and Côte d'Ivoire, respectively. In Ghana, old cocoa stands and weeded fallows have moved from only 10% of plantings in the decade surrounding Independence, to over half of those in the last 5 years. In Côte d'Ivoire, the trend is once again more recent, but clear: a small amount of replanting since Independence, essentially on old coffee farms, has given way to roughly a quarter of the past 10 years' plantings on assorted non-forest precedents: coffee, weeded fallow, and old cocoa. The rates are highest in the eastern regions of both countries.

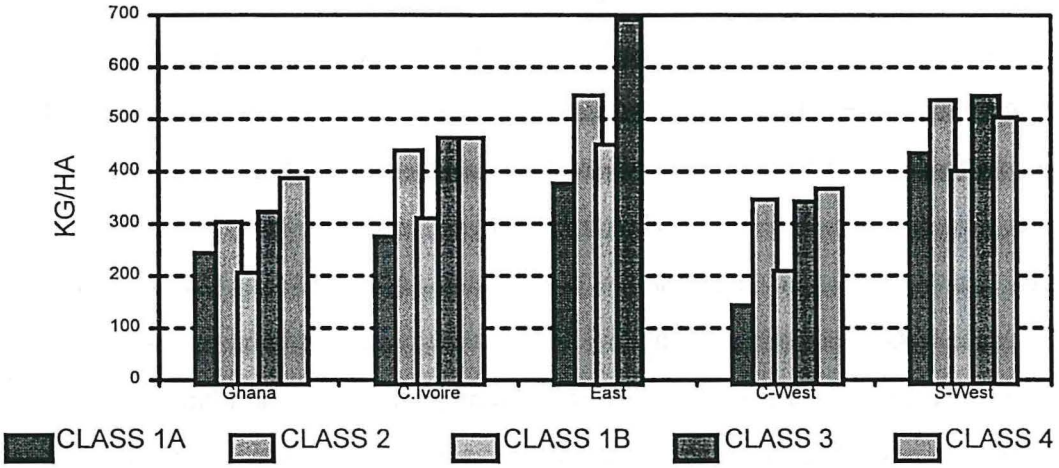
5. The impact on yields

The innovations constituting the "package" are all intended to raise yields, a central factor in the economics of innovation when it implies additional costs, as is the case with chemical treatments (essentially a purchased input cost) or transplanting (which adds to the labor costs of investment). Data from the survey, which measured yields in 1992/93 and 1993/94 based on declared area and output, permit an examination of the determinants of this productivity indicator in the field. The preliminary results raise a number of questions.

A simple way of looking at the cumulative impact of intensification is by comparing average yields of adult cocoa according to the typology developed above (Graph 4). For Ghana, where the absence of regional differences permits the presentation of a single curve, there is a clear effect of treatments under extensive planting (gain of over 60 kg moving from class 1a to 2), but an apparent drop when moving to more intensive planting (class 1a to 1b), subsequently recouped under the combined package (classes 3 and 4). In Côte d'Ivoire, there is a larger gain in yields with capsid treatments under extensive planting in all three regions (100 to 200 kg/ha), and an increase of 60-70 kg/ha with intensive planting in the two dryer regions where this practice is quite frequent--East and especially Central-West. There is, however, a drop with intensive planting in the South-West, and, apart from a small number of farms in the East, no additional yield gains when passing from class 2 to the most intensive classes. On average, yields are higher in Côte d'Ivoire at every level of intensity; even at the regional level, the sole exception is the most extensive level in the Central-West, a small fraction

(8%) of total cocoa area.

Graph 4. Average yields by class
1992/3 & 1993/4, cocoa aged 8 - 30



Multiple regression analysis, using a semi-logarithmic specification, confirms this basic picture, at the same time revealing the role of other potential sources of variation. Anti-capsid treatments are highly significant in both countries, and the results on planting methods ambiguous: transplanting techniques register a significantly positive impact in Côte d'Ivoire, but in Ghana there is no significant difference between the polybag method and direct seeding, and an apparent negative impact of bare earth transplants. What this suggests is either that Ghanaian farmers are mainly using these techniques on relatively degraded soils (for which transplanting only partially compensates); and/or that they have not acquired proficiency in their execution (likely for the fairly recent practice of bare earth transplanting). The lack of statistical evidence that elite varieties improve yields is a clue to the flattening of the yield curve for classes 3 and 4, and raises questions concerning seed distribution programs.

The news is also mixed for agronomic factors not incorporated in the typology. The only category of shade which appears to matter is in Côte d'Ivoire, where the prevalent "no shade" practice adds to yields. The general effects of age suggest that cocoa remains in its "prime" under smallholder conditions for quite a long time; farmers who let their cocoa live somewhat beyond age 30 may not be losing much. By the same token, the results on precedent suggest less cause for concern about the effects of

replanting than has been hypothesized. There is no evidence of a negative yield impact for plantings on old cocoa or coffee farms in either country. Cocoa planted on weeded fallows may be at some disadvantage, however: in both countries, there were significant negative effects in one year out of the two.

On the one aspect of grooming which could be captured quantitatively, number of weedings, the results are puzzling: whereas positive impact on yields seems likely in Côte d'Ivoire (significant in one of the two years), the evidence points to a negative impact in both years in Ghana. The discordance may derive from the imprecise nature of this proxy for grooming quality, which controls neither for variability in weed pressure across fields nor for the intensity of the labor input per passage. In Côte d'Ivoire, the negative incidence on yields when young cocoa is planted in association with the rice-based systems of the western forest zone, in comparison with either the yam or maize-based systems, raises questions for research.

Finally, we note the strong positive association of yields and the sharecropping system: in Côte d'Ivoire, where the effect is highly significant in both years, plots thus managed have an estimated average yield bonus of at least 40% over owner-operated plots. In Ghana, where the effect seems probable, the estimated gain is about 25%. These results contradict certain preconceived notions that sharecropping systems put a damper on efficiency. As De Fina has shown, Ivorian sharecroppers select superior plots when negotiating their contracts. It is also possible that these plots subsequently generate higher yields because of better overall maintenance. In any event, sharecropping appears, particularly in the Ivorian case, to be an efficient social innovation. For the owner, the average estimated yield gain actually covers the labor costs of the sharecropper, who earns 1/3 of output under the standard contract.

6. The socio-economic conditions of innovation

A surprising general outcome of the Ghana/Côte d'Ivoire comparisons is the fair degree of similarity in general indicators of innovation, despite a considerably less favorable price level for cocoa in Ghana prior to the 1994/95 season. Indeed, while the Ivorians show signs of somewhat greater intensity in the elements of the package, the Ghanaians have done more planting in the past 10 years. For the dynamics of new

plantings, at least, the relative trends in real producer prices may have been as important as their level: while the Ivorian countryside has been in crisis since the late 1980s, things have improved for Ghanaian farmers since 1985. That a similar proportion of households in the two countries applied pesticides in the 1993/94 season, despite a producer price 1/2 as high in Ghana, is no doubt related, in good measure, to the reintroduction of input subsidies: a survey done by the Cocoa Research Institute of Ghana just following their removal in 1990 found a much lower use rate (20%).

To understand the dynamics of innovation processes, it is also important to move beyond the role of the incentive structure faced by farmers as a group, to the factors which differentiate the adopters from the non-adopters. When households are distinguished by three broad types of capital commonly considered in the literature, the patterns of intensification do not always coincide with the expectations. The first is human capital related directly to the head of household. Schooling, one of the more common proxies for openness to science-based innovations, has at best a weak relationship to adoption. Ghanaian cocoa farmers have both high rates and levels of education--60% of farmers have some education and nearly half at secondary level or higher--yet the only link to intensification is among the handful (7%) of university educated farmers. In Côte d'Ivoire, where less than a third of the farmers had some schooling (and none beyond secondary level), there is, if anything, a negative correlation with adoption.

Contact with extension services is another common indicator of knowledge and openness to change. In Côte d'Ivoire, a positive relationship is confined to establishment methods: the 28% of farmers' who received advice, seeds, and/or other assistance were almost twice as likely to transplant, but only about half as likely to treat against capsids. The link is much stronger in Ghana, where 35% of farmers have had some contact: they are 1.5 times more likely to treat, more than 4 times more likely to transplant, and nearly 6 times more likely to adopt both types of techniques.

Earlier we noted the leading role played by migrant farmers in the westward expansion of the cocoa in both countries. It turns out that migrant status is also a key to differentiation among households in terms of farming practices. In Ghana, where roughly 30% of those surveyed could be classified into a loose definition of migrant

(origin outside of the village of residence), migrants were somewhat more likely to transplant, and twice as likely to combine intensive practices (classes 3 and 4) as non-migrants. In Côte d'Ivoire, where half of the farmers surveyed were migrants in the strict sense (origin outside of the region), the rates of adoption of pesticides was over 4 times higher than among non-migrants, and of combined intensive practices nearly 3 times higher. While the migrant group in Ghana was also better connected to extension services, the reverse is true in Côte d'Ivoire. The fact that the various ethnic groups which are present in the migrant category all appear to have similar behaviour as concerns intensification patterns runs counter to the literature's tendency to focus on ethnic-based interpretations of dynamism in Ivorian cocoa.

A final characteristic of the head of household upon which much theorizing has been done is age. Inasmuch as knowledge can accumulate with time, age could be a positive factor in the likelihood to innovate. Yet as concerns perennial crops, and cocoa in particular, there has been a tendency for the hypotheses to oppose age, at least beyond a certain point, and dynamic behavior on the farm: farmers get old with their trees, and prevent the younger, potentially more dynamic generation, from taking over. As concerns the measures of intensification, we find no evidence of this hypothesis at work. Nor does age matter for either measure of sustainability: new plantings and replanting on non-forest precedents.

The second type of capital concerns labor resources of the household, whereby one might expect that households having better access might be more inclined to intensify. We examined this by two types of measures: an aggregate classification of households according to the type of labor used on cocoa (family only, family plus hired labor, family plus sharecroppers, and all three types combined), and a ratio of household labor to the area of cocoa and total area cultivated. The first measure is only mildly discriminating: the minority of households (14%) using all types of labor tend to adopt more intensive practices along both axes, and households using only family labor are a bit more likely to fall into the most extensive group. By the second measure, we find the reverse of what one might have expected. Rather than being associated with a greater availability of labor, the intensification process appears to enable greater efficiency in its use.

The third type of capital concerns physical resources available to the household. Scale of operations appears critical, particularly in Côte d'Ivoire. At 10 - 11 ha, the average area under cocoa for households in all three classes which treat against capsids is double that of the households which do not. The yield impact of treatments leads to an even greater divergence of output levels: average sales of cocoa in 1992/93 and 1993/94 amounted to 1300 kg for the households in the most extensive class, and rose to 4 tons and more for the households using pesticides. In Ghana, those who treat have, on average, an additional 1.5 ha of cocoa (over the 4.3 ha for non-treaters), and nearly double the output: 625 kg versus 1100 kg. As striking as the similarity of the tendencies is the difference in levels: the "best" Ghanaian farms produce less cocoa than the lowest group in Côte d'Ivoire.

In contrast to Ghana, where average revenues from cocoa are low and differentiation relatively limited (less than 1/4 of households with over 1 t. for a median output of 450 kg), there are signs in Côte d'Ivoire that cocoa acts as a catalyst in the emergence of agricultural business operations. With a median output of 1.5 t, nearly 40% of households produce over 2 t., and 15% over 5 t. Larger Ivorian farmers not only have a greater tendency to farm intensively, they also tend toward specialization: the 38% of cocoa farmers who also sell foodstuffs produce half as much cocoa as those who do not. They also tend to acquire means of transport, not only a sign of wealth, but also a means of raising farm-level productivity (economies of travel time for moving labor, seedlings and inputs to the farm and for evacuating produce). Overall, more than 40% of Ivorian farmers own one or more vehicles (usually bicycles or motorbikes), and this variable correlates directly with successive levels of intensification: the average number of vehicles progresses from 0.3 per household in class 1A to one or more in classes 3 and 4. In Ghana, where nearly 90% of farmers sell foodstuffs, there is no trace of specialization underway, and vehicle ownership is practically non-existent.

In a system without rural credit, it is natural that farmers with greater access to capital are more likely to purchase inputs. Farmers who buy their land are also more likely to plant and farm them intensively, both in Ghana, where purchases represent a small share of the total (5%), and in Côte d'Ivoire, where they account for 1/3 of mature plots, again suggesting the association of intensification processes with the dynamics of

agricultural investment more generally.

These tendencies are either less apparent, or even reversed, for patterns of renewal. While, in Ghana, neither scale nor availability of reserves distinguish the 40% of farmers who have done some planting on non-forest precedent from the rest, the survey corroborates Léonard and Oswald's observation that Ivorians who have embarked on this process (10% of the sample) are more hard-pressed in both respects.

7. Conclusion

Contrary to expectations, cocoa farming in these two West African countries shows a number of signs of dynamism. Despite a virtual absence of complete adoption of the intensification package, partial adoption is fairly widespread, and increasing over time. Neither the age profile of farmers, nor the system of tenancy, are a hindrance to innovation. Nor do the systems appear blocked by the rarefaction of forest reserves. But if the survey findings permit a rejection of the more pessimistic scenarios, they also point to some queries concerning the scope for raising farm-level productivity. The importance of scale in a system devoid of rural credit highlights the key role of the incentive structure. The fact that not all innovations are unambiguously beneficial from the standpoint of yields under smallholder conditions raises questions for research and extension. Both themes are the subject of work in progress.

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References

Chauveau JP. 1995. L'innovation cacaoyère: histoire comparée de la cacaoculture en Afrique de l'Ouest. In Innovation et sociétés, actes du XIVeme séminaire d'économie rurale, Vol I. Montpellier, France: CIRAD-MES.

De Fina C. 1995. Le contrat de travail dans un univers complexe. Doctoral thesis, Ecole nationale supérieure agronomique de Montpellier, France.

Léonard E, Oswald M. 1994. Une agriculture forestière sans forêt. Communication au colloque " Crises, ajustements et recompositions en Côte d'Ivoire" 28 nov. - 2 déc. Abidjan, Côte d'Ivoire: ORSTOM, GIDIS-CI.

Nyanteng VK. 1993. The prospects of the Ghana cocoa industry in the 21st century. Paper presented at the International Conference on Cocoa Economy, Bali, Indonesia, October, ASKINDO/CIRAD.

Ruf F. 1995. Booms et crises du cacao: les vertiges de l'or brun. Paris: Karthala.

Documents de travail en économie des filières

Déjà parus

1. Benz H., Mendez Del Villar P. Le marché international du riz. Facteurs d'instabilité et politiques des exportateurs. Avril 1993.

2. Freud C., Hanak Freud E. Les cafés robusta africains : peuvent-ils encore être compétitifs. Août 1993. Article à paraître.

3. Gouyon A., Supriono A. De la forêt à hévéas aux usines d'Akron : une production paysanne pour un marché industriel. Avril 1993.

4. Leplaideur A. Innovations récentes dans les réseaux commerciaux et de transformation du riz à Madagascar. Résultat d'une enquête 1991 dans la filière sur Antananarivo, Antsirabé, lac Alaotra. 21 p. Septembre 1933.

5. Moustier P. Etat d'avancement du programme Filmar, phase III (CIRAD-CA/Agricongo). Octobre 1993.

6. Fusillier J.-L. La filière maïs au Cameroun. Quelles perspectives de développement de la production de maïs ? Contribution à l'étude FAC-CAPP/USAID. Octobre 1993.

7. David O., Moustier P. Systèmes maraîchers approvisionnant Bissau. Résultats des enquêtes (15 décembre 1992 au 15 juillet 1993). Octobre 1993.

8. Fok A.C.M. Le développement du coton au Mali par analyse des contradictions. Les acteurs et les crises de 1895 à 1993. Novembre 1993.

9. Cousinie P. Dynamique des systèmes de production en zone cotonnière au Togo de 1985 à 1992. Novembre 1993.

10. Observatoire des marchés internationaux. Fiches produits. Décembre 1993.

11. Naire D.L. Enquête manioc/Pool-Congo. Formes de production et modes de mise en marché des « produits manioc » dans le pays rural de Mindouli. Janvier 1994.

12. Naire D.L. Contexte d'urbanisation et démographie rurale dans le Pool congolais : les villages-centres du district de Mindouli. Janvier 1994.

13. Balde A., Leplaideur A., Pujo L., Tounkara O. Les filières du riz en Guinée forestière. Résultats intermédiaires. Novembre 1993.

14. Hanak Freud E., Freud C. Methodological issues in the analysis of the competitivity of cocoa sub-sectors. Paper presented at the Workshop of the International Conference on Cococa Economy, October 19-22, 1993, Bali, Indonesia. October 1993.

15. De Crozals A. La place des Etats-Unis dans le marché mondial du coton-fibre. Décembre 1993.

16. Fusillier J.-L. La diffusion de la culture du maïs en Afrique de l'Ouest. Communications présentées au séminaire CIRAD-UNB-FAO de Cotonou (Bénin) sur la production et la valorisation du maïs en Afrique de l'Ouest. Avril 1994.

17. Observatoire des marchés internationaux. Fiches produits n° 2. Mise à jour juillet 1994.

18. Mendez Del Villar P. Les marchés mondiaux du riz. Structures et fonctionnement. Observatoire des marchés internationaux. Août 1994.

19. Daviron B. " Le pire n'est jamais certain " éléments sur la dynamique des marchés internationaux des produits agricoles tropicaux. Août 1994.

20. L'unité de recherche Economie des filières. Novembre 1994.

21. Observatoire des marchés internationaux. Fiches produits. Région Afrique de l'Ouest et du Centre. Février 1995.

22. Observatoire des marchés internationaux. Fiches produits n° 3. Mise à jour juillet 1995.

23. Liste des publications 1992-1993-1994. Unité de recherche économie des filières CIRAD. Décembre 1995.

24. Voituriez T. L'huile de palme et son marché : un essai de modélisation. Décembre 1995.

25. Benz H., Fusillier J.-L., Hassane S., Liagre L., Mendez Del Villar P., Sourisseau J.-M.
Les premiers effets de la dévaluation sur les filières riz irrigué au Sahel (Sénégal, Mali, Niger). Synthèse. Décembre 1995.

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