Penn State Uses Cloning Technology To Improve Cocoa Plants

UNIVERSITY PARK (Centre Co.) — Scientists in a Penn State research program have developed a process to clone genetically identical cocoa trees from cocoa flowers, which could enhance cocoa plant quality on a large scale. And that, in turn, could increase cocoa farming profitably and stabilize the supply of cocoa beans on the global market.

"Right now, cocoa plants are grown from seed, and these plants vary greatly in their yield and disease resistance," said Mark Guiltinan, associate professor of plant molecular biology in the College of Agricultural Sciences. "In some cases, up to 50 percent of the trees can be substandard. By selecting the best trees and producing identical clones, we potentially can increase plant productivity on farms."

Guiltinan and a team of scientists soon will begin a long-term field test of cloned cocoa plants at the Union Vale Estate on Saint Lucia Island in the West Indies (located off the northern coast of South America). The estate is owned by Edmund Opler, chief executive officer of World's Finest Chocolate Inc.

The Penn State team, funded by the American Cocoa Research Institute, collected flowers from 14 of the most productive cocoa trees on the estate. As a control, they also collected flowers from several of the worst trees. The flowers were flown back to Penn State University Park campus, where individual cells from the buds were grown into full-sized plants. Guiltinan says the process, called "somatic embryogenesis," replicates a more complete plant than those derived from grafting.

"Plants produced from grafts do not develop a tap root that can sustain the plant in adverse conditions," Guiltinan explained. "Grafted plants also grow in the shape of a bush and have to be pruned during growth to resemble a natural cocoa tree. In Brazil alone, there are 660 million cocoa plants, which means a lot of pruning."

The plants produced from the flower cells have been grown in Penn State greenhouses for the past year. By June, the cloned cocoa plants will be planted in a Union Vale Estate field together with plants grown from grafts and from seed. Over the next three to five years, researchers will measure growth rates, pod production and chocolate-making quality.

"When plant breeders find a superior plant, the idea is to make more of them," Guiltinan said. "A tree grown from a single cell is genetically identical to the parent tree from which the flower was isolated. This means plant breeders can choose plants that are best adapted to a particular geographic area or are resistant to certain diseases."

Guiltinan said the cocoa tree cloning project on Saint Lucia will take years to implement on a large scale because the plants take four to five years to mature enough for scientists to gauge yield, production and disease resistance. "Corn breeders can produce three generations of plants in one year," Guiltinan said. "Cocoa will take 15 years to reach the same stage of development."

If tests prove positive, then cocoa-producing nations can increase production of promising lines of cocoa plants. "Brazil currently has 600 million plants susceptible to disease, and breeders there have only a few hundred plants from which to start a breeding program," Guiltinan explained.

Guiltinan said the economic implications of Penn State's research are significant. Most cocoa is grown on small farms in five countries: Brazil, Ghana, Indonesia, the Ivory Coast and Malaysia. If breeding programs can produce plants particularly well-suited for different growing areas, farmers' incomes will increase. In addition, the elimination of boom-or bust crop cycles will help stabilize world cocoa production, which would benefit Pennsylvania's $4 billion chocolate industry. Pennsylvania is the country's top chocolate-producing state.

Increased cocoa production also may have an ecological benefit, Guiltinan says. The cocoa plants are a sustainable crop for tropical ecosystems because they are grown for long periods of time. The plants also require a large canopy of shade trees for growth, which offers superior habitat for migratory birds and other wildlife. In addition, cocoa farms could act as connective greenways between islands of rainforest habitat.

In addition to the Penn State cloning process, which has a provisional patent, Guiltinan's team also is starting a genetic engineering research program to breed plants resistant to disease and pests.

By injecting a plant with the DNA of a natural pesticide, horticulturists can breed plants resistant to such pests as the cocoa pod borer, which is the major pest in Malaysia, or the myriad, an insect that infests cocoa crops in the Ivory Coast. Similar treatments for such plant diseases as witch's broom, pod rot and cocoa swollen shoot virus could be engineered into the genetic blueprint for cocoa plants, Guiltinan said.

"Forty percent of the cocoa crop is lost to disease and pests every year," Guiltinan said. "That's billions of dollars lost to the economies of cocoa-producing countries."

Pedigreed Council Honors Core

ST. JOSEPH, MO.–Maurice Core, Columbus, Ohio, pictured right, was honored with the National Pedigreed Livestock Council's Lifetime Honorary Membership Award. Core, who is retired from the American Jersey Cattle Association, was an active member of the organization during his career. The award was presented at the National Pedigreed Livestock Council's annual meeting, May 6-8 in St. Joseph, Mo., and sponsored by the American Angus Association. Also pictured presenting the award is Zane Akins, secretary-treasurer of the National Pedigreed Livestock Council.

NC+ Releases First Bt Corn Hybrids

LINCOLN, Neb. — has released its first three corn borer resistant hybrids: NC+ 3668B (105-107 days), NC+ 5588B (113-115 days), and NC+ 5878B (115-117 days). The hybrids are protected by YieldGard® Insect Protection from the Monsanto Company.

These releases are the result of license agreements between NC+ and Monsanto, which allow NC+ to market biotechnology products in corn and soybeans. In addition to YieldGard, the agreements cover Roundup Ready™ corn and soybeans.

"We already have several Roundup Ready soybean varieties in our product lineup," said Dr. Ted Givens, NC+ research and product development director. "We're anticipating the release of Roundup Ready corn hybrids as soon as next year."

NC+ has also released several new IMT corn hybrids, including NC+ 5278M, which is available for planting this spring. New high oil corn hybrids from NC+ include NC+ 3688 and NC+ 4881H, which are also available for planting this spring.