

COMPACT SEEDS
AND CLONES

COMPANY
PROFILE



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The origin of the ASD brand (Agricultural Services & Development) is linked to the efforts of the company Chiquita Brands International (CBI) to introduce and develop new crops in the American humid tropics, where it has developed agricultural activities for about a century.

The United Fruit Company (UFC), the former name of the CBI, introduced various plant species as part of its agricultural diversification programs and established important germplasm collections, such as the cocoa collection in Costa Rica and the oil palm collection in the Botanical Garden of Lancetilla in Honduras, whose first introductions date back to 1926.

In 1942, the first results of field experiments carried out with genetic materials introduced from Southeast Asia and West Africa confirmed the superiority of the

Deli dura lines coming from Indonesia. During the following decade small oil palm plantations were started in Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia and Ecuador. The UFC continued with the development of commercial oil palm plantations only in Costa Rica and Honduras; however, the industry also prospered significantly in several of the areas where the first small plantations were established, such as Quininde (Ecuadorian Pacific) and Santa Marta (Northern coast of Colombia).

Between the mid-1930s and the first half of the 1940s, the UFC developed the first commercial oil palm plantations on the Atlantic coast of Honduras and the Pacific coast of Costa Rica; as part of a program of alternative crops to bananas. Building of the first oil extraction mill began on the Quepos plantation (Costa Rica) in 1954. That plantation





continued to expand until it became the second largest in America in the 1980s.

In the early 1960s, Numar Group (Nutritious Margarine), which was the oils and fats division of the UFC, began an expansion that led it to become the largest edible oil company in Central America. At the end of 1995, the Numar group ceased to belong to Chiquita Brands International and passed into the hands of a group of Central American investors.

Today the Numar Agro-industrial Group (NAG) owns in Costa Rica about 24,000 hectares of its own plantations and runs 17,000 hectares with associated producers. Likewise, the NAG started an oil palm plantation in the Atlantic region of

Nicaragua (9,940 ha) in 2000 and subsequently developed new plantations in Colombia (5,400 ha), Mexico (4,899 ha), and Panama (1,776 ha).

Currently, the Numar Agro-industrial Group is vertically integrated, comprising four companies dedicated to: I- The generation of agricultural technology and the creation of new varieties and clones, under the ASD brand (Compact Seeds & Clones); II- The operation of oil palm plantations and palm oil extraction plants (Palma Tica); III- The operation of vegetable oil refineries and the manufacture of finished products based on vegetable oils (Numar Company) and IV- The sale and distribution of various own and third-party products (Unimar).



THE BEGINNINGS OF ASD



The first steps in oil palm research in the Americas were taken by the UFC in the late 1940s, and the activity intensified significantly in the mid-1960s. Approximately a decade later, an important germplasm collection of *Elaeis guineensis* and *Elaeis oleifera* had already been assembled. Currently, this blend of oil palm germplasm introductions, from all the tropical regions of the planet, is recognized as the largest and most varied private collection in the world.

Until 1960, research objectives were mainly focused on the development of new seed varieties and the improvement of oil extraction technology. Subsequently, more emphasis was placed on agronomy and phytosanitary crop protection, and important projects were carried out in the areas of

fertilization, weed control, cover crop management, pollination and seed physiology and germination. Starting in 1991, the tissue culture research program was consolidated, and the agronomy and plant protection programs contributed with research that had a great impact on increasing the productivity of commercial plantations.

Between 1960 and 1974, the UFC used the Deli dura lines introduced in Lancetilla (Honduras) to produce the seeds required in their plantations. Starting in 1975, formal seed production began in Coto, Costa Rica, using Deli mother palms introduced from Malaysia. These seeds produced in Coto proved to have good potential and in 1977 the first commercial exports were made to Honduras and Colombia.



ASD CONSOLIDATES



The high demand for the seeds produced in Coto revealed the existence of a significant gap in the market for high-quality seeds in tropical America. This motivated the creation of ASD de Costa Rica S.A. in 1986, as a company specialized in oil palm breeding for the production and sale of seed varieties and clones. A year later, ASD exported seeds to Africa and later to Southeast Asia.

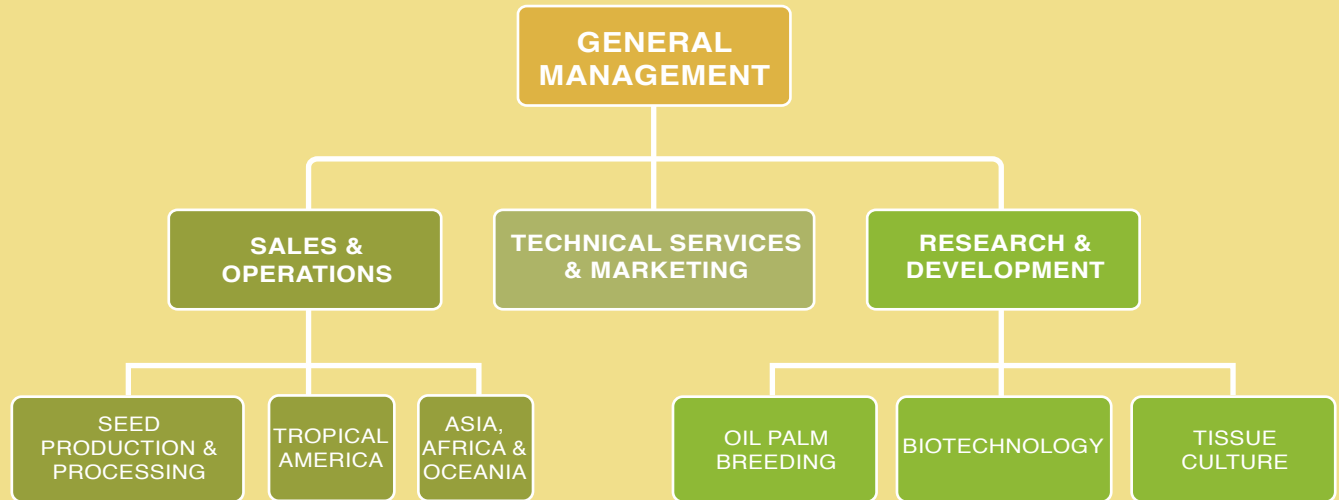
Since its creation, the company has supplied more than 350 million seeds (equivalent to about 2 million hectares of commercial plantations) in 45 countries in America, Asia, Africa, and Oceania, which represents around 8.5% of the total area planted in the world.

The prestige and growth of the ASD brand worldwide are based on a work environment that

stimulates innovation and the establishment of high-quality standards to meet the requirements of the international market. ASD's essential objective is the development of technology, particularly in what concerns to the creation of novel planting materials, improvement of seed production processes and management of planting materials, particularly during their first stages in the field (prenursery and nursery). Much of the technology generated is transferred to clients through consulting, technical support, and training.

On January 23, 2006, the company Compact Seeds and Clones S.A. was created, which is currently the company that produces, processes and exports seeds under the ASD™ registered trademark.

COMPACT SEEDS & CLONES ORGANIZATIONAL STRUCTURE



SEED VARIETIES



More than fifty years of work in oil palm breeding, starting from a very broad genetic base, have allowed Compact Seeds and Clones to offer the international market more diversity of planting materials than any other group in the world. The traditional varieties such as Deli x AVROS, Deli x Ekona and Deli x Yangambi with which the company entered the seed market for the first time, have given way to others that have better attributes for the modern palm oil industry.

Before any of the ASD brand varieties hit the market, their potential is guaranteed by no less than eight years of evaluation in progeny trials. The use of highly qualified and experienced staffs, and seed production and processing methods with strong scientific basis and international acceptance, allow our company to

guarantee 99.9% purity of teneras and offer seeds certified by the National Seed Bureau of the Government of Costa Rica.

Compact Seeds and Clones currently produces seed of eleven *E. guineensis* varieties for diverse environments and needs. Among these varieties we have High-Density (Challenger, Avalanche, Supreme and Evolution Blue), Premium (Themba, Spring Black and Spring Green), Standard (La Me), and Specials (Kigoma and Bamenda). In addition, we produce seed from a composite hybrid (Amazon), which is highly tolerant to Bud Rot (PC). The characteristics of these varieties are described in detail in our Guide to Varieties and Clones.



TOLERANCE TO BUD ROT (PC)



Amazon Hybrid (6-years old palm),
Coto, Costa Rica



Most of the commercial oil palm plantations in the world have been established with *E. guineensis* varieties. Commercial planting of OxG interspecific hybrids (*E. oleifera* x *E. guineensis*) has been considered as an alternative in those areas threatened by bud rot (PC) in tropical America. The main disadvantages of traditional OxG hybrids when compared to *E. guineensis* varieties are the large vegetative growth with very long leaves (which require to reduce planting density), very thick petioles (which make harvesting difficult) and the need for assisted pollination and the application of auxins (which increases production costs).

Compact Seeds and Clones S.A. has launched an advanced hybrid on the market with characteristics superior to traditional OxG hybrids. For its development, mother palms originating from Manaus, Brazil and compact pisifera were used. This hybrid, named “Amazon”, has shorter leaves than other hybrids available on the market, so it can be planted at 128 palms/ha. In addition, its pollen has a relatively good self-compatibility degree, and its vertical growth is very slow. On the other hand, the Amazon hybrid shows homogeneous growth and the culling rate in the nursery is low (15-17%). The characteristics of this variety are described in detail in our Guide to Varieties and Clones.

CLONES



Because in commercial plantations originating from seed varieties there is a wide variation in fruit production among individual palms, clones are an alternative to reduce such variation to a minimum and thus increase productivity per hectare.

In 1982, the company began a tissue culture research program to clone oil palm. In order to compete efficiently and successfully with this new product, the best compact palms (ortets) were used as sources of material to be cloned (explants). After many years through which exclusive procedures were developed for the cloning of this plant, it was possible to offer the first clones with commercial potential in 2002.

Currently we offer five different clones of compact palms, whose initial performance in semi-commercial and commercial plantations in Costa Rica, Nicaragua, Ecuador, México, and Colombia is very promising.

Some of the clones offered have very slow trunk growth rate and short leaves, which allow them to be planted at a density of up to 170 palms per hectare without affecting bunch production per plant, which is equal to or higher than that of conventional varieties. The productive potential of compact clones per unit area is between 20 and 30% higher than that of conventional varieties. The characteristics of those clones are described in detail in our Guide to Varieties and Clones.



INNOVATIONS



Breeding

The diversity of oil palm introductions throughout the long history of the ASD breeding program has made it possible to create different varieties as innovative as the Premium ones and others mentioned previously. However, the company is always looking forward in search of new planting materials that allow the expansion of the crop agroecological frontiers and offer better quality oil. The program objectives are to continue exploiting the compact character in seed varieties and clones, develop new varieties with tolerance to different stress types, with high iodine index, less fruit detaching, bunches with longer peduncles and other characteristics that facilitate harvesting, and varieties with tolerance to diseases such as bud rot (PC) and root and stem base rot caused by the fungus *Ganoderma boninense*.

Tissue culture

Apart from the development of the exclusive seed varieties and clones described previously, the company research staffs have developed new procedures for commercial seed processing and oil palm cloning. ASD is proud to be the only company in tropical America that has managed to consolidate oil palm cloning through a unique methodology that uses inflorescences as a source of explants.

Excellent cloned palm
(5 years old) using
compact palm
inflorescences.



View of the ASD tissue culture laboratory in Coto, Costa Rica.





The germinated ASD seeds are coated with a colored polymer that protects them against infection by pathogens and allows the ASD brand to be differentiated and its different varieties to be identified

Seed processing

In the seed processing field, new machines have been developed to facilitate the separation of the fruits from the bunch and the removal of the mesocarp from the seeds. Likewise, the use of rigid containers to keep the seed before, during and after the heating process, has made it possible to improve germination rate and the quality of the germinated seeds. The modifications made to the packaging for the transport of the germinated seed are recognized throughout the world as a guarantee of freshness and preservation of the physical characteristics of the product. Compact Seeds and Clones also identifies ASD brand varieties and differentiates their seeds by coating them with different attractive colored polymers.

Plant protection

Our company has made a notable contribution to the knowledge and management of phytosanitary problems of oil palm, particularly in tropical America. In all the programs, emphasis has been placed on the comprehensive and sustainable management of the different disorders, diseases, and pest problems.

Numerous studies have been carried out on the genetic response, causes and epidemiology of the main phytosanitary problems of oil palm, such as the red ring disease and the different spear and bud rots. Successful management protocols have been developed from these studies. In the area of pests, the biology and habits of the most important pests and their natural enemies have been studied, and sustainable methodologies have been developed for their management. Some of these objectives have been achieved through alliances with national and international universities, which has allowed us to bring recognized experts in these fields to our plantations.

Machines used for mechanical removal of mesocarp at the new Seed Processing Unit in Coto.



BIOTECHNOLOGY



Molecular biology is seen as a very important tool for the selection of superior palms in breeding programs. Therefore, the company established in 2009 a laboratory that is allowing it to exploit these new techniques for the development of genetic markers and gene sequencing, as tools for the genetic improvement of varieties and clones.



View of one of the sections of the modern molecular biology laboratory.

TRANSFER OF TECHNOLOGY AND SOCIAL WORK



Compact Seeds & Clones has extensive experience in training and transferring state-of-the-art technology in oil palm cultivation. For more than 40 years, various training activities have been organized, mainly in Costa Rica, in which more than a thousand participants have been trained and educated. Of all these training programs, the "International Oil Palm Course" is undoubtedly the most recognized activity, which has been organized 32 times and professionals from 20 countries have participated.

Apart from generating specialized employment in a marginal area in Costa Rica, CSC has actively collaborated with institutions such as the FAO to alleviate the demand for energy sources and essential vitamins in several East

African countries. This program has been based on the collection of genotypes in African high and dry lands, in search of tolerance to stress (low temperatures and water), which are improved in Costa Rica and sent back to the countries of origin, where they have caused a great impact on marginalized households. This program has especially favored families that receive a few palms to be planted in their patios.

Children in Zambia show one of the palms from Costa Rica planted in their backyard through FAO programs



Participants in the international oil palm course held in July 2009, in Coto, Costa Rica.



PUBLICATIONS

Compact Seeds & Clones is a company willing to share the results of its research efforts with its clients and friends, and its staff systematically disseminates its experiences through personalized training or international courses for its clients. Additionally, the company has been generous in disseminating this knowledge in publications of all kinds, including prestigious magazines, conference proceedings, pamphlets, manuals, etc. An important publication is the ASD Oil Palm Papers, started in 1992, which is for scientific papers on oil palm. All issues of this magazine and various other publications can be found on our website: www.asd-cr.com.



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