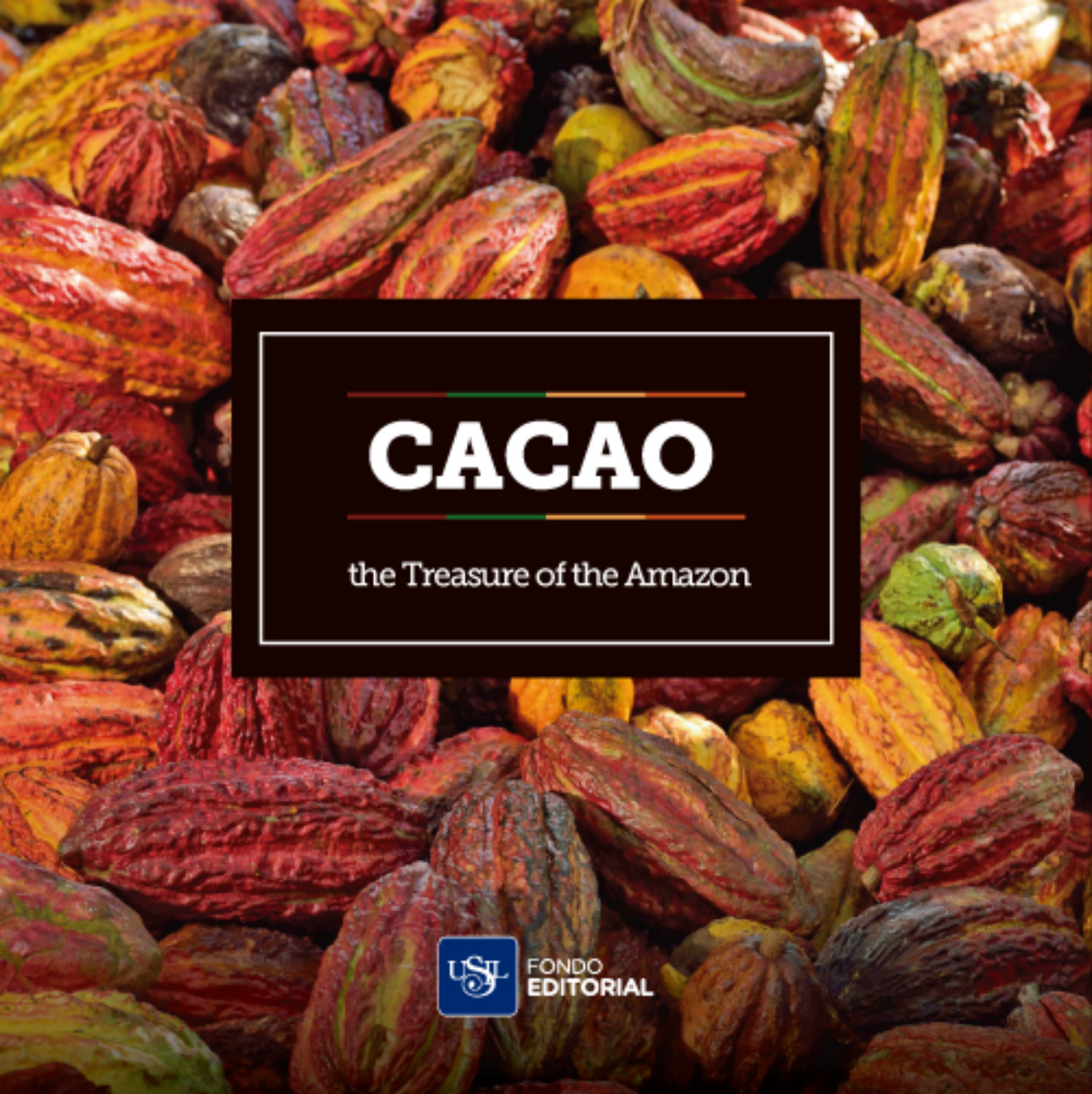
CACAO
the Treasure of the Amazon
USIL
FONDO
EDITORIAL

CACAO

The Treasure of the Amazon

FONDO EDITORIAL

CACAO, THE TREASURE OF THE AMAZON

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San Ignacio de Loyola University
Fondo Editorial
Av. La Fontana 550, La Molina, Lima
Telephone 317-1000 Extension 3705

General Project Management
Luciana de la Fuente de Diez Canseco

Research Team
Ana María Muñoz Jáuregui
José Valdizán Ayala
Juana Zavaleta Melgar
Luis Olivera Montenegro
José Gómez Mendoza
Fernando Ramos Escudero
Martín Cárdenas Jarama

Fondo Editorial
Director: José Valdizán Ayala
Coordinator: María Olivera Cano
Editor: Rafael Felices
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Content Writers
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Julio Parraguez Santisteban

Cuper Comunicación Integral
General Editing: Kathy Perales Ysla
Graphic Design: Belisario Negrillo
Photography and Graphic Editing: Gabriel Herrera
Photography: Gabriel Herrera, Christian Quispe

Complementary Photography
Heinz Plenge / Pages 23, 24, 26
Yutaka Yoshii / Page 27
Walter Alba / Page 27

English Translation
Marcia Choquesillo Martínez
melisachmartinez@gmail.com

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Antonio Tacchino Del Pino, Vice President of Decentralization of USIL, General Coordinator of the Guinness Record "Tasting the World's Biggest Chocolate."

"...A cup of this precious drink
enables a man to walk throughout
the whole day without food."

Hernán Cortés, *Letters of Relation to Charles V*

Foreword

Raúl Diez Canseco Terry
Founding President
San Ignacio de Loyola
University

The world would not be as it is today without the Amazonia. It is home to the largest area of tropical rainforest where more than half of our planet's animal, plant and insect species live. This immense green ocean plays a vital role in the regulation of the Earth's climate, the purification of water, and the absorption of carbon.

Peru is a country blessed by nature. Its largest and most biodiverse region is the Amazonia. According to the National Ministry of the Environment, the Amazonia covers, in its entirety, the departments of Loreto, Ucayali, and Madre de Dios; almost entirely, the departments of San Martín and Amazonas; very partially, the departments of Pasco, Junín, Huánuco and Cusco; and, finally, certain protected areas of Cajamarca, Puno and Ayacucho.

About 60 percent of the national territory, with 782,880 square kilometers, corresponds to the Amazonian territory, which is home to 31 ecosystems and 14,712 species of animals. However, the Amazonia contributes slightly more than 5 percent of the national product to the country's economy.

The vision that still exists of this vast territory is that of a region rich in natural resources that must be exploited through either the extraction of oil, gas, and minerals or the use of forests, assuming that they are exclusively economic and profitable areas.

However, it is forgotten that, besides having diverse and heterogeneous ecosystems, the Amazonia is also diverse and heterogeneous in terms of its people, as it has several types of populations that depend on it for their survival. Let's remember that the Peruvian Amazonian region has around 3 million inhabitants, among whom a variety of ancestral cultures with more than 60 ethnic groups coexists.

The Amazonia is being rapidly deforested: indiscriminate logging, illegal mining, oil spilling, and climate change, among other factors, are destabilizing the region. If the current rate of deforestation as well as the factors damaging the forest continue, the forest will disappear so quickly that the grandchildren and great-grandchildren of those who live today in the tropical forest will not be able to benefit from its fruits and medicinal plants, and will never know they ever existed.

More than half a century ago, President Belaunde made a dream come true: to begin the expansion of the agricultural frontier by building the Carretera Marginal de la Selva (the Jungle Border Highway) so that, in Peru, with every heartbeat of a newborn, new plant life will spring from the land.

The incorporation of fertile lands into the jungle continues to be a national objective because, through the expansion of the agricultural, livestock and forest areas, this would ensure not only the economic development and the success of the region, but also food for the Peruvians.

There is now a great possibility of achieving an ecologically sustainable development that generates surpluses without neglecting the environmental care. International markets are more demanding with regard to the conditions for environmental conservation and sustainability of the products that are traded and consumed. Competitiveness is closely associated with social responsibility.

Sustainable use activities are possible because in the Amazonia there are more and more Natural Protected Areas that have very particular benefits. For example, thanks to the joint work of the State, the private sector and some NGOs, economic resources are being generated for small farmers in Madre de Dios with cacao production, and simultaneously, it contributes to the conservation of more than half a million hectares of Amazonian forests in protected areas. This is the deforestation-free cacao production based on the pay-for-performance model, i.e. farmers receive financing on the condition of not deforesting and, on the contrary, restoring degraded land with cacao-based agroforestry systems. This business model offers greater flexibility and efficiency to take advantage of more areas of the Amazonia and benefit, especially, the disadvantaged local populations.

This model also allows minimizing the impacts of the climate change on the Amazonian biome and increasing livelihood resilience of people in the face of environmental changes. By ensuring a regional and cross-border approach of the Amazonia, the project better protects its biodiversity and safeguards local communities and economies that depend on it as a source of food and sustenance.

The cultivation of this fruit represents today a great opportunity for the sustainable development of the country, which has the privilege of being the cradle of the finest cacaos in the world. Its proven nutritional value and the massive acceptance of its exquisite taste thanks to the precious chocolate, its main by-product, meet the demands of the growing interest in healthy nutrition and of the gourmet gastronomy, passionate about the discovery of cacao beans with unique and exclusive flavors.

Nowadays, the Peruvian cacao is recognized for its quality, and the chocolates made with it have been qualified as the best in the world, standing out from those produced in Belgium, Switzerland, and France, countries that, by tradition, are synonymous with quality and fineness in the chocolate industry.

Committed to making the value of Peru's native crops known to the world, San Ignacio de Loyola University brings to light the great wealth of the Peruvian cacao, star of our Amazonian biodiversity.

Cacao crop in the sector Nuevo Horizonte in Pucallpa - Ucayali.

Prologue

Luciana de la Fuente de Diez Canseco
Executive President
San Ignacio de Loyola University

Peru is one of the 10 countries with the greatest biodiversity in the world. Its different climates, ecological strata, production zones and productive ecosystems guarantee an impressive variety of flora and fauna, much of which is still waiting to be discovered by science. Much of this natural wealth is represented by its Amazonian territory, considered a unique food pantry on the planet.

Peru's lush forest is home to native treasures full of enormous nutritional value and human health benefits, including valuable cacao, which is the focus of this publication.

The nutritional benefits of cacao and its contribution to human well-being have been valued since ancient times. Its invigorating power accompanied the force of the Aztec warriors and Mayan natives to cope with fatigue by getting an extra dose of energy. They created the drink precursor to chocolate, which, besides being used as an invigorating tonic, it was exclusive to the privileged classes. It is not for nothing that the cacao fruit was considered by these cultures as a "food of the gods."

Nowadays, the benefits of cacao have been supported by science, as it is not only of great value in gastronomy since it is the precious raw material for the production of exquisite chocolate, but also because its use extends to the cosmetic and pharmaceutical industry.

Cacao is a rich source of fats, minerals, and vitamins. Research has proven its anti-inflammatory properties, and its contribution to lowering blood pressure, regulating triglycerides and cholesterol, slowing down the aging process and improving the performance of mental processes, including memory performance.

The antioxidant capacity of cacao has been highlighted by nutrition researchers, who also show a growing interest in its potential for cancer prevention. Thus, the activity of its flavonoids is being studied, which allow, among other functions, the elimination of free radicals, inhibiting inflammation, cell proliferation, angiogenesis, and metastasis.

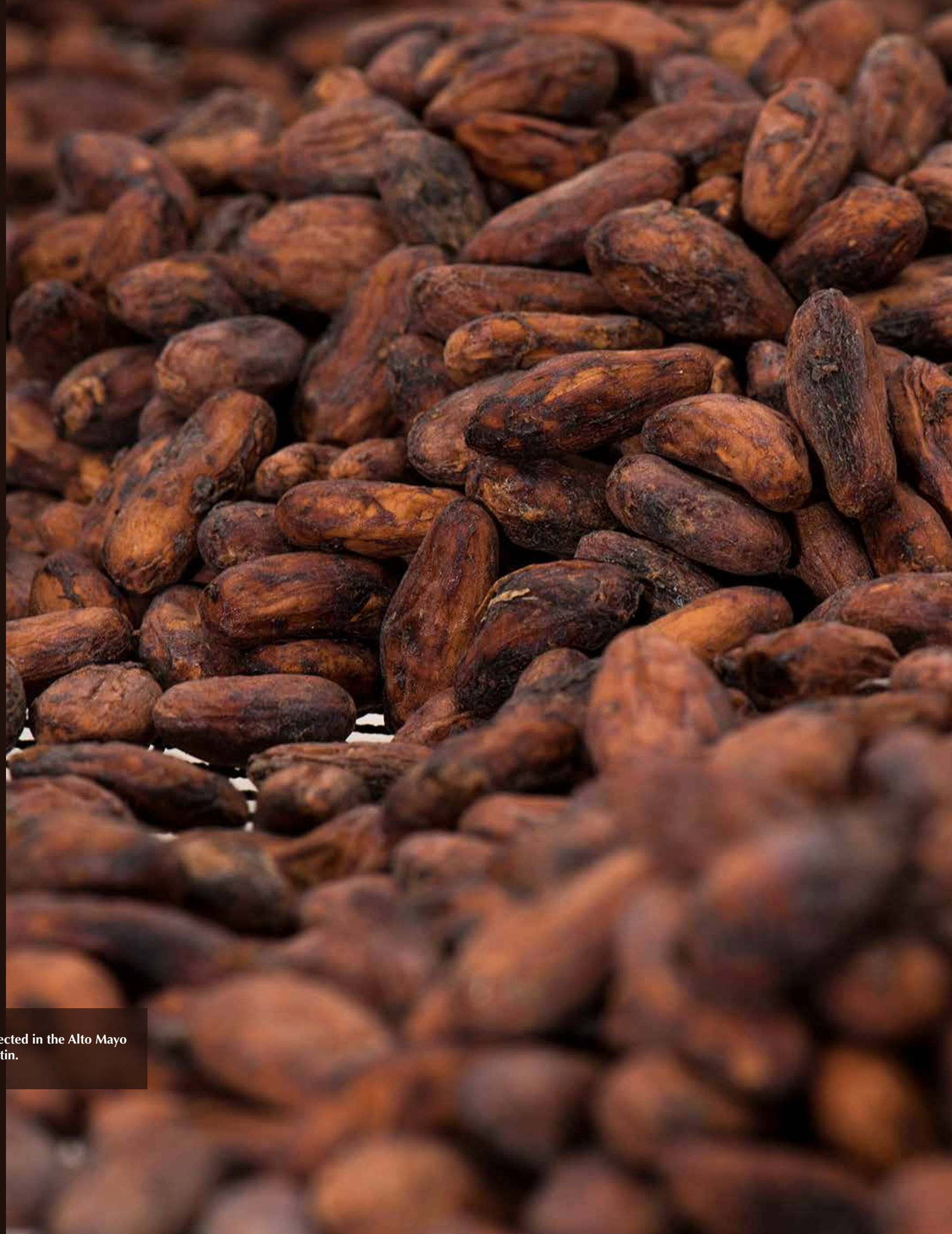
The cacao butter, another of its derivatives, is used in the cosmetic industry due to its richness in fatty acids, vitamins, and minerals, which keep the skin hydrated and protect it from aging through its antioxidant agents. The butter is also used to make moisturizing lotions, protective lipsticks, ointments, soaps and facial masks. The cacao is also used in hair care treatments, hydrating and recovering hair from damage.

The cacao's theobromine has a slightly diuretic and bronchodilator action that serves to supplement treatments for respiratory or urinary conditions. Recent studies indicate that the consumption of 20 grams of dark chocolate per day (200 milligrams of theobromine) may prevent kidney stones from appearing because this substance slows down the production of uric acid which, when crystallized, forms the so-called "stone disease." The potential of the cacao to prevent type 2 diabetes is also being studied thanks to its flavonols, a type of flavonoids that is capable of reducing excess blood sugar levels.

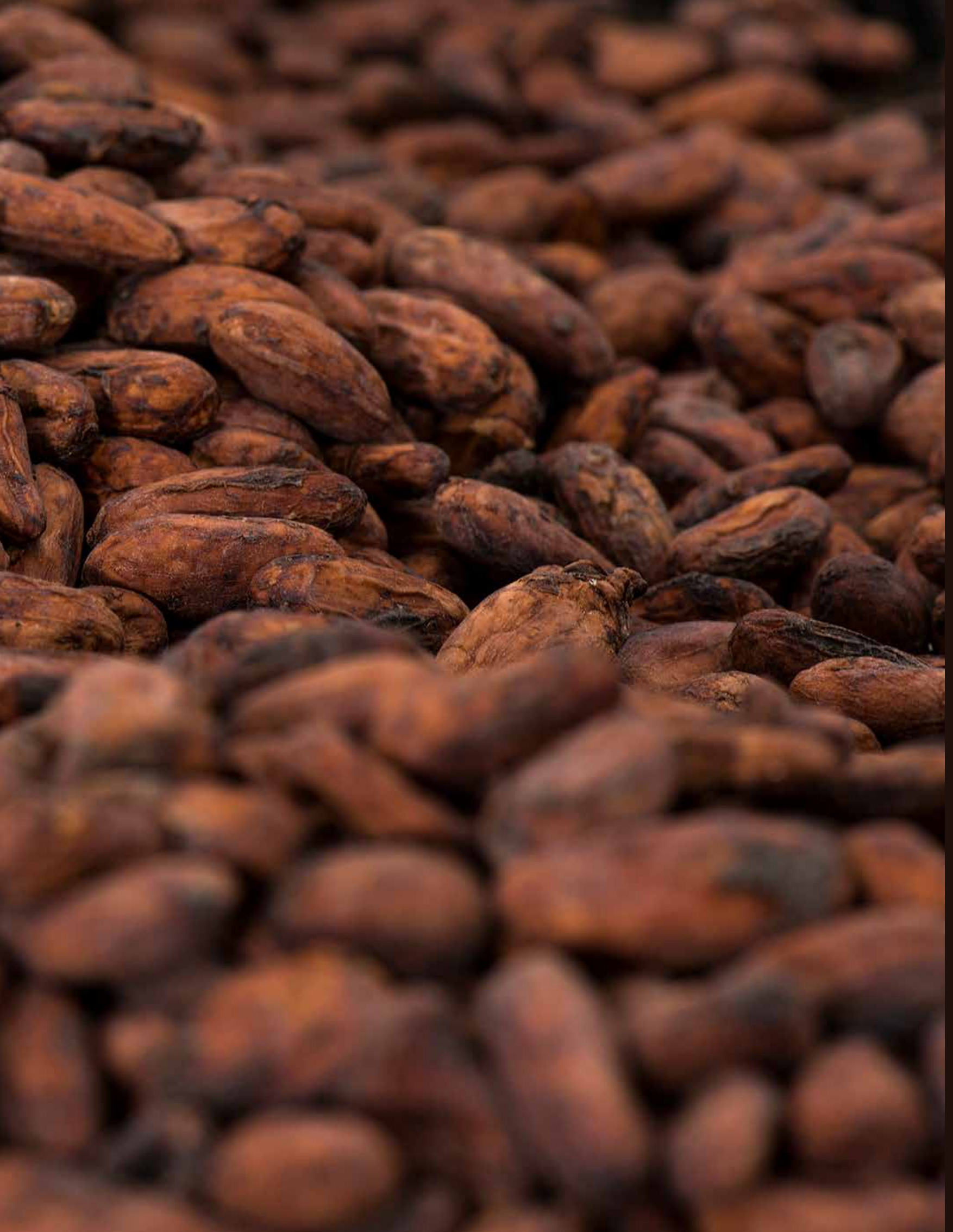
Likewise, in recent years it has been determined that the consumption of chocolate (especially bitter, which has a higher concentration of pure cacao) - contributes to good health due to its high levels of polyphenols, whose antioxidant, cardioprotective, chemopreventive and neuroprotective effects reduce the possibility of developing chronic diseases, such as cardiovascular diseases, cancer, and diseases associated with aging.

The good mood attributed to the consumption of this cacao derivative is the result of its content of phenylethylamine, a chemical produced naturally in the brain that has antidepressant properties, which induce the feeling of well-being, excitement, and pleasure.

Research on the countless benefits of cacao is progressing alongside the growing appreciation of the flavor and aroma of its finest and most exquisite specimens. Therefore, since Peru is the cradle of the highest quality cacao, our publication seeks to deepen the knowledge of this generous fruit of nature, as established by the aim of San Ignacio de Loyola University: to promote a healthy lifestyle, based on a nutritious diet, and to rescue the ancestral wisdom of our ancestors, which, today, is highlighted by science.



Dried beans ready to be selected in the Alto Mayo Protected Forest in San Martin.



Preface

Enrique Arévalo Gardini
President of the Tropical Crops Institute, Technological Innovation Center for Cacao (CITECacao) and other tropical crops

In recent years, Peru has positioned itself as one of the largest producers of organic cacao and fine flavor cacao in the world, according to Willer and Lernoud. In this regard, the National Ministry of Agriculture and Irrigation (MINAGRI, by its Spanish initials) points out that there are currently 126,000 hectares of land sown with cacao, which production amounts to 108,000 tons of beans.

The cacao plant is native to the Amazonian region. In this regard, Krug and Quartey-Papafio, as well as Evans and his collaborators, maintain that, according to the evidences, Peru is the center of origin of the greatest diversity of *Theobroma* genes, probably at the confluence of the Marañón and Ucayali rivers. It is also one of the most technologically advanced countries in cacao production, with yields exceeding 850 kilograms per hectare.

Added to this are the recent archaeological findings dating back to approximately 5,500 B.C., which have exhibited the use of cacao as chocolate by the ancient inhabitants of Peru, in the north of Cajamarca and Amazonas. The history of cacao, which until recently was believed to be native to Mexico, has therefore begun to be rethought.

In 1944, Cheesman considered cacao within the three major genetic groups: Forastero or Amazon, Criollo and Trinitario, the last ones are hybrids between Criollo and Forastero. Later, in 2008, Motamayor and his collaborators proposed a classification based on 10 genetic groups: Marañón, Curaray, Criollo, Iquitos, Nanay, Contamana, Amelonado, Purus, Nacional and Guiana, six of which are Peruvian.

Meanwhile, the Tropical Crops Institute (ICT), in collaboration with USDA/ARS and INNOVATE Peru, has created new collections of wild cacao in the northern, central and southern cacao basins of the country, rescuing more than 600 accessions that have been duly grouped and categorized.

This collection of wild cacao, in addition to the collection from the International Cocoa Quarantine Centre at the University of Reading, United Kingdom, among others, is housed in the ICT's germplasm bank in Tarapoto, San Martin, which is currently the largest one in Peru.

Since ancient times, Peruvian cacao genotypes have been the source of genetic variability that has given rise to promising populations in Africa, according to Posnette, and in Asia, according to Dinarti and his collaborators.

However, the abuse of monoclonal systems, the lack of shade, low rainfall and the increase in temperature favor the occurrence and severity of highly harmful diseases, such as witches' broom, in previously resistant cacao genotypes.

Added to all this is the increasing damage caused by insect pests such as *Carmenta* and *Steirostoma*, which perforate the fruit and debark the branches and trunk, respectively. Therefore, it is urgently recommended to change from the monoclonal to the polyclonal system in the area of the agroforestry practice.

In Peru, however, much progress has been made in the integrated management of cacao cultivation through pest control, in the technified systems of organic and conventional production, in the clonal arrangements for better production and quality, in the methods of massive propagation based on somatic embryogenesis, in the rooting of cuttings and grafting, as well as in the fertilization and optimization of post-harvest processes to obtain quality beans.

Similarly, progress has recently been made in the knowledge of practices for the mitigation and remediation of heavy metals in the cacao bean in order to cope with new standards that limit the minimum content of these elements, especially cadmium.

With over 400,000 hectares of land suitable for cacao production in the departments of the Amazonia, Peru has the potential to be a significant producer of quality, fine and flavor cacao. Hence, the importance of this work and the vital contribution of the San Ignacio de Loyola University, which highlights the great value of the exquisite Peruvian cacao and the possibilities it offers for the livelihood of the Peruvian families and the development of the country.

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Chapter I

The Origin of Cacao

"The most beautiful thing we can experience is the mysterious. It is the source of all true art and science."

Albert Einstein

Plantation of cacao ready to be harvested in Pucallpa.

If part of the jungle is still a real mystery today, the history of the origin of cacao, as well as its cultivation in tropical regions of the Americas, continues to be inexplicable and controversial, although, in light of the recent archaeological research works, perhaps the enigma will soon be revealed.

The first evidence of cacao cultivation in the New World is attributed to the Mesoamerican civilizations, especially to the Maya and Aztecs, who gave it great value: they gave it an important place in their sacred rites, consumed it in important celebrations, used it as a revitalizing food and created the drink precursor to the seductive chocolate.

The main proponents of this theory are José Cuatrecasas and the Mexican botanist Arturo Gómez-Pompa, who claim that wild populations of *Theobroma cacao* L., the scientific name for cacao tree, have been found in the jungle of the state of Chiapas, in southeast Mexico, and in the Usumacinta river basin, which separates Mexico from Guatemala. They consider that these populations are not only wild but also highly variable, which is often seen as a sign that they may have been domesticated in this area (Coe and Coe, 2000). Cuatrecasas also suggests a vast early distribution of wild *Theobroma cacao* in the Americas, from Mesoamerica to the northern and western Amazon basin.

The other position goes in the opposite direction. He claims that cacao was born in the jungle of South America. The region between the basins of the Caquetá, Putumayo and Napo rivers, tributaries of the Amazon river, is even identified by Cheesman as the center of origin of cacao (García, 2000). In the same vein, Motamayor refers that, once the cacao extended throughout the Amazon, it was spread (through human action) along two routes: one leading north (Central America and southern Mexico) and the other, west (Peru, Ecuador, and Colombia) (Motamayor et al., 2002).

An Intriguing History

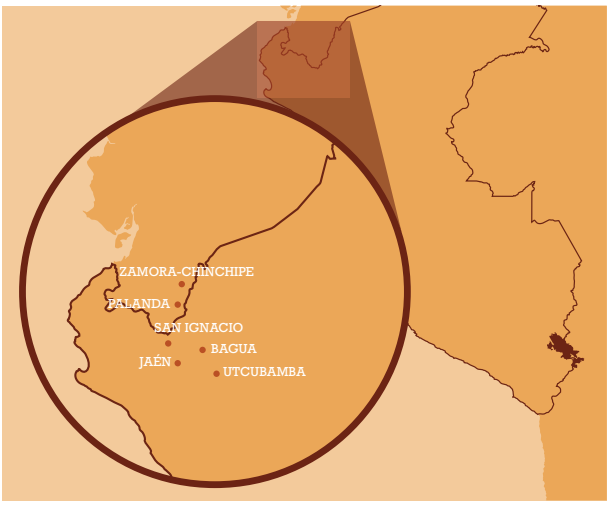
According to the botanical sheet of the *Peru biodiverso* project, all *Theobroma* species grow under the canopy of tropical rainforests. This natural area of distribution, which extends south from the Amazon basin to the southern region of Mexico (18°N to 15°S), has the Amazon region as its center of diversity, in what is now Brazil, Peru, Ecuador, Venezuela and Colombia (Dostert et al., 2011).

For this reason, in Peru, the existence of dispersed wild and native populations found in the central and southern regions of the Upper Amazon would support the theory that the place of origin of cacao would include the basins of the Huallaga, Ucayali and Urubamba rivers (Romero, 2016).

These regions located at the edge of the Peruvian jungle (also called rupa rupa or yunga) are characterized by a marked temperature disparity that defines a diversity of microenvironments and a multiplicity of fauna and flora. Although the soils are relatively fertile, due to the presence of alluvial deposits, they are obviously fragile for the scarcity of phosphorus and the strong erosion caused by their rugged relief. In this fertile tropical territory (with temperatures exceeding 30°C), the contrasts between mountain ranges, valleys, and pampas located between 600 and 3,000 meters above sea level (m.a.s.l.) can be seen.

So far as we know, thousands of years ago (since the dawn of the Andean civilization) different cultures coexist in the lush highlands of the Amazonia at the northern border of Peru and the southern border of Ecuador, in one of the areas with greater cultural integration and interrelation between the Amazon peoples and those located in the coastal and western high Andean region of the Andean Mountains.

The first inhabitants have left archaeological evidence of their settlement, as well as their ceremonial centers that, along with its lithic and pictorial arts and its varied pottery, among other remains, are the traces of their existence several millennia before the foundation of the Inca Empire.



The Northeastern Andes, between Peru and Ecuador, has provided clues as to the probable origin of the cacao in South America.

For the Spaniards, there were not roads that allowed access to the Amazonia from the Pacific coast; however, the routes were well known by the pre-Columbian peoples who travelled along the two sides of the mountain to exchange products from different ecological niches (Valdez, 2008).

The transit of goods and beliefs between the two sides of the Andes was frequent since the mountain passes are the lowest passes in the whole mountain range; that is, this access between the jungle and the sea has been used since ancient times by the native peoples.

Precisely in those territories, in the towns of Palanda (southern Ecuador) and Montegrande (northern Peru), recent archaeological discoveries (which are still the subject matter of research) add intrigue to the mysterious history of cacao, rearranging the course and suggesting that this millenary tree is not only native to South America, but that its cultivation began in this part of the world.

The Enigmatic Discovery in Montegrande

In the northeastern region of Peru, the excavations carried out by archaeologist Quirino Olivera and his team, which began in 2010 and continues today, revealed the remains of a civilization without precedent in the history of the Peruvian archaeology, one of the oldest cultures in the Amazonia.

It is a mysterious spiral- or snail-shaped enclosure of 600 m2 located in the town of **Montegrande** on the outskirts of the city of Jaen, on the edge of the Peruvian jungle in the department of Cajamarca. It is a religious building that reflects the ritual system of a very well organized society. The vestiges allow establishing that the beliefs and the cosmic worldview would have been the main elements that contributed to the design of the architectural creation since it is subject to rules and artistic-cultural patterns of a high culture, which apparently are recurrent in this geographical space of the Upper Amazon.

In this sense, up to eight construction phases have been identified. The architectural shape and style are semicircular in its early stages and circular in its later stages. The construction is made up of a system of platforms designed using boulder walls (river stones), external faces of which are plastered with beaten clay. In some cases, colored oxide minerals have been used to achieve better surface finishes. The walls were built with a very well planned design, taking into account the earthquake resistance criteria and taking care that the base had a greater dimension than the upper part. The use and function of the building illustrates the perfect harmony between the space and the construction technique in its architectural development. One detail that stands out is that the walls and spaces are not associated with any ceramic fragments.

The spiral or snail shape of the ceremonial center has attracted the attention of researchers, as it is the oldest and the most universal symbol of the human being. For many cultures, the symbol of the spiral represents the spiritual and intuitive connection and union of the man with the universe. The snail recalls the Mayan concept that time is cyclic and non-linear. For other cultures, the snail is linked to the beginning of sowing time or to conception and childbirth, and to the prosperity of a generation compared to the previous one. Undoubtedly, Montegrande's architecture has been designed under sacred ideological concepts to express the different spheres of the real and spiritual world.

In the center of the spiral archaeological remain of Montegrande, according to Olivera, would be the tomb of the person with the highest religious hierarchy of the temple. Among the offerings and artifacts made of stone and ceramic, it is expected to discover evidences of the oldest cacao in the world, such as those found in Ecuador.

The archaeological site of Montegrande in Jaen, Cajamarca. Scientific works undertaken since 2010 has discovered the world's oldest cacao remains.