

# Agroecological assessment of Ecuadorian Cacao Production Systems

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## ***Abstract***

Globalization, trade liberalization, and the commoditization of agricultural products have given rise to increasing concerns about mechanisms to preserve ecologically-wise forms of agriculture, which provide multiple social and environmental services on top of being the source of globally scarce goods. One of those goods is the dark chocolate with a perfumed floral scent and fruity flavor produced using Arriba Cacao beans, which come from a genetically distinctive shade-grown, low yield cacao variety from the Arriba region of Ecuador. Due to the fact that the production of these beans has declined in favor of non-aromatic varieties, heterogeneous alliances of farmers, farmer's organizations, non-profit organizations, exporters, local and international institutions, and manufacturers are looking into alternatives for improving the fare of producers, preserving the environmental services of shaded cacao farms, and securing a supply of Arriba beans. With the long term goal of studying the effects of such assorted alliances, the objective of this study was to assess the agro-ecological values of shaded Arriba cacao farms in comparison with other cacao production systems. The study of the tradeoffs among different productions systems will allow us to spotlight the challenges that farmer's face in the search of environmental, social and economic sustainability.

## ***Introduction***

International trends favoring development of commoditized high end, luxury food products have also affected chocolate manufacturers. Given aromatic “fine” cacao is only 5% of the global cacao production responds to aromatic cacao, and Ecuador produces at least half of that volume (ICCO, 2006), there have been interest into capitalizing out of the exclusivity of a chocolate made out of high quality beans, creating products that are clearly different from those made with bulk cacao. Arriba (know in Ecuador as National) is a genetically distinctive fine cacao with a unique floral aroma given by a combination of farming practices, genetics, climate, soil and luminosity that occurs exclusively in the shaded cacao farms of Ecuador’s coastal lowlands (Lerceteau et al. 1997, Deheuvels et al. 2004).

Historically, Ecuador emerged as the world largest cacao producer in the 19th century, producing 15-20% of the world production by during the early years of the 20th century (Henderson, 1997). Arriba cacao beans, with a unique floral aroma, were shipped from large states in the Rio Guayas Upper-Basin to chocolate manufacturers in Europe and the U.S (Bentley et al. 2004; Henderson, 1997; Parson, 1957; Crespo, 1986). However, by 1930’s Ecuador share of world’s cacao production was down to 6.8% of the world harvest, due to the catastrophic effects of two previously unknown fungal plant pathogens, *Crinipellis perniciososa* (which causes the disease know as ‘witches broom”) and *Moniliophthora roreri* (know as frosty-pod disease) (Griffith, 2004; Parsons, 1957).

The rise and collapse of the Arriba production gave origin to three lingering trends whose effects have shaped Ecuador's cacao production. First, after the crisis finished the large plantation states Ecuadorian cacao production survived as small farmer's cash crop, in part because they did not have access to the resources needed to convert their holdings to more profitable production systems, and in part due the crop's rugged nature (Parsons, 1957; Bentley et al., 2004). Second, foreign disease-resistant cacao varieties were introduced in attempts to revitalize the industry (Lerceteau et al., 1997). The effects of this trend were only magnified when in the late 70s and early 80s the development of plant cloning and grafting allowed farmers to replicate selected varieties, creating uniform agricultural landscapes planted with one high yield variety. In fact, one of these high yield non aromatic varieties, know by its acronym CCN 511, has become the single most planted variety and accounts for half of the plantings of less than ten years (SICA 2003). Because this and other cloned varieties did not have the Arriba flavor, naturally-occurring hybridization led to a progressive erosion of the Arriba genotype up to the point where "the Arriba flavor is hardly found" (Petithuguenin and Roche 1995 in Deheuvels et al. 2004: 23). Finally, as early as the 1930's scientist were encouraging changes in plantations management in order to combat diseases (Bentley et al. 2004). Given that both *C. pernicioso* and *M. royeri* infestations are more severe under denser canopies, farmers were encouraged to regulate the shade on their grooves (Griffith 2004). The practice of growing cacao under natural canopies (natural shade) was abandoned, and cacao was raised under planned shade. Indeed, some of

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<sup>1</sup> CCN 51 stands for Castro Collection Naranjal #51.

the new varieties (like CCN-51) are not planted under shade at all (Bentley et al. 2004). Evidently, the developments of these “modern” agricultural systems come with a price. Full-sun plantations require irrigation to maintain the levels of humidity required to sustain a viable population of cacao pollinators (Young 1994), and the lack of a biomass producing, nitrogen-fixating legume-based shade imply that these plantations require additional nitrogen-based fertilizer to maintain high yields (see Bentley et al. 2004, Lehmann et al. 2000, Perfecto et al 1996).

These trends reached a cusp in 1998, when El Niño Southern Oscillation flooded Ecuadorian lowlands (UN, 1998). The 1997-1998 ENSO affected all sectors of Ecuador (i.e. agriculture, fisheries, shrimp farming, etc), and it has been estimated that it caused lost equivalent to 25% of all agricultural incomes (Vos et al. 1999). As a consequence of this crisis, by 1999 the number of Ecuadorian poor increased drastically, especially in provinces in the coastal lowlands. This meteorological phenomenon had a catastrophic effect in Ecuadorian Cacao Production. It affected directly 18.9% of the total surface dedicated to this crop, and the areas that were not flooded were affected the proliferation of diseases due increased humidity and lower luminosity (Vos et al. 1999). Indeed, 1998 harvest was 43% of the previous year. About 40,000 hectares were lost, and the surface dedicated to cacao reached an historical low of 300,000 hectares. In average, the yield of all plants was halved. Interestingly, the first plantations to recover after the 1998 catastrophe were those established with CCN-51, which is hardly surprising given that these capital intensive plantations are normally established in better land than those planted with traditional varieties. The early rebound of CCN-51

plants implied that 1999 more of this non-aromatic, non-Arriba beans were mixed in the Ecuadorian exports (Chacon, 2007). Also, most new plantings were done clones of this highly productive variety. By 2005, the cacao being exported from Ecuador have lost quality, up to the point in which the International Cacao Organization had to downgrade Ecuador's cacao rating from 100% fine flavor cacao to 75%, and inform Ecuadorian exporters that this rating could be further reduced (ICCO, 2006).

As a consequence of the scarcity of "Arriba," the attention of chocolate manufacturers turned into Ecuador. Since the collapse of the price-per-quality scheme back in 1970, exporters have been extracting rents out of select Arriba cacao for those buyers willing to pay extra for this quality. It has been reported that exporters "profitability relies heavily on these differentials" (Collinson and Leon 2000). The declining quality of Ecuadorian exports made the exporters association ANECACAO, the private Ecuadorian Cacao Trading Commission, and government institutions aware of this crisis. They responded with measures to recover the productivity of existing plantations, with engaging private institutions to provide extension services, and with attempts at reestablishing price-by-quality systems (operating under a scheme of quality certification). Ecuadorian state was mobilized into this process due pressures by social groups that have coalesced in time of the ENSO crisis (see Fairtrade Foundation 2002: 4). The Ecuador's Ministry of Agriculture Accord 070 of July 22 of 2005 declared cacao as a strategic crop, there has been a conscious effort to establish institutional framework to regulate "Arriba." In a first step, the fourth revision of the Cacao Beans Technical Norm (NTE INEN 176:2006), published in 2006, classifies Ecuadorian cacao

in Arriba and CCN-51, therefore creating the normative needed to separate traditional and hybrid varieties. This legal framework also allowed exporters to actually establish a price differential to offer a premium for high quality Arriba cacao, as opposed for “bulk,” low quality beans.

This trend of creating a market for high quality beans raises some questions over the feasibility of Arriba cacao production. How well is Arriba holding under the assault of more productive varieties? What are farmers doing, maintaining traditional varieties, adopting new ones or deploying some other sorts of strategies? Are the newly established premiums per quality enough to reverse the trend towards agricultural intensification in Ecuadorian cacao production? Are there other alternatives?

## ***Methods***

### **Study site**

The study was conducted in the western lowlands of Ecuador in December 2007. Fieldwork was conducted in the provinces of Los Rios, Guayas, El Oro, and Azuay, which account for 56.82% of the total acreage dedicated to cacao in Ecuador (138083 out of 243059 has) (SICA 2003).

### **Arriba versus CCN51: variety planted**

Field visits were coordinated through FEDECADE (Ecuador Cacao Producer Federation), Data about the cacao production system (variety, amount and types of shade), was collected in a poll given to 20 farm owners in each of 5 cacao producers Associations (Cooperatives Nueva Union Campesina, 6 de Julio, and La Florida, Associations

Camacho (Luz y Guia Campesina) and 3 de Octubre (Rio Bonito)), for a sample of 100 farmers (~450 ha). The farmers were polled at community events organized for the Christmas festivities; organizers reported that practically everybody was at those events. The poll was administered to only one person per family. This sample represents a 7% of the farmers reportedly living at these localities, but necessarily excludes farmers that were not at their holdings at the time of the visit<sup>2</sup>.

### **Understanding Arriba: in-deep interviews**

A total of 7 in-depth open-ended interviews were conducted in each location. Farmers were recruited with the basis of availability (convenience sample). Visits to these farmers' plantations were conducted, and questions were raised about productivity, labor, diseases, inputs, yield, and economic benefits of each variety. These interviews complement the quantitative information raised from the polling. Interviews with farmer's groups (ASOVINCES), farmer's representatives (Victor Chacon, FEDECADE), and representatives of two of the main exporters (COFINA and Exportadora Martinetti) were also conducted. We also visited 10 cacao plants breeding facilities (commercial nurseries) to ask about which variety was being growth. A farmer's confidentiality is guarded, identifying our informants only by the place where the interview was conducted.

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<sup>2</sup> It should be noted that the fact that field work was conducted near Christmas actually reduced the incidence of absentee farmers.

## **Results**

### **What do you have, Arriba or CCN51?**

The average farmer in our sample have holdings of 4.46 ha (SD 2.498), even though we found farmers holding as little as 0.5 ha and one farmer that have holdings of 15 ha. About half of the farmers in our sample (49%) reported that they have plantations established from “pepa” (naturally occurring seed), with the other half (51%) reporting that they have a fraction of their holdings dedicated to Arriba (averaging 62% of their holdings) and the rest dedicated to CCN51 (average 38% of their holdings); none of the farmers in our sample reported to have CCN51 plantations exclusively. The holdings of farmers who have both varieties are slightly larger (average 5.038 ha, SD 2.167) than the holdings of farmers that only have Arriba (average 3.871 ha, SD 2.696); these differences are statistically significant ( $P > 0.01$ ). The data suggest that there are differences among localities ( $P > 0.003$ ); in general, farmers living closer to the area of development of CCN51<sup>3</sup> are more likely to have both varieties, while farmers living farther away are more likely to have Arriba only-plantations. Thus, in our sample of farmers from the Cooperatives Nueva Union Campesina and 6 de Julio (located at less than 15 km from Naranjal), we found that the average holding of CCN51 is of 1.950 ha (SD 1.504); in contrast, farmers living in La Florida reported an average CCN51 holdings of 0.438 ha (SD 0.738), and 3 de Octubre farmers reported an average CCN51 holdings of 0.662 ha (SD 1.353).

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<sup>3</sup> This variety was developed in a commercial cacao plantation located in Naranjal, Guayas.

## **Yield, inputs, and production costs**

The average yield for Arriba is of 4.38 quintals of dry beans per hectare/year<sup>4</sup>, with 50% of the farmers reporting yields of 4-5 qq/ha/year. In contrast, the average yield of CCN51 is of 13.510 qq/ha/year, with 50% of the farmers reporting 12-14 qq/ha/year. For both varieties, we found no indication that there were differences in yield among localities. Overall, by 2007 the farmers in our sample produced 1650 qq of Arriba cacao in 354.5 ha dedicated to this variety; and about 1335 qq of CCN51 cacao in the 97.25 ha dedicated to this crop. 54% of the farmers reportedly use fertilizers on their Arriba plots; in contrast, 72% of the farmers use fertilizers on their CCN51 plots. Interestingly, farmers that have both varieties are more likely to use fertilizers in their Arriba plots (57%) than those who have exclusively Arriba (51%). Likewise, farmers that have both varieties are more likely to have irrigation in both plots; while 100% of the farmers have some sort of irrigation in their CCN51 plots, 96% of them reportedly irrigate their Arriba plots as well. In contrast, only 71% of the Arriba-only farmers reportedly irrigate their fields. In an in-depth interview conducted with a small farmer (~4 ha, 1 ha Arriba/3 ha CCN51) near Naranjal, we established that his production cost for his CCN51-planted hectare is of \$559 per ha/year (with a density of 1000 plants per ha and reduced shade) (see Table 1, Fig 1 and Fig 2); with irrigation (done manually with a hose) and post harvest treatment accounting for most of the costs. This farm yield was average for our sample (14 qq/ha/year), and considered as low for the yields that CCN51 can achieve.

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<sup>4</sup> Quintals and pounds are the unit of choice for dry cacao beans in Ecuador, even if people generally use the metric system. In this paper, we follow the farmer's practice in this regard.

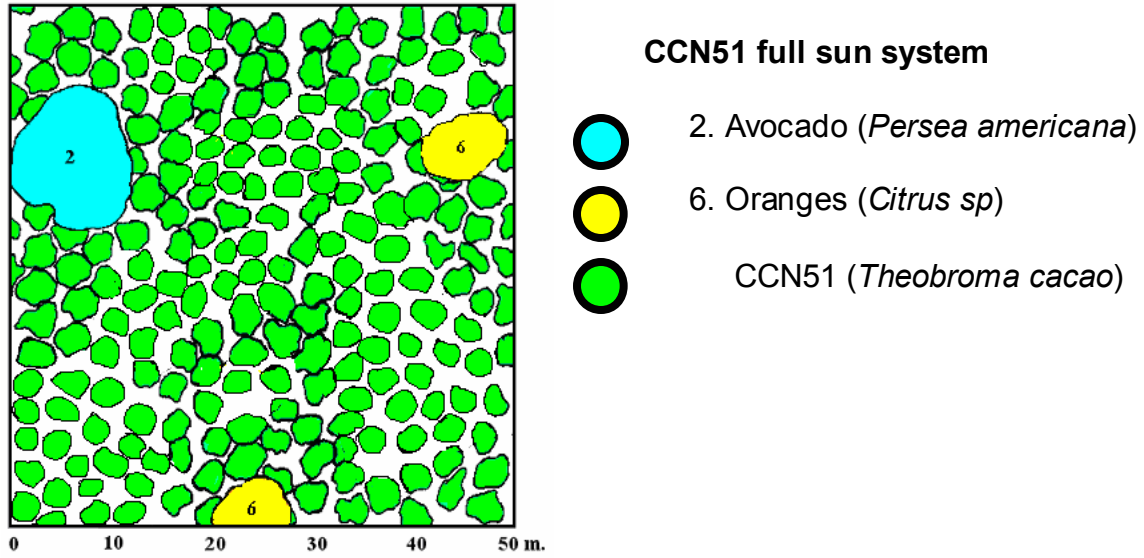


Figure 1. Diagram of tree species found in a 50x50 meters plot in an CCN51 cacao farm



Figure 2. CCN51 cacao farm, Naranjal, Guayas, 2007.

The farmer was mostly concerned about hose-irrigation, because it is “not efficient” but justified using this method because it “was better than nothing.” This farmer reportedly sold his cacao at an average price of \$86 per qq, for a gross income of \$1204 per year and a net income of \$645 per ha/year. This farmer saved a few avocado and orange trees for commercial purposes, which gave him an extra income of roughly \$100 ha/year (2000 units/ha/year @ on-farm price of \$0.05 c/u), so his income was in the order of \$745 ha/year. This farmer was not tending his Arriba holdings, as he was planning to replace the old plantation with a new one planted with CCN51.

Table 1. Production cost for 1 ha of CCN51 (~1000 plants), with hose irrigation, weeding, pruning and application of fertilizer (2007, Naranjal)

Input	Amount		Cost/unit	Cost	Notes	Notes 2
Fertilization (crew)	10	wages	\$7	\$70	Once a year	Crew includes farmer
Fertilizer	50	pounds	\$0.80	\$40	Once a year	Urea and potassium
Irrigation	24	wages	\$7	\$168	2 days every two weeks, summer time (24 weeks)	Using a hose
Pruning	7	wages	\$7	\$49	10 days, every year	Crew includes farmer, no power tools
Weeding (crew)	8	wages	\$10	\$80	Two persons for two days, twice every year	Crew included farmer, manual pump
Herbicides	3	Lt	\$4	\$12	3 lt per ha	Herbicide (glyphosate)
Harvest	4	Wages	\$7	\$28	One day every two weeks, 4 months per year	Wages
Post-harvest	16	Wages	\$7	\$112	Two days every two weeks, 4 months per year	Wages (sun-dried)
TOTAL PRODUCTION COST				\$559		

A second in-depth interview was conducted with a Arriba small farmer (~6 ha) from Nueva Union Campesina. We established that his production cost per hectare is about \$307 per ha/year (with a density of 800 plants per ha). Savings are achieved by cutting down the inputs, especially labor (wages), and by using low cost inputs (such as applying manure for fertilizer; the farmer had to pay for the pickup truck, the manure

was free). Cacao post-harvest treatment (fermentation and drying) accounted for  $\frac{1}{3}$  of the production cost, but the farmer was interested in obtaining a premium (of \$20 per qq) for selling environmentally friendly-certified (non-organic) high quality beans to Nueva Union Campesina/FEDECADE commercialization system. This farm yield was average for our sample (5 qq/ha/year). The farmer was mostly concerned about the prevalence of disease (witches broom) in his plantation, and was concerned about finding an “organic” product that could be used to fight this disease. This farmer reportedly sold his cacao at an average price of \$106 per qq (with a premium of \$20 over bulk cacao price), for a gross income of \$530 per year and a net income (before taxes) of \$223 per ha/year. This farmer had other sources of income built-in to his shaded cacao farm; indeed, he sold mangoes, avocados, oranges and other fruits for an extra income of \$200 per ha/year (4000 units/ha/year @ on-farm price of \$0.05 c/u) (see Table 2, Fig. 3 and 4), which raised his income up to \$423 per ha/year.

Table 2. Production cost for 1 ha of Arriba (~800 plants), with gravity irrigation, weeding, pruning and application of free organic fertilizer (manure) (2007, Naranjal)

Input	Amount		Cost/unit	Cost	Notes	Notes 2
Fertilization	8	wages	\$7	\$56	Four days, twice each year	Farmer only
Fertilizer	2	Pickup trips	\$10	\$20	Manure picked up from a neighbor	Free manure, only pays pickup truck
Irrigation	12	Wages	\$7	\$84	Water from channel, every two weeks in summer (24 weeks)	Farmer only
Pruning	3	Wages	\$7	\$21	10 days, every year	Farmer only
Weeding	6	Wages	\$7	\$42	Once a year	Farmer only
Harvest	4	Wages	\$7	\$28	One day every two weeks, 4 months per year	Wages
Post-harvest	16	Wages	\$7	\$112	Two days every two weeks, 4 months per year	Wages (sun-dried)
TOTAL PRODUCTION COST				\$307		

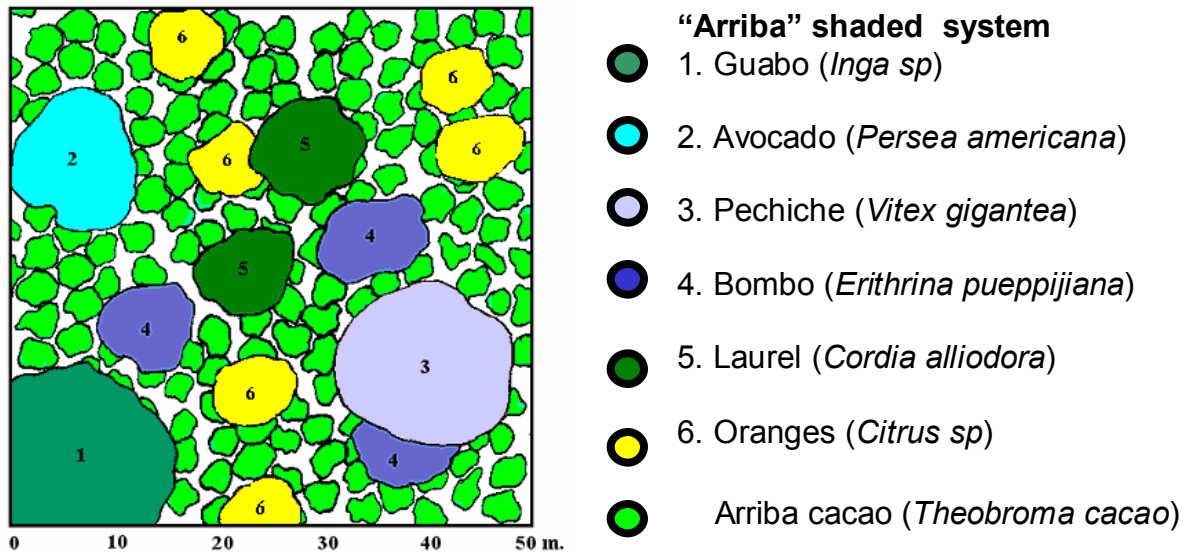


Figure 3. Diagram of tree species found in a 50x50 meters plot in an Arriba cacao farm.



Figure 4. Arriba cacao farm, Naranjal, Guayas, 2007.

A third interview was conducted with the owner of an organic cacao/banana production system. This hybrid system was developed by the Agronomists Julio Cerezo and Gerardo Molina from the Asociacion de Productores Organicos de Vinces (Los Rios), and consists on replacing  $\frac{1}{4}$  of the Arriba cacao plants for commercial grade Cavendish banana plants. This hybrid farm is then cultivated under a strictly organic regime in order to achieve organic certification. The 2.5 ha farm we visited had two hectares of cacao planted with a density of aprox. 600 cacao plants per hectare, with about 400 bananas planted in clusters inside the plantation<sup>5</sup>. Cacao yield was of 8 qq/ha/year. This is higher than the yield reported in our poll (4.38 qq/ha/year), even if the cacao density was lower (600 plants per ha vs. 800 plants per ha) (Fig. 5 and 6). The farm owner considered that increased luminosity (due to cutting down  $\frac{1}{4}$  of the old cacao trees), aggressive pruning, irrigation, disease control and the use of organic inputs accounted for the difference.

The cacao from this farm was sold as organic for \$105 per qq, with a premium of \$20 over the local market price (\$85 at the time of the research). The introduction of input dependent banana into the cacao farm considerably increased cost per ha/year, up to \$1150 per ha. Once again, irrigation (done manually with a hose) was the highest expense (see Table 3). The farmer considered that this was unavoidable given that banana is a water-dependent crop. The farmer used organic fertilizers and other organic approved inputs, acquired from a reputable commerce in town.

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<sup>5</sup> The most current version of the Cerezo-Molina model calls for 600 cacao plants and about 640 banana plants, planted in lines to make it more efficient.

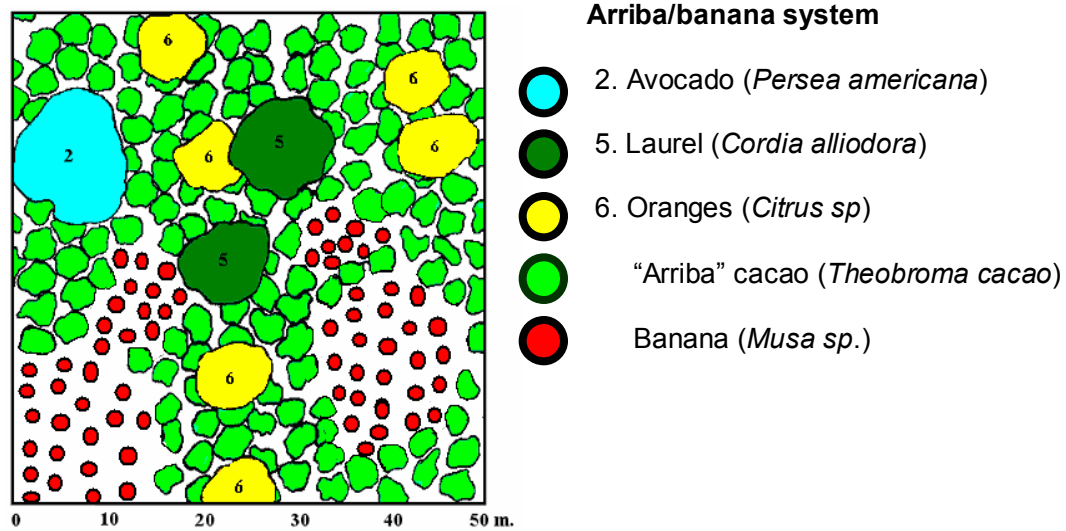


Figure 5. Diagram of tree species found in a 50x50 meters plot in an Arriba/banana cacao farm.



Figure 6. Arriba/banana Cerezo-Molina hybrid system, Vinges, Los Rios, 2007.

These organic inputs were slightly more expansive (per unit) than their conventional counterparts, but had the benefit of being approved by the farmer's organic certification firm.

Table 3. Production cost for 1 ha of Arriba/banana hybrid plantation (~600 plants cacao/~400 plants banana) (Cerezo-Molina model, Vences, 2007)

Input	Amount	Cost/unit	Cost	Notes	Notes 2
Fertilization	16 Wages	\$7	\$112	Crew of two, four days, two times each year	Crew includes farmer
Fertilizer	100 Pounds	\$1	\$100	Organic fertilizer (compost/humus/other)	Crew includes farmer, cost of fertilizer estimated by farmer
Irrigation	104 Wages	\$7	\$728	2 days every week, all year long	Using a hose
Cacao pruning/banana maintenance	14 Wages	\$7	\$98	14 days, every year	Crew includes farmer
Weeding	12 Wages	\$7	\$84	Once a year	Farmer only
Harvest (cacao)	4 Wages	\$7	\$28	One day every two weeks, 4 months per year	Wages
Post-harvest (cacao)	16 Wages	\$7	\$112	Two days every two weeks, 4 months per year	Wages (sun-dried)
Banana harvest	78 Wages	\$7	\$546	Crew of three, every two weeks	Crew includes farmer
Banana (other costs)	320 Cost per box	\$1	\$320	Cost of boxes, bags, labels, etc	
<b>TOTAL PRODUCTION COST</b>			<b>\$1,150</b>		

The farmer reported selling his cacao for an average price of \$105 per qq, for an income of \$840 ha/year. The on-farm banana plants had a relatively low ratio of 0.8 boxes per bunch<sup>6</sup>, which multiplied by 400 banana plants produced about 320 boxes of bananas/ha/year. About 320 boxes were sold as organic certified bananas, with a premium price of \$6 per box (with a premium of \$3 per box, twice as much as conventional), therefore generating an income of \$1920/ha/year. The farmer also sold avocado, oranges, mangoes, and other fruits for an additional income of \$200 ha/year

<sup>6</sup> A conventional banana plantation may achieve ratios of over 1.4

(4000 units/ha/year @ on-farm price of \$0.05 c/u). The fraction of land not dedicated to cacao, banana and fruits was used to produce crops for household consumption (vegetables and staples such as corn and beans). We calculate that the gross income for this farmer is of \$2960 ha/year, with a net income of \$1810 per ha/year.

## ***Discussion***

### **Arriba: An unsustainable crop?**

While Arriba certainly is a low impact crop, with considerable environmental and social benefits, our results suggest that the Arriba production is likely to continue to decline. If an average farmer, with holding of 7 ha (SICA 2000), plants a traditional shade-growth cacao plantation, our results suggest that his income will be of \$2961 per year, with about \$1561 coming from cacao, and \$1400 from selling other crops. This yearly income figures acquire relevance when compared with the Ecuadorian poverty level (minimum income to secure food and shelter for a 5 members family), set at \$3806 for the year 2007. Our results indicate that an Arriba farmer will not be able to feed his family with the income from his farm, and is likely to be forced to find an off-farm source of income. A farmer with a 7 ha holding planted with CCN51 certainly fares better, with an income of \$5215 per year of which \$4515 come exclusively from his cacao (even if our study indicates that this farmer will sell his cacao for \$86 per qq, while his Arriba counterpart will sell cacao for as much as \$106 per qq). While above poverty line, the farmer's yearly income is still below Ecuadorian basic income level (which is the level need to supply food, shelter, health care and education for a five-members family), set a \$5460 for the 2007.

By switching varieties, a farmer is able to secure an adequate income. In our interviews with cacao exporters, we found them aware of this economic issue. The manager from Exportadora Martinetti (Los Rios) said that “I pay \$91 per qq of Arriba, and just \$86 per qq of CCN51, and the producers do not care because CCN51 produces a lot more... CCN51 is just jumping on us, there has to be a considerable premium for Arriba or in two or three years we will be getting 70-80% of CCN51. ” This person main concern was about decreased quality of cacao lots given that CCN51 is being mixed with Arriba cacao. He mentioned that “before, we had a premium of \$400 per ton, now we have to fight to get \$150... but you will get no premium with 30-35% CCN51 in lots that are sold as Arriba” (Martinetti’s cousin, Quevedo, 2007).

The farmers we interviewed shared this opinion. When asked about the benefits of Arriba, an anonymous farmer from Camacho said that “For me, Arriba has no advantage, only disadvantages. [Arriba] is good for the environment, buy you know that nowadays we want productivity. The advantage is reaped by other countries that take the quality [of Arriba] but they never acknowledge its worth. They should say “look, that cacao national [Arriba] has good quality, good aroma, we will pay you at least a 30% premium.” No, they pay us the same as for the CCN-51, then we got tired, I do not know later, we better get quantity no quality, because the countries that buy the cacao do not give us a better price” (Anonymous informant, Camacho, 2007). Other farmers share this opinion, expressing that “having only national [Arriba] cacao does not generate income enough to survive...” (Anonymous informant, Naranjal, 2007). Bitterly

talking about his exclusively Arriba farm the year before switching to a banana/cacao system, one farmer told us that “you know, I was making so little money that I had to get a job in the bananeras [banana plantation nearby]. They fired me because I got sick, and then it was winter, there was no cacao, no money... it was Christmas of 2005, my woman left me because we did not had food... I was seriously thinking about drinking Gramoxone<sup>7</sup>” (Anonymous farmer, Vinces, 2007).

While CCN51 is seen as costly, adopting this variety is seen as part of a risk reducing strategy. A farmer that was converting his holdings from banana to cacao told me that “Planting from seed does not cost you upfront, that is true. With CCN51 you pay \$0.30 per plant, so it is costly because you need to make an investment of \$360 per ha, plus fertilizer, chemicals, weeding, etc... but you know, it is cheaper in the long term. Why you ask? Well, CCN51 is cheaper because from pepa (seed) you do not know anything: you do not know the material, the yield, disease resistance, genetics, nothing... with CCN51 one can plan ahead, and we know what to expect... and those who say that CCN51 is not good... well, I have asked in Naranjal, and they pay the same for both so I do not care” (Anonymous farmer, Naranjal, 2007).

This farmer concern about the lack of commercially available Arriba plants was also noted by the exporters. Exportadora Martinetti reportedly has an Arriba plant production program, but they use locally selected varieties only. He admitted that they “just clone plants that we know are productive from personal observation. We do not have a lab or

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<sup>7</sup> Drinking Gramoxone (paraquat) is an euphemism to avoid saying “committing suicide”

a genetic bank where to look for the ideal equilibrium.” This person was critical of the local agricultural research and extension services, saying that “they talk and talk about this and that clone, with so many names, but all of them are the same.” In our sample of cacao commercial nurseries, we found that the only variety being sold was CCN51; there were no plants of Arriba being produced at all.

Finally, the ASOV Cerezo-Molina cacao-banana production system offers an interesting alternative to CCN51 plantations. While traditionally cacao farmers have used bananas and plantains for temporal shade or in clearings inside the plantation, by aggressively replacing at least  $\frac{1}{4}$  of the existing cacao plants with bananas this generates a economically viable production system. Certainly, the income of 7 ha (\$12670) operating under this system set his owner well above basic level, but there are questions about the viability of a niche market for organic banana and cacao. Julio Zambrano, CEO of Cacao Exporter COFINA, considers that “there is such a demand for eating healthy that there is the chance that organic becomes a requirement, something you must do, instead of a niche market” (Zambrano, 2007). Also, banana production is a demanding crop, and before a farmer start “shipping” boxes he must invest capital in planting banana trees (9 months), tending the bananas, and building the infrastructure needed for cleaning, cutting and packaging export-quality bananas. One of our interviewed farmers reported that, certainly, banana is a demanding crop. He said “to have banana you have to tend the plant, every day, almost like hanging from the plant. I had banana before, until we got sick of it and we said lets plant [cacao]. I do not have young children anymore, my daughters are well married, and I and my old lady

can live with what we make out of our cacao plot.” However, most farmers have to change their livelihood in order to survive. In a farmer's words, “a traditional cacao producer is broke... everything changes, you can not live like before” (Anonymous farmer, Vences, 2007). While they have several options (i.e. becoming certified, switching crops or varieties, or getting an off-farm job), if they wish to remain cacao producers they opt for supplement their income from an Arriba plot with income from a CCN51 plot. Slightly more than half (51%) of the farmers in our poll are growing both varieties, and even though the CCN51 share is 21% of the total holdings in it yielded 44.7% of the total production. Our results indicate that the Cerezo-Molina banana-cacao hybrid production system offers a good alternative for the farmers who have access to this market niche, but this is not likely to work for the majority of them.

## ***Conclusion***

Under the current market conditions, an Arriba farmer can not make a living out of his or her plot. With a low productivity, and a premium of \$20 per qq, a farmer is better off by switching to CCN-51 or other production system. While the high costs of switching, and farmer's well known risk adverse behavior may act as deterrents, it is likely that conversion will continue. Arriba will become scarcer due further hybridization if not by replacement, and further downgrades of Ecuadorian cacao quality rating could be expected. Certainly, the lack of tested Arriba cultivars also contributes to the decline of the production of this crop: even if farmers are looking for other varieties, CCN51 is the only one that is commercially available.

Of the several alternatives we found during our research, we found that only the Cerezo-Molina banana-cacao production system is economically viable, and allows

Arriba cacao production to continue. While premiums for Arriba quality exist, premiums that go from \$5 to \$20 per qq are not enough to reverse the decline of Arriba production in shaded plantations. As long as the premium given to Arriba in international markets is not transferred to the producers (which according to an anonymous informer can go as high as \$1000 per ton, ~\$45 per qq), there are strong economic incentives to change to varieties with higher yields. Evidently, more research is needed. The farmers that we interviewed are relatively skeptical of new varieties, but may be willing to try improved Arriba cultivars as long as these plants become commercially available, and the profits from these highly appreciated beans are transferred to those that produce them.

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