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TWENTY-FIRST CENTURY PREP:

SPANISH MACHINERY FOR FOOD PRODUCTION

FAST, SAFE FOOD PROCESSING

Cured meat has been around at least since the time of the Romans, who ground fresh meat, salted it, and infused it with spices; fermented it to fuse the mass together; then allowed the meat to hang and dry for two to three months. The final products, such as salami, chorizo, and dry-cured sausage, are still popular today.

Josep Lagares, CEO of Girona's Metalquimia, working with Institute of Agricultural Research and Technology (IRTA) general manager Josep Maria Montfort, believed it was time for a change. Instead of a drying period that stretches out over several months, "We have reinvented this process to be able to dry these products in 20 to 50 minutes," says Lagares.

Metalquimia's innovation was to slice the meat before curing it, then send it through a machine that tweaks the humidity and temperature of the air inside to create the perfect curing conditions. The result: identical slices of cured meat. Its first industrial-scale machine, which can process 800 pounds of meat per hour, has been installed on the premises of the company's local partner, Casa de Mon.

Lagares sees endless opportunities for this machine. "For instance, [typically] if you want to try a new product in dry cured meat, you have to wait for months to see the results. With Metalquimia's [machine], you have the results in one day," he explains, adding that this technology will allow users to cure salt-free meat products, impossible with traditional techniques. And that's not the only benefit: Lagares points out that the space needed for meat drying can be reduced significantly, while a company can avoid having excess stock drying for months. This cure uses about 30 percent less energy than what many environments require to maintain the ideal temperature and humidity for long-term curing.

A focus on storage inspired Burgos-based NC Hyperbaric, whose technology improves the shelf life of minimally processed foods. In fact, according to marketing director Francisco Purroy, the company's continued dramatic growth can be attributed to two international movements. "There's a consumer trend towards foods and products that can be labeled as natural, minimally processed with no preservatives," points out Purroy. "At the same time, there's concern about [food-borne pathogens such as] listeria and salmonella."

NC Hyperbaric makes machinery that can kill pathogens in food without high temperatures, relying instead on extraordinarily high

Olive oil, chorizo, sherry, fine cheeses, and traditional tapas have earned Spain a worldwide reputation for gustatory delights. Spanish companies have also achieved international recognition for the quality of their agriculture machinery, food processing, and packaging, which is sold to customers in hundreds of countries that represent nearly every major market around the world.

In southern Spain, the sun shines nearly all year long, providing energy for its wealth of crops, which have made the region a breadbasket not just for Spain, but for much of the rest of Europe. In 2010, Spain exported more than 9.4 million tons of fruits and vegetables.

Food and wine have long been a source of national pride here, and a major attraction for the more than 70 million tourists who visit every year. "Then those tourists go home, and they want to continue consuming the olive oil, the wine, the oranges that they ate in Spain," observes Jaime Hernani, general director of AGEX, the Spanish association for food production machinery.

This has stimulated a boom in the export of not only Spanish products, but Spanish know-how in irrigation, cultivation, and cleaning, separating, processing, and packaging those agricultural products. Spanish companies that manufacture machinery for food production, he adds, have been selling their advanced technology throughout Europe, North America, and Asia for more than two decades.



levels of water pressure to shatter bacteria's normal functions and kill them. The company was one of the first in the world to bring this technology to an industrial scale for the food industry. In an NC Hyperbaric machine, packages of food are placed in a plastic chamber inside a steel vat. Water fills the vat beyond the volume of what a chamber of that size is able to hold. This increases the pressure just as if the package had been dropped deep into the ocean. While the high pressure kills microorganisms, the process leaves nutrients and taste alone.

This process allows minimally processed foods to enjoy a stable shelf life with less salt and no additives, says Purroy. NC Hyperbaric's newest and largest machine can process more than two tons of food per hour.

This technique has attracted the attention of drug manufacturers as well. Purroy explains that NC Hyperbaric has now partnered with an American company to use high pressure to unfold a protein, a better method for creating a drug used to treat multiple sclerosis.

NC Hyperbaric's research department is now focused on developing technologies that combine pasteurization and sterilization, melding high pressure and heat. "With heat, you need to heat the product to 120 °C all the way to the middle, keep it there for a time, cool it down," says Purroy. "This is all quite damaging to the quality of the product."

The temperatures used for sterilization with high pressure, however, will be significantly lower—80 °C—and applied for shorter periods of time, so the final product will retain a quality closer to the original than canned goods offer. NC Hyperbaric has a prototype in development and is continuing to investigate improvements to decrease the cost.

Heat is used not only to sterilize food, but also to sanitize the equipment to process it. Engineers at the hygiene machinery company Mimasa realized that the current requirements for washing and sanitizing—subjecting equipment to water that has been heated to 83 °C (181 °F) for three minutes—can take up to an hour to achieve. They reasoned that bacteria start to die off at lower temperatures, so the water could pass through these temperatures as the heat rises.

So they worked with researchers at Catalonia-based IRTA to determine the optimal temperature increase and the time needed at each temperature to kill the required number of a given microorganism. The resulting machine saves time.

SEEDS OF CHANGE

The greenhouse next to Conic System's seed-planting company in Barcelona is filled with the welcoming scent of new growth. The building houses budding plants that the company sells to hobby gardeners and growers. And the space also provides the perfect test bed for innovations in Conic System's seed-planting and irrigation machinery.

After decades in agriculture, the Gusi family still could not find a suitable machine to rapidly and effectively plant seeds



in trays for nurseries. So they built their own, and formed the company Conic Systems. The machine—rapid, efficient, and cost effective—has helped nurseries for food products and forestry for more than 20 years.

But in the past two years, the company's engineers have incorporated dramatic improvements to the seed-sowing technology to create the first fully automatic seeding machine.

Seeds come in significantly different sizes, and so trays, holes, and the machine's settings must be changed to switch from, for instance, onion seeds to the larger cucumber seeds. Today all these changes and adjustments are done by hand, a time-consuming process. Now Conic Systems engineers have developed a new machine that employs advances in computer technology to allow all changes to the settings to be made using a touch screen.

This took significant in-house creativity. "The commercial computers available in the market, the ones that would be able to do what we need, are very expensive," says Jordi Gusi, director of sales. "So we began to make our own hardware for the kinds of things we need the machine to do: to change the tray, the way the machine is moving, the height and width." The new system is about 20 percent faster than the previous one, and reduces the frequency of errors.

To facilitate maintenance, the seeder machines can be connected by the Internet to Conic System's offices, so the company can diagnose any problem remotely—whether it's in South America or China or Australia—and provide detailed repair information. The first prototypes have recently been completed: one will be installed for a client in Barcelona, another in Israel.



As plants grow, farmers make use of sprayers and dusters, such as those created by Goizper, to apply nutrients and protection. Goizper, which sells manual sprayers in more than a hundred countries, created a research center that focuses on developing technologies for different types of spraying needs and on improving the physical components of its systems. “For instance, 95 percent of the products we fabricate are made from plastic, so for us a very important technology—and one we’re working on a lot—is the technology for the manipulation and transformation of plastic,” says Mikel Irizar, director of research and innovation.

Once seeds grow and the resulting fruits are ripe for picking, the work of Tecnidex begins. One of the company’s specialties is the application of the appropriate combination of gases and temperature, either to ripen fruits and vegetables or to improve their appearance (changing, for instance, the peels of ripe but green-hued citrus to the more recognizable yellows and oranges). Tecnidex developed one of the first systems to eliminate unpleasant tannins in persimmons, which are picked before they’re fully mature, allowing the fruit to be more easily exported.

The company has also developed water-cleaning technology especially designed to remove the fungicides used in treatment of produce after it’s picked and before it’s shipped. And it is using its expertise in modifying the atmosphere of a treatment room to attempt to eliminate the Mediterranean fruit fly. Current systems for killing the fruit flies, says business manager Valentin Turégano, require very low temperatures that can “injure the internal and external quality of the fruit. So we’re

trying to develop a solution that will benefit the customers and the importers of the fruit in the market.”

Water is the primary concern of Murcia-based Azud, a company which has spent three decades manufacturing technology for its area, one of the most arid regions in Europe—and applying its solutions around the world. Azud’s success has been in the creation of technologies for the most exact application, testing, filtration, and treatment of water. Today, the company is one of the top suppliers in the world of irrigation technology, including drip irrigation.

“We’re in a situation where there’s...growth in ecological concerns, and increase in the cost of electricity, and a reduction in both the amount and the quality of water,” says Ramon Alcaraz, Azud’s business director. “And so for us, in this sector, the challenges are to always find solutions that lead to the most efficient use of water, energy, and fertilizers.”

Some of the company’s successful innovations have included systems for drip technologies, and a combination technology that applies fertilizer and water at the same time (a process they call fertigation); and monitoring solutions that carefully control the application of water and fertilizer. Azud’s engineers and researchers have implemented improvements to filtration and irrigation systems that conserve energy by operating at lower pressure.

PACKAGED FOR CONSUMPTION

The technology behind food packaging rarely commands as much attention as the food itself. Spanish companies have been innovating in this sector, however, for decades. For instance, the Barcelona packaging company Posimat’s founder and CEO Jaime Martí realized that the machinery for organizing plastic bottles to be filled was not as efficient as it could be. So in 1977 the company developed its reliable, inexpensive Unscrambler, which funnels loose, light plastic bottles down a chute so they all drop down and into place upright.

From that point, the company has continued to innovate and address market needs, modifying this technology for the pharmaceutical industry, or for bottles that have their caps on the bottom instead of on the top, or for unstable bottles, such as those that have handles on the side. Posimat has continually focused on products that are noteworthy for their efficiency and simplicity, explains Maribel Rodríguez, assistant to its president, and has created machines that are easy to use and will last for years.

The packaging company Giro, in Badalona, Spain, supplies packaging materials and machinery to bundle fruit and vegetables into breathable, plastic net packaging. Unlike most companies in this field, Giro engineers both the material (the plastic net, the films, the labels) and the packaging machines as well. In recent years, the company has improved the automation of the process through a system they call GirControl Plus, so that multiple machines in a given plant can be controlled by

one computer; this also allows Giro's technicians to diagnose problems from miles away and determine any servicing needs.

Giro's latest offering is plastic netting that "speaks to the machines," says Salvador Sola, business strategy and export director, through a radio-frequency identification tag that alerts a machine to the type of material and the necessary settings for it. This dramatically speeds the process and at the same time helps to eliminate human error. The new technology was launched at the end of 2010. "The end users don't need to do anything but fill the reel of net onto the machine, and the machine is capable of knowing exactly what is loaded and performing accordingly," says Sola.

SCANNING THE CONTENTS

Olives tumble over one another, separated out into different streams by hue and shape. Multiscan Technologies was created more than a decade ago by university researchers from the Polytechnic University of Valencia, who realized that their artificial vision technology might be useful in the food sector, as a method for determining the quality of a particular product or of classifying and separating produce by color. They focused on olives—a key Spanish product—collaborating with a local Spanish olive packaging company, La Española. The machines could determine which olives were ripe by their color, and separate those for packaging.

"The first machines functioned quite well, and so La Española proposed that we create a company and commercialize the machines—even to their competitors," says Álvaro Soler, Multiscan's general manager.

At the time, the olive sorting machines on the market could only categorize types of olives roughly and moved quite slowly, about 2,000 kilos an hour. The new Multiscan machine could, through artificial vision technology, separate out the best olives with greater precision and at a speed 10 times as fast, at 20,000 kilos an hour.

Today's machines can manage millions of olives an hour, as much as 30,000 kilos. That is in large part because of improvements in computer speed, together with the development of proprietary software that allows the machine to make decisions at lightning speed.

"So we're no longer just classifying the olives by color," says Soler, "but now we're also able to rapidly classify them ... by their form, by visible defects, even utilizing technology to detect internal defects." The machines' artificial vision employs infrared and ultraviolet light, lasers, and x-ray technologies, to get the maximum amount of information about a particular product as it passes through.

But the knowledge the company had accrued—how to distinguish among very small objects at a speedy pace—was not applicable only to olives. "We realized that we're actually specialists in managing small, round objects, so we entered the U.S. market by applying our technology to cherry tomatoes," continues Soler. Today the company exports more than half of its machines to



Multiscan is a specialist in using artificial vision to classify and separate small food products such as olives or macadamia nuts.

Photo Courtesy of Multiscan

process cherry tomatoes, macadamia nuts in Hawaii, and other products throughout South America and Europe.

Multiscan is now focusing on improving x-ray technology for quality control, to scan inside, for instance, bottles of olives to detect whether perhaps a pit escaped notice, or a bottle is contaminated with a stray piece of plastic. With such advanced technology, and with their experience in rapid evaluation of information from various information inputs, in 2010 the company expanded its artificial vision product line from food into the realm of security, developing a machine to detect explosives in hand luggage. These machines are being sold by the Spanish multinational Indra.

"We've developed a high-resolution machine that can operate 10 to 100 times more rapidly than current technology, and costs 10 times less," says Soler.

All these innovations in machinery for the food sector, says Victor Alves, director of the Spanish Association of Machinery Technology, which represents a number of different food industry associations, "help customers reduce their costs, and reduce their consumption of resources for a smaller impact on the environment... These companies design products that increase the value of food products" around the world.

Learn more at www.technologyreview.com/spain/food