Twenty Proposed Alternative Crops for Coca in Putumayo

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Colombia Alternative Development Project

FINAL REPORT
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EXECUTIVE SUMMARY: After objective and subjective compilation and appraisal of the literature on some 60 medicinal plants, spices and aromatic plants, the consultant selected the following as potentially the most promising economically remunerative species as alternative crops for coca in Putumayo: *Aloysia trifoliata* (for lemon verbena products), *Artemisia annua* (for antimalarial and other medicinal products), *Bixa* (for medicinal and food colorant products), *Cinnamomum* (for canela and/or cinnamon, both spice and antidiabetic medicine), *Croton lechleri* (dragon's blood as an increasingly popular phytomedicine), *Curcuma longa* (both spice and COX-2-Inhibitory medicine), *Cymbopogon citratus* (for lemon grass and red-zinger-like products),
Dipteryx sp. (for coumarin-containing products, no longer considered unhealthy), *Hibiscus sabdariffa* (for red-zinger-like products and medicines), *Momordica charantia* and *M. balsamina* (for food and antidiabetic capsules), *Paullinia cupana* (for guarana-like caffeinated products), *Phyllanthus* spp. (for litholytic medicines), *Pilocarpus* sp. (to break current monopolies on the derivative drug pilocarpine for glaucoma and xerostomia), *Plectranthus* sp. (as a source of the multiutilitarian phytomedicinal forskolin), *Pogostemon* (for the aromatic pachouli), *Stevia rebaudiana* (as a non-nutritive antidiabetic sweetener), *Tabebuia* sp. (for its anticancer and antiyeast potential), *Tamarindus indica* (as both food, spice, medicinal and potential cosmetic), *Uncaria* sp. (as an immunostimulant phytomedicinal with many proven biological activities), *Vetiveria zizanioides* (for the aromatic khus khus), and *Zingiber officinale* (for the spice and increasing medicinal potential for ginger and its phytochemicals).

INTRODUCTION

Asked by Chemonics to suggest alternatives for Putumayo coca growers, I went to files I had accumulated over 30 years at the USDA re alternative crops for narcotic plants. Chemonics wanted a short list within 30 days. To prepare such a shortlist, I, the consultant, updated more than 50 promising species variously characterized as medicinal, spices or aroma plants. There is no clear-cut line between these three categories, e.g. ginger is all three, aromatic, medicinal and spice. These individual information summaries were drawn from the published public literature, public domain web sites and/or some of my own books, published and unpublished, on medicinal plants. For these private, privileged reports (hereinafter referred to as "writeups" or "information summaries"), there was not been time to obtain permission to quote the sources consulted. Hence, dissemination of this report outside Chemonics might violate certain copyrights.

I am told that the climate and ecology around the coca growing area of Peru is very similar to the climate and ecology of Putumayo. I have had an aggregate of one full year of experience in Amazonian and Andean Peru (since my first visit in 1972 to present), and almost and much in the ever-wet area of the Choco in Pacific Colombia and the more seasonal Atrato Region of Caribbean Colombia, and an aggregate of three years in adjacent Panama, where I worked between 1966 and 1968 of the AEC sea-level canal survey. The draft writeups (information

summaries) used in arriving at a short list of recommendations, were prepared solely for the use of Chemonics Inc., and for Duke's Herbal Vineyard, Inc., for whom I, James A. Duke, compiled the report. These writeups, incomplete at best, helped me arrive at my shortlist of some 20 species worth consideration for crop diversification schemes in Amazonian America. I feel certain that the recommended species can be grown in certain regions of Putumayo. Whether they can be grown and produced economically in Putumayo remains to be seen, depending on microecology, cultural practices, and ever-changing market and transportation conditions.

I considered these ~ 60 species (and others) and started draft writeups on all them, including *a description of the identified plants, their ranking in order of their potential economic importance to Putumayo, and information on the commercial products that can be derived from the plants.* (italics from contract, from Prado's e-mail). These as well as cultural, biological, ecological, economic and other data, as available were included in these writeups. Drafting this information in very rough style enabled me to proceed and produce the early list during April 2002, following a full month of consulting. While not all writeups are complete, I tried to assemble pertinent information in the following areas.

FORMAT FOR WRITEUPS

NOMENCLATURE :
Synonyms:
Common Names:
USES:
FOLK MEDICINE :
BIOLOGICAL ACTIVITIES:
CHEMISTRY:
DESCRIPTION:
GERMPLASM:
DISTRIBUTION:
ECOLOGY:
CULTIVATION:
HARVESTING:
YIELDS:
PROCESSING:
ECONOMICS:
CHEMICAL AND PHYSICAL SPECIFICATIONS (cinnamon, ginger, and turmeric only)
ENERGY:
DOSAGES:
BIOTIC FACTORS:
SPECIFIC REFERENCES:

ANALYTICAL PROCESS

I was also asked to *produce three summary reports*, one for medicinals, one for spices, and one

for aromatics, *followed by **a final report**. The final report will present the **analytical process**, the consultant's **conclusions**, and his or her **recommendations for future action** to develop agribusinesses in Putumayo based on the production, processing and marketing of the three plant categories* (italics from contract, as per Prado's e-mail).

Here are the three summary reports, with an explanation of the analytical process (submitted earlier) and the criteria used for an objective scoring.

SUMMARY: MEDICINAL CANDIDATES

After two week's intensive review of some 30 potential medicinal plants, I ranked them in the table that follows, 10 being top priority, 1 being bottom among the top ten, X being "also ran." Strange, I had not even thought of qing hao or sweet annie, *Artemisia annua,* a very promising antimalarial weed, but it seems to be adaptable. It is a cheap affordable antimalarial (both treatment and prevention) that is needed badly in Amazonia. New research that crossed my desk during the study, indicates it might also be useful as the source of an antiviral and anticancer drug as well, easily produced, and particularly useful in multiple-drug-resistant (MDR) cancers. I hence added *Artemisia annua* midway during the study soon ranking it second highest because of new activities on top of its well-known antimalarial properties. (And some visitors to my garden requesting it for themselves.)

X to the left suggests that my gut reaction places these lower in likelihood of economical success in Putumayo than the selected ten, annatto (*Bixa*) being lowest (1) in priority, cat's claw (*Uncaria*) highest at (10). As when I was with the alternative crop (for narcotics) program at the USDA, I fear that we will have to twist some arms to insure markets for some of these.

The high scores to the right are based on the 5 selection criteria, objectively scored, though they might be weighted differently by different agencies, consultants and experts. But the subjective ("gut feeling") score on the left is the way I'd vote if it were my personal money instead of Uncle Sam's money investing in the Amazon. That is my final decision criterion. These gut feeling reactions and scores led me to the selection of the species the ones I would pursue, were it my entrepreneurial money rather than Uncle Sam's.

MEDICINAL (TOP PRIORITY) (Phase 1) I was asked to select 8

Rank	Genus	A	B	C	D	E	TOTAL
X.	*Aloe*	3	2	3	3	2	13
X.	*Ananas*	3	3	3	3	2	14
9.	*Artemisia*	2	3	3	1	3	12
1.	*Bixa*	2	3	2	3	3	13
X.	*Carica*	3	3	3	3	3	15
X.	*Cinchona*	3	2	3	2	1	11
8.	*Croton*	2	2	3	3	3	13
X.	*Melaleuca*	3	2	3	1	3	12
2.	*Momordica*	2	2	2	3	3	12

Rank	Genus						
X.	*Neurolaena*	2	1	2	2	3	10
X.	*Myrciaria*	1	2	1	2	3	9
7.	*Paullinia*	2	2	2	1	3	10
X.	*Pfaffia*	2	2	1	?	3	9
X.	*Phlebadium*	2	2	1	2	3	10
3.	*Phyllanthus*	1	3	2	2	3	11
5.	*Pilocarpus*	3	1	2	1	2	9
4.	*Plectranthus*	2	2	2	1	3	10
X.	*Ptychopetalum*	2	1	1	1	3	8
X.	*Quassia*	1	2	2	2	3	10
X.	*Serenoa*	3	3	1	1	3	11
6.	*Tabebuia*	2	2	1	2	3	10
X.	*Theobroma*	3	2	3	3	3	14
10.	*Uncaria*	2	1	1	2	3	9

Column A. Markets 1. Very Limited 2. Weak US or European 3. Strong World Market
Column B. Germplasm 1. Almost Impossible 2. Not Real Easy to Come By 3. Easy to Come By
Column C. Agronomy 1. Harvested From Wild 2. Limited Info 3. Well Studied
Column D. Local 1. Little Known in Colombia 2. In Colombia 3. In Putumayo
Column E. Adaptability 1. Special Climate Required 2. Limited 3. OK For Putumayo
(X=Dropped from Final Consideration)

SUMMARY: SPICE CANDIDATES

Spice species I'd recommend as a group for the integrated Rainforest Spice Rack: allspice, annatto, capsicum, cardamom, cinnamon, clove, garlic, ginger, nutmeg, stevia, tamarindo, and turmeric, but my subjective top 6 individual spices after the four weeks of review are turmeric, ginger, roselle, cinnamon, stevia and tamarind.

SPICES: Third (Phase III) Choose 6-8 most promising

Rank	Genus	A	B	C	D	E	TOTAL
X	*Allium* (garlic)	3	3	3	3	2	14
X	*Alpinia galanga* (galangal)	1	2	2	1	2	8
X	*Alpinia officinarum* (lesser galangal)	1	2	2	1	2	8
X	*Amomum* (nepalese cardamom)	1	2	2	1	2	8
X	*Capsicum* (paprika)	3	3	3	3	3	15
X	*Cinnamomum* (cassia)	3	2	3	1	2	11
3	*Cinnamomum* (cinnamon)	3	2	3	2	2	12
6	*Curcuma longa* (turmeric)	3	3	3	2	3	14
X	*Curcuma zedoary* (zedoary)	2	2	2	1	2	9
X	*Elettaria* (cardamom)	3	3	3	2	3	14
4	*Hibiscus* (roselle)	3	3	3	2	3	14
X	*Myristica* (nutmeg)	3	2	3	2	2	12
X	*Pimenta* (allspice)	3	2	3	1.5	2	11.5

		A	B	C	D	E	TOTAL
X	*Piper* (pepper)	3	3	3	2	3	14
2	*Stevia* (stevia)	2	3	2	1.5	2	10.5
X	*Syzygium* (clove)	3	3	3	1.5	3	13.5
1	*Tamarindus* (tamarind)	3	3	3	2	2	13
X	*Vanilla* (vanilla)	3	3	3	2.5	2.5	14
5	*Zingiber* (ginger)	3	3	3	3	3	15

Column A. Markets 1. Very Limited 2. Weak US or European 3. Strong World Market
Column B. Germplasm 1 Almost Impossible 2. Not Real Easy to Come By 3. Easy to Come By
Column C. Agronomy 1. Harvested From Wild 2. Limited Info 3. Well Studied
Column D. Local 1.Little Known in Colombia 2. In Colombia 3. In Putumayo
Column E. Adaptability 1. Special Climate Required 2. Limited 3. OK For Putumayo
(X=Dropped from Final Consideration)

SUMMARY: AROMATIC CANDIDATES

I used the same scoring criteria for the aromatic candidates as I did for spices and medicinals but finally, more on gut feelings, selected as follows:

ESSENTIAL OIL (AROMA) PLANTS: Second (Phase II) Choose 6-8 most promising

Rank	Genus	A	B	C	D	E	TOTAL
6	*Abelmoschus*	2	3	2	3	3	13
1	*Aloysia*	2	3	2	2	2	11
2	*Cymbopogon*	2	2	3	2?	3	12
4	*Dipteryx*	2	2	1	2	3	10
X	*Eucalyptus citriodora*	2	3	3	2	2	12
X	*Eucalyptus globulus*	2	3	3	2	2	12
X	*Melaleuca*	2	3	3	2	2	12
5	*Pogostemon*	2	3	3	1	3	12
3	*Vetiveria*	2	3	3	2	3	13

For the aroma plants, in ascending order, 1. lemon verbena (*Aloysia triphylla*), 2. lemongrass (*Cymbopogon*); 3. Khus Khus (*Vetiver*); 4. Tonka bean (*Dipteryx*). 5. Patchouli (*Pogostemon*) and 6. Musk Okra (*Abelmoschus moschatus*)

Column A. Markets 1. Very Limited 2. Weak US or European 3. Strong World Market
Column B. Germplasm 1. Almost Impossible 2. Not Real Easy to Come By 3. Easy to Come By
Column C. Agronomy 1. Harvested From Wild 2. Limited Info 3. Well Studied
Column D. Local 1. Little Known in Colombia 2. In Colombia 3. In Putumayo
Column E. Adaptability 1. Special Climate Required 2. Limited 3. OK For Putumayo
(X=Dropped from Final Consideration)

FINAL REPORT : FINAL CANDIDATES

As determined in the three reports I recommend for consideration and experimentation *Aloysia trifoliata* (for lemon verbena products), *Artemisia annua* (for antimalarial and other medicinal products, *Bixa* (for medicinal and food colorant products), *Cinnamomum* (for canela and/or cinnamon, both spice and antidiabetic medicine), *Croton lechleri* (dragon's blood as an increasingly popular phytomedicine), *Curcuma longa* (both spice and COX-2-Inhibitory medicine), *Cymbopogon citratus* (for lemon grass and red zinger-like products), *Dipteryx* sp. (for coumarin containing products, no longer considered unhealthy), *Hibiscus sabdariffa* (for red-zinger-like products and medicines), *Momordica charantia* and *M. balsamina* (for food and antidiabetic capsules), *Paullinia cupana* (for guarana-like caffeinated products), *Phyllanthus* spp. (for litholytic medicines), *Pilocarpus* sp. (to break current monopolies on the derivative drug pilocarpine for glaucoma and xerostomia), *Plectranthus* sp. (as a source of the multiutilitarian phytomedicinal forskolin), *Pogostemon* (for the aromatic pachouli), *Stevia rebaudiana* (as a non-nutritive antidiabetic sweetener), *Tabebuia* sp. (for its anticancer and antiyeast potential), *Tamarindus indica* (as both food, spice, medicinal and potential cosmetic), *Uncaria* sp. (as an immunostimulant phytomedicinal with many proven biological activities), *Vetiveria zizanioides* (for the aromatic khus khus), and *Zingiber officinale* (for the spice and increasing medicinal potential for ginger and its phytochemicals).

Writeups can be made available with pertinent details that helped me arrive at my decision. The following species were rejected in the last pass. I started preparation and compilation of data for all these writeups as part of the evaluation requested by Chemonics.

RECOMMENDATIONS

In the July meeting, local and visiting specialists should discuss the pros and cons of the short and long lists presented in this report and evaluate other species that have been wisely recommended. Long-winded technical writeups should be reduced to short factual illustrated planting and utilization pages in Spanish.

I recommend procurement of germplasm of these species, especially the top twenty, making all efforts to obtain germplasm from ecologically similar sources. Some germplasm will be difficult to obtain, others easy. The more difficult may be eliminated from further consideration for that reason alone.

US experiment stations and botanical gardens in tropical sites (Florida, Hawaii, Puerto Rico, e.g.) may have specimen plants of some of these candidate species and might be induced to make selected cuttings. The Colombian extensionists might benefit from studying propagation methods etc. at such sites. Alternatively, they might benefit from a short course in the ReNuPeRu garden on the Napo River of Amazonian Peru.

Planting should be started of several major candidates at a wetter and a drier site in Putumayo, but with several other outlying experimental plots, tended by local farm leaders. Local "town meetings" should help select the local farmers with greatest potential for experimentation. They should be given one-page Spanish-language fact sheets for species given to them. Such leaders should be instructed in the care of these plants by the equivalent of US agricultural extension agents.

Before being presented with germplasm, the local farm plot curators should be trained in the more important and proven medicinal uses of all the plants (the spices and aromatic plants often have many proven medicinal uses as well). In the section of the writeups on activities and indications, an "f " implies folk medicinal use only, a "1" score means there are phytochemical or animal data supporting the use, and a "2" score mans there is clinical prove or strong support from well recognized commissions like commission. The more the local farmer knows about the potential utility of the plants, the better the survival potential for that germplasm. The rational farmer will maintain the plant for its folk medicinal potential, whether or not a money market develops or not.

Further studies are needed (and the information not readily available in literature at my command) on getting the products prepared properly and processed for market potential. Government support may be necessary to achieve a marketable product for external markets. Chemonics also requested that I recommend candidates for two sites, one lower and wetter tentatively Puerto Asiz (P) the other higher and drier, maybe Mocoa (M) (which might even support quinine). I have put a (P) by those I think would have a better chance at the lower Puerto Azis site, and (M) by those at the higher drier site (possibly Mocoa), although many will survive at both. (M,P):

For the final medicinal plant recommendations, in ascending order:
1. Achiote (*Bixa*) (M,P). 2. Bitter Melon (*Momordica*) (M,P). 3. Stonebreaker (*Phyllanthus*) (P). 4. Forskolin (*Coleus forskohlii*) (M). 5. Jaborandi (*Pilocarpus*) (P) 6. Pau D'arco (*Tabebuia* spp.) (M,P). 7. Guarana (*Paullinia cupana*) (P). 8. Dragon's Blood (*Croton lechlerii*) (M,P). 9. Sweet Annie (*Artemisia annua*, even though it would not produce as well there as it does at higher latitudes, Colombia needs a cheap antimalarial. (M), and top number 10. Cat's Claw (*Uncaria tomentosa*) (P).

For the final spice recommendations, in ascending order:
1. Tamarind (*Tamarindus*) (M) 2. Sweet Grass of Paraguay (*Stevia*) (M). 3. Canela (*Cinnamomum*) (M,P). 4. Roselle (*Hibiscus sabdariffa*) (M,P). 5. Ginger (*Zingiber*) (M,P), and my top choice, 6. Turmeric (*Curcuma*) (M,P).

For the final aroma plant recommendations, in ascending order:
1. Lemon Verbena (*Aloysia triphylla*) (M,P). 2. Lemongrass (*Cymbopogon*) (M,P). 3. Khus Khus (*Vetiver*) (M, P). 4. Tonka bean (*Dipteryx*) (P). 5. Patchouli (*Pogostemon*) (M), and tops on my hit parade, 6. Musk Okra (*Abelmoschus moschatus*) (MP).

If I had to limit myself to ten mutually exclusive crops for each demo plot I'd today select the following:

Mocoa: Bitter Melon, Cinnamon, Forskolin Coleus, Khus Khus, Lemon Verbena, Musk Okra, Patchouli, Roselle, Sweet Annie, Sweet Grass of Paraguay.

Puerto Asiz: Camu-Camu, Cat's Claw, Dragon's Blood, Ginger; Guarana, Lemongrass, Pau D'arco, Pilocarpus, Tonka Bean, Turmeric.

ALSO RAN BUT ELIMINATED

Abelmoschus, Allium (garlic), *Aloe, Alpinia officinarum, Alpinia galanga* (galanga), *Amomum* (nepalse cardamom), *Ananas, Cananga, Capsicum, Carica, Cephaelis* (Psychotria ipecac), *Cinchona, Curcuma zedoary, Elettaria* (cardamom), *Eucalyptis citriodora, Eucalyptus globulus, Malpighia, Melaleuca, Myrciaria* (camu-camu), *Myristica, Neurolaena, Pimenta, Piper* (black pepper), *Polypodium* (Phlebadium), *Ptychopetalum, Quassia, Serenoa, Syzygium* (clove), *Theobroma* (chocolate); *Vanilla*.