Oh the Road to High-Value Production

Linking tropical farmers to new markets

The marketplace at Punata, Cochabamba Department, Bolivia.

Globally speaking, changes in the human diet over the past few decades have been nothing short of remarkable. We now eat more vegetables, fruits, meat, dairy products, and fish than ever before, relying far less on traditional staple grains and other commodities like wheat, rice, maize, potatoes, and cassava. This largely positive nutritional trend is expected to continue strongly for many years. It will, on the whole, improve our health status as a species. But beyond that, increased consumption of these higher value products is resculpting our agricultural landscape and will indelibly alter economic relations among continents, countries, and communities. The crucial task for CIAT is to help the rural poor actively exploit these changes in economically and environmentally sustainable ways rather than become passive bystanders or, worse, victims of the entrepreneurial success of others.

A diverse human diet is just the tip of the iceberg. It is one of the more obvious signs of the much broader dynamic we loosely refer to as globalization—changes in international trade, corporate structure, commodity prices, methods of buying and selling, and information and communication technologies. In this new reality, the world's food consumers, their voices ventriloquized for better or worse by supermarket chains, now call the shots. For their part producers must listen carefully to consumers' requirements for product variety as well as quality and safety.

In the next few pages, we look at recent trends in global food production, marketing, and consumption, and what they mean for tropical farmers, scientists, and their development partners. We also review recent research by CIAT to help farmers make the difficult but necessary transition to producing higher value products and linking to existing or newly emerging domestic and export markets for those products. As we will see, this research is fully consistent with CGIAR priorities and with CIAT's pursuit of the three global research-for-development challenges that guide its work: Agrobiodiversity, Agroecosystem Management, and Rural Innovation.

More trade but declining commodity prices

From 1980 to 2003, world trade in food, expressed as the value of exports, more than doubled. And the annual value of world trade in agricultural products is now approaching US$600 billion. The industrialized world exports slightly more than the developing countries combined, but it imports substantially more. For tropical producers it is a huge and potentially lucrative market. But with the last vestiges of pure subsistence farming now vanishing, developing country markets too are on the rise and present substantial opportunities for raising farmers' incomes.

What's of special significance here is the product balance. Bulk commodities like grains and oilseeds have dwindled in economic importance, now making up only one-sixth of global trade in agricultural products. Their place has been taken by a range of processed and high-value food items, which now account for more than 80 percent of trade. For example, exports of fruits and vegetables rose
330 percent during the post-1980 period; in Latin America, they shot up 400 percent, with Central America becoming a major supplier. World meat exports also rose dramatically, by some 250 percent, with the increase reaching 300 percent in Latin America.

The growth of trade has been accompanied by rising pressure on prices. World prices for wheat, maize, and rice, adjusted for inflation, are the lowest they have been over the past century. And prices for commodity pulses (dried legumes) are about half what they were in 1989–90. Producers of traditional cash crops, such as coffee and tea, have also faced severe price declines. In all these cases, the reasons are a mix of increased supply and sluggish demand, leading to market saturation.

"Prices of the top 20 or so commodities are at historic lows," says Shaun Ferris, manager of CIAT's agroenterprise development project. "If we continue to focus just on the productivity of those commodities, we lock rural people into poverty. We're arguing for much greater investment in helping farmers diversify into different sectors, so they have a range of options in supplying high-value products."

Globalization has increased both the supply of and demand for food, and altered the product mix. In particular, it has simultaneously created both threats to traditional field-crop production in tropical countries, due to stiff competition from efficiently produced cheap foreign imports, and an array of new opportunities due to consumer hunger—in the good sense—for variety and quality. Globalization, then, supports market supply from new sources. Among the commercial trends that can link tropical farmers to new markets, we note the rise of trade houses, supermarkets, and niche markets (for specialty coffees, for example), as well as the Fair Trade movement and the growing popularity of organic produce.

A stated research priority

Anyone who listens to agricultural scientists talk about shifting tropical research to high-value crops and other products is bound to hear the word diversification. It is closely linked to the economics of survival in the rural tropics. The connection is spelled out in research priorities for the period 2005-2015, set out by the CGIAR's Science Council (see box).

A framework for realistic action

A group of about 40 experts in diverse aspects of high-value agriculture gathered recently at CIAT headquarters to examine how the poor, especially neglected groups such as rural women, can benefit from growing markets for these products. Convened by the Global Forum on Agricultural Research (GFAR) and the CGIAR Science Council, the workshop was organized by the secretariats of these groups in collaboration with CIAT, the World Vegetable Center (AVRDC), International Plant Genetic Resources Institute (IPGRI), and International Federation of Agricultural Producers (IFAP).

The meeting was an important first joint initiative following the Science Council's recent decision to prioritize agricultural diversification and high-value products, such as fruits, flowers, vegetables, and livestock products. The experts were quick to acknowledge that, while small farmers enjoy some advantages, such as the limited economies of scale in markets for high-value products, they also face significant challenges, including the need to organize, acquire new knowledge and skills, and gain access to business support services.

Workshop participants made a good start toward doing a better job of helping farmers meet those challenges. Specifically, they reached a shared understanding of what high-value products are, reviewed strategies used in different regions for linking smallholders to markets, identified high-priority issues for a shared research agenda, and began creating informal networks and alliances for addressing key themes. The CGIAR and key partners now have the makings of a solid framework for realistic action.

The five CG priorities were selected to contribute directly or indirectly to seven of the eight UN millennium development goals. The Science Council proposes that within 3 years 80 percent of the CGIAR budget be devoted to the five priorities, one of which is "reducing rural poverty through agricultural diversification and emerging opportunities for high-value commodities and products." The Council sees the added income for farm families coming from several sources: fruits, vegetables, livestock, fish, and nontimber forest products. Pursuing this priority is expected to contribute directly to the first two millennium goals: curtailing extreme poverty and hunger, and reducing gender disparity. The CGIAR also sees diversification as contributing indirectly to the goals of lowered child mortality, better maternal health, and environmental sustainability.

The priorities document calls for the CGIAR's research on fruit and vegetables, currently at a low level, to be expanded significantly. CIAT's project on tropical fruits, launched 3 years ago, as well as its longer-standing focus on value added and marketing, through its agroenterprise project, are already in step with this thinking.

Diversification in coffee zones

One obvious entry point for research on high-value products is the coffee supply chain. Coffee has suffered a slow decline as a cash crop in recent decades. International prices fell

on average a little more than 5 percent a year from 1977 to 2001. The trend jeopardizes the livelihoods of some 25 million growers in about 70 countries, particularly poor hillside farm families working small plots of environmentally vulnerable land.

Under a 3-year project, CIAT is designing a three-part research strategy to help coffee and other smallholder farmers find viable higher value crop replacements that match demand from markets. In some cases, the recommended diversification will include continued coffee production but aimed at specialty markets that appreciate specific quality traits and are willing to pay a premium for them. In addition to specialty coffee, the project is working on tropical fruits, medicinal plants, high-value fodder crops, and specialty honeys, with the aim of developing concepts and methods to facilitate the participation of small farmers in high-value product supply chains.

At the heart of the diversification strategy is a triad of activities: market analysis, use of geographic information, and crop management tailored to match products from particular environmental niches with specific markets. Together, these activities can help bridge the gap between what farmers might successfully grow, given local climate and soils, and what buyers want—a gap that has plagued earlier crop diversification schemes.

Tropical fruits are another promising option for smallholders (see box). Their cultivation is generally well suited to the intensive management that can be readily provided at a small scale—such as coffee farms, 70 percent of which are less than 5 hectares. And since many fruits are perennials, they fit well into coffee production systems from an environmental standpoint: They ensure continuous groundcover, protecting slopes from erosion.

“To fully benefit from growing and selling such higher value crops, you need more specialized knowledge, such as production requirements and market intelligence,” says Thomas Oberthür, a GIS specialist with CIAT’s land use project. This is important not only for the smooth operation of production and distribution, but also for ensuring an equitable distribution of benefits along the supply chain. The slice of the pie that goes to the tropical farmer is small and shrinking. An analysis of the distribution of benefits from African coffee production, for example, showed that the farmer got only US$0.12 of the $26 for which one kilogram of coffee retailed in London in 2002.

The CIAT strategy, which combines expertise from several disciplines and four on-going research projects, recognizes that agroecological conditions vary widely in the highlands, between farms and even between fields within the same farm. So, not all farmers in an area may be able to grow the same crop and a single smallholder may need to diversify into other products. In these environments, regional one-size-fits-all strategies won’t work, says Oberthür, and fragmentation of supply is a risk. Successful diversification, then, requires farmers to cooperate among themselves, as well as with service providers and other actors, to build a viable market chain. They must know their clientele and their tastes, the technical requirements of the supply chain, such as product quality, volume, and timing of delivery, and the specific characteristics of the higher value crop they are selling.

As a Colombian exporter told Oberthür: “We’ve got to learn more about our product at both ends. These producers want to know where their product is going.”

Fulfilling the promise of tropical fruits

Since its establishment several years ago, CIAT's tropical fruits project has channeled its efforts mainly in two directions. First, it is creating information tools that help partners decide what species can best be grown where. And second, it is developing methodologies and technologies that can be applied with numerous fruit species to accomplish key tasks or solve major problems.

One of the main obstacles to expanding and improving production of some high-potential tropical fruits, such as lulo (*Solanum quitoense*) and soursop (*Annona muricata* L.; *guanábana* in Spanish) is the difficulty farmers face in obtaining high-quality planting materials for clonal propagation.

To support our partners' search for solutions to this problem, we are developing, to cite just one example, participatory methodologies that enable lulo growers to select elite clones as well as tissue culture methodologies for rapid in vitro multiplication of these elite materials on a large scale. "In vitro propagation can provide farmers with a source of healthy plant material. Some of them have reported increased productivity with these materials," comments geneticist Zaida Lentini, who coordinates this work.

A second major challenge for small farmers is how to manage major diseases and pests attacking diverse fruit species. "A serious attack, by reducing both the quantity and quality of fruit, can quickly wipe out producers' investment," notes Alonso González, manager of CIAT's tropical fruits project. For that reason the project will put increased effort into integrated management of diseases and pests like fruit flies, he explains.

Another promising but challenging line of research is aimed at developing practical means for genetic control of flowering in mango as a model for other tropical fruit species. If farmers were to gain the ability to control flowering in fruits, they could better target their produce to markets with narrow windows of opportunity. Recent ground-breaking research on this theme, funded by the Rockefeller Foundation, focuses on achieving in vitro regeneration of plantlets, using tissue culture techniques. This is required for developing an efficient protocol for genetic transformation, which would make it possible to splice in genes for flowering control and other valuable traits.

Higher value through commodity rejuvenation

The drive to raise rural incomes may take the form of direct diversification into new, higher value crops, or even off-farm activities, related or not to agriculture. But changes in the production, grading, processing, and marketing of the crops farmers already grow may also open economic doors. A traditional food staple like cassava, for example, can also be grown

as a source of industrial starch or processed into chips for animal feed. Both types of alternative product, typically involving a switch to new cassava varieties, will provide higher and more stable incomes than if the roots are merely sold fresh in local markets.

CIAT has worked for many years with numerous farmer groups on such nontraditional uses of cassava and has increasingly incorporated industrial requirements into its cassava breeding strategy. Its collaboration with the Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA), headquartered in the Agronatura Science Park on CIAT's campus, has helped stimulate and maintain a creative dialog between the R and the D in the consortium's name.

Following major yield improvements in recent years, Hernán Ceballos, manager of CIAT's cassava project, says that the crop can now compete with other sources of starch at commercial levels. This has fueled scientific and commercial interest in complementary qualitative improvements. "We are interacting closely with the industry to find out exactly what it is they want."

One opportunity is protein enhancement for improved nutrition of both people and livestock. While the leaves of cassava are rich in protein, the bulk of the edible portion of the plant, the roots, is not. Root protein is generally only 2 to 3 percent. But Ceballos notes that promising exceptions to the rule have recently been observed in some Central American cultivars, which have protein levels as high as 8 percent and more than twice the normal levels of pro-vitamin A carotenoids.

Improving the quality of cassava starch will also add value to a field crop produced mainly by poor people. Starch consists of two compounds, amylose and amylopectin, the latter being the more abundant and also responsible for the texture of "waxy" starch, which fetches a high price. One CIAT strategy, then, is to select for lower amylose content. In decades past CIAT cassava researchers analyzed only about 300 cassava samples a year for starch quality. In 2005 the Center began to beef up its analytical capacity. Throughput is expected to reach 300 samples a week during 2005.

Perhaps the most novel aspect of CIAT's new cassava breeding strategy is the introduction of mutagenesis to induce new value-adding traits. "Inbreeding allows you to push for the appearance of recessive genes, most of which will be bad for the plant but which can be easily bred out," says Ceballos. The key is to increase the chances that useful recessive genes—such as ones coding for quality starch traits— will express themselves. With support from CIAT, national research programs in India, Thailand, Vietnam, Uganda, Ghana, Cuba, and Brazil began projects in 2004 to incorporate inbreeding into their cassava research.

The message is clear. Even with a traditional food staple like cassava, there is excellent potential to add value, thus rejuvenating the commodity.

Better buffaloes from improved forages

CIAT's work with smallholders in Southeast Asia to improve the supply of forages is also a good example of the economic power of quality improvement. The forage technologies, developed with support from the Australian Agency for International Development (AusAID) and the Asian Development Bank (ADB), help farmers raise healthier animals, with less

investment of time and energy (especially in collecting fodder and herding animals). When farmers adopt such technologies, says Rod Lefroy, CIAT's regional coordinator for Asia, "they cease being livestock keepers and become livestock producers." It is a change in both outlook and behavior. Instead of keeping animals mainly as an insurance policy, to be sold for cash to cope with emergencies like crop failure or family funeral expenses, the farmers begin to see their animals as a source of income, of products they can market on a regular basis.

Lefroy cites the case of Hmong highland farmers in Laos and their draft animals. After buying a single buffalo at the beginning of the cropping season, a farmer would typically see the animal's physical condition slowly deteriorate due to inadequate nutrition. But now, with good-quality forages available, the buffalo can be properly fed with less investment of family time and labor. As animals are in better health and show significant weight gain instead of loss, some farmers are buying and selling more than one animal per year, providing a welcome boost to their income. Traders coming to the village, explains Lefroy, are willing to pay more per kilo of live buffalo thanks to simpler marketing (i.e., buying more animals in one visit) and better quality animals. "This amounts to improvements in livestock production and the overall livestock marketing chain."

Potato farmers enter the fast-food lane

Good planning and organization by farmers is another means of boosting the de facto value of agricultural products, whether traditional commodities or new high-value niche crops. For example, pooling research, technology, production, equipment, transport, and support services, as well as working out clear delivery timetables with customers, yield economies of scale and other efficiencies that put money directly into producers' pockets. The same is true of business development strategies, such as formal contract farming and the use of information services. CIAT is actively investigating various organizational options, notably through its projects on participatory research and agroenterprise development.

An enterprise in Uganda demonstrates how good planning and organization can help bring farmers financial success with a traditional product. In the country's hilly southwest, the Nyabyumba Farmers' Group, originally set up in 1998 as a spinoff from a Farmer Field School, now supplies high-quality, pregraded chipping potatoes to a fast-food restaurant in Kampala, part of the Nandos chain.

CIAT trained staff of the NGO Africare in market facilitation methods; Africare in turn helped the farmers plan and set up their business. The group set out strict planting schedules for members to synchronize their production with the client's needs. The group also changed their planting density to obtain the required size of potato for this market. These and other technical innovations were designed with the help of Uganda's National Agricultural Research Organisation (NARO).

With Africare's help the group also sorted out conditions of sale with Nandos. These related to price, terms of payment, potato variety, timing of delivery, volume, and quality. Deliveries of 190 tons per month as of May 2005 have earned the group the equivalent of US$33,000.

Several lessons from this experience stand out. First, while a market orientation does enable smallholder farmers to plug into higher value markets, the process requires long-term support from research and development partners. Second, access to innovations at critical points, such

as production, postharvest handling, and marketing, are vital to success. Third, participatory methods allow market chain participants and service providers to better understand each other's needs and challenges. Finally, by consolidating relationships with buyers and opening communication channels with all market chain participants, farmers gain confidence and improve their negotiating power.

The high road to high value: Hurdles and rewards

Diversification into novel high-value crops, or at least ones the farmer has never grown before, may be the boldest strategy for raising farm revenues. But it is also a strategy prone to great uncertainty. While traditional commodity production also carries with it certain risks, like a poor harvest due to a pest outbreak, experienced farmers can anticipate the threat and make plans to cope with it. It is the devil they know. With crops that are new to them, the uncertainty, even about the production risks involved, is high. And on top of these are the risks associated with marketing.

On the supply side, information and knowledge bases may be weak (see box), and relevant technical expertise and business services scarce. Farmers may also lack sufficient investment capital and inputs, and face technical constraints such as inappropriate germplasm. Other obstacles have to do with a "demanding" demand side—buyers who impose increasingly stringent quality, safety, and traceability requirements, especially in industrial countries. As CIAT's director of research, Douglas Pachico, notes, "We're seeing that market entry issues are often more important than production problems."

Agroenterprise service providers may need to alter objectives and retool. With a history of largely unsuccessful supply-driven agricultural development haunting them, their learning curve can be as steep as the farmers'. A pitfall any new support strategies must avoid is loss of service to the poorest. Since high-value crops generally require more technology, knowledge, organization, communication, and cash investment than standard food staples, there is a risk that those who lack such resources will be left on the sidelines. Furthermore, R&D organizations must not become too enamored of their favorite product list, since today's high-value crop may be tomorrow's loss maker.

So the road to high-value cropping is strewn with many obstacles. But the rewards are enticing.

Cyberspace and the rural marketplace

Development partners, farmer groups, and other actors in chains for high-value products are keenly aware of the need for stronger links with multiple sources of market-related information. Exciting opportunities to strengthen information services are being created by the gradual spread of Internet access and other new information and communications technologies (ICTs) in developing countries.

In order for rural communities and organizations to reap the potential benefits of ICT use, further interventions are required beyond the initial investment in connectivity and training. One of these involves the creation of local content that responds to rural people's needs. During recent years CIAT has gained valuable experience in determining how to promote the generation of market-related content at the regional, national, and local levels.

A notable example is CIAT's relationship with the African software developer Busylab, with whom we have developed market information systems for Africa (www.tradenet.biz) and Central America (www.agroemprendedor.org).

Through complementary research in Colombia and Bolivia, the Center has also developed an approach for creating local information systems for rural agroenterprise development, or SIDERs (their acronym in Spanish). These systems are constructed in a participatory manner with community-based stakeholder groups, representing farmer associations, other chain actors, and local organizations. Trained to act as "information and communications promoters," the groups develop and disseminate market-related content, using Web sites (see, for example, www.caucasider.org) and diverse conventional media, such as radio, printed bulletins, and local drama.

What to grow? Ask Homologue

The first question asked by farmers wanting to diversify into higher value crops is, "What can we grow profitably in our fields?" Choosing an appropriate high-value product is critical, but the decision may not come easily, especially if the producer has been growing the same mix of crops for many years and has little marketing experience. The first step is to find out which new high-value crops will thrive in the farmer's agroecological zone. In highland areas, where soil and climate conditions vary widely over short distances, what's suitable for one farmer may be inappropriate for another.

CIAT has designed a computer tool called Homologue that can provide part of the answer. Homologue is a Windows application that uses climate and soil information about one or more locations to identify other places with similar characteristics. An agroenterprise service provider could use Homologue to answer these questions: "Where on earth are there farms like ours? What high-value crops are being grown there that we too could try out?" Similarly, researchers or development agencies looking to put improved crop varieties into farmers' hands can use Homologue as a targeting tool.

The result of collaboration between CIAT's tropical fruits and land use projects, Homologue is a self-contained, user-friendly mapping system. The user simply points the cursor to a target site on the screen to generate a display of homologous locations elsewhere on the continental or world map. Future releases will have high enough resolution to allow a specific farm field to be selected as the input point.

CIAT is also helping to reinforce the global knowledge base on high-value crops through various information services, including the recently launched New World Fruits Database. This is a joint effort with the International Plant Genetic Resources Institute (IPGRI). The database, which allows for Web-enabled searches, holds information on more than 1,200 fruit species from the Americas. In addition to pictures, this resource covers taxonomy, common names, uses of the species, and geographic distribution. It also provides bibliographic references for further research and links to information on the availability of germplasm. Work was under way in 2005 to allow the database to be used in tandem with Homologue and other geographic information systems (GIS) tools.

Learning alliances for agroenterprise development

While good crop information tools are essential to high-value production, farmers need direct assistance with many other aspects of agroenterprise development as well, especially organizational and economic aspects. Through "learning alliances" with Catholic Relief Services (CRS), CARE International, SNV Netherlands Development Organisation, and other major international development agencies, CIAT and its partners are developing and testing a comprehensive participatory approach to helping farmers design, set up, and manage small agroenterprises.

As the approach is refined through action research conducted across different locations and products, it is being widely implemented through development projects. In Central America, for example, CIAT's international partners work with more than 30 local organizations in four countries, who, in turn, support enterprise development for more than 125,000 rural families. The learning alliance thus provides a strong leverage point for achieving impact on a large scale.

The alliances have already allowed CIAT to help thousands of rural entrepreneurs in Latin America, Africa, and Southeast Asia. Shaun Ferris, manager of CIAT's agroenterprise development project, comments that the alliances are "an incredibly useful way to build capacity around the relatively complicated task of enterprise development."

In addition to building the capacity of local business service providers, the learning alliances provide a platform for demand-driven action research carried out by CIAT and its partners. Through such research we can help development practitioners, the private sector, and policy makers design or adapt new approaches and tools that support enterprise development. Moreover, this work enables CIAT scientists to draw on a wealth of field cases for strategic research resulting in international public goods that help create new options for small farmers in high-value agriculture.

In Southeast Asia, with support from the Swiss Agency for Development and Cooperation (SDC), CIAT and local partners are helping farmer groups in six districts of Vietnam to diversify into higher value products using its four-step agroenterprise development process. A major success to date has been a significant increase in peanut production. This was achieved through a technique known as market chain analysis, which brings all players in the chain together in a participatory approach to problem solving. Mark Lundy is an agroenterprise specialist and the main architect of CIAT's learning alliances. He notes that in Central America, where the learning alliance is supported by Canada's International Development Research Centre (IDRC), there is strong consumer interest in high-value products, including organically grown produce.

Many poor farmers in Central America live in environmentally sensitive highland areas, where they try to make a living from tiny holdings, often just a hectare or two. Together, the farmers and service organizations with which CIAT has worked decided that, with so little land available, intensive vegetable production would be a good bet. But the big urban supermarket buyers are very demanding about quality and also about the use of ecologically sound production practices. So the farmers, says Lundy, have to consider many factors as they switch into or enhance vegetable production. Besides economic feasibility, they have to decide on the types of inputs they will use and how they are going to manage their natural resources sustainably.

There's also the issue of product volume. Fortunately, scaling up to provide a sufficient quantity of quality products creates postproduction jobs—sorting, grading, washing, and packing—which tend to benefit women. "It's a simple kind of value adding, but it's occurring at or near the farm level," says Lundy. He cites the example of a project in El Salvador, where farmers produce high-quality vegetables for a city supermarket with backing from CRS. "This project has generated livelihoods, not just for smallholders, but also for family members who help prepare the vegetables for delivery."

The high-value horn of plenty

That and the other experiences and achievements described in this report reflect a conviction that CIAT shares with growing numbers of scientists, development practitioners, and rural people: The journey toward sustainable livelihoods depends, not just on the staple foods that sustain life, but also on a cornucopia (the "horn of plenty" from Greek mythology) of higher value products that could improve life's quality.

Based on its work and accomplishments so far, what has CIAT learned about tapping the potential of such products for reducing rural poverty? One clear lesson is that, while building on our traditional strengths in crop improvement, we must learn to exercise those strengths differently.

In research on cassava and tropical forages, for example, this means developing new traits or promoting uses of crops that better enable farmers to seize emerging market opportunities. Another challenge is to derive generic tools and approaches (sometimes from work that originally centered on staple foods), which our development partners can adapt and apply to a wide range of tropical products. For example, the robust participatory methods devised by CIAT's agroenterprise project build on our experience in developing new markets for cassava.

To guarantee that such methods are widely implemented and can achieve large-scale impact, we must also create more effective models of collaboration, such as CLAYUCA and the learning alliances described above, which involve traditional and nontraditional partners. Precisely because the high-value horn of plenty offers so many possibilities, it will take an unprecedented collaborative effort to identify and develop options that can deliver on the promise of high-value products.