Phytoform Labs co-founders Nicolas Kral (left) and William Pelton (right) with Phytoform tomatoes.

High-Yield High-Tech Tomatoes

Phytoform Labs has fine-tuned the Alisa Craig tomato variety genes to boost yield by up to 400 percent through dense planting of compact plants. The plants are one-sixth the size of the conventional Alisa Craig, with 50 or more plants in the same area usually used by a single plant. Although the vegetation size changed dramatically, the fruit is unchanged.

"We started with a salad variety that was already very nutritious and flavorful," explains Dr. Will Pelton, Phytoform Labs. "We were worried that if we shrunk the plant, we would also shrink the fruit. That was not the case. Our tomatoes are the original size."

Phytoform, a U.S./British company, changed the tomato using CRISPR-based gene editing. Geneticists use CRISPR to cut a gene's DNA, then modify it using natural DNA repair processes.

They're currently using AI (artificial intelligence) to rapidly search large data sets from existing genetic research for specific gene changes that can be used to improve drought tolerance and other beneficial traits. Pelton likens AI to a surgeon's brain and CRISPR-based gene editing to the surgeon's scalpel.

"The scalpel is nothing without the surgeon's brain knowing where to cut and how," he says. "We created an AI tool to identify where and how to use CRISPR with a very light touch on the genes. We don't add or remove genes; we simply work with ones that are there."

Pelton and others in the company had worked with both technologies in academic research and wanted to apply them in a more impactful way.

"We focused on the tomato as a good crop to start with," says Pelton. "It's a high-value crop that produces lots of seeds. We felt we could have a lot of impact with tomatoes."

They started out working with open-field production, developing the technology and finding some success. At the suggestion of a marketing intern, they refocused on indoor vertical farming. This industry has struggled to add high-value crops to its proven production of leafy greens.

The results with the Alisa Craig variety have been positive, notes Pelton. "We've had a lot of positive feedback and are already working on our next generation of products," he says. "We hope to commercialize production in the U.K., perhaps as soon as this spring, as well as in the U.S. and Australia."

Phytoform is working with other tomato and potato varieties and plans to apply its technologies to other crops. Commercial greenhouse producers have shown an interest in the compact Alisa Craig variety, and the company has developed a tomato variety for open-field production to be introduced in Florida.

Home gardeners won't be planting dense beds of lettuce-height tomatoes any time soon. "We're establishing commercial production first," says Pelton. "Then we may expand to home garden sales."

Contact: FARM SHOW Followup, Phytoform Labs, Rothamsted Research, Harpenden AL5 2JQ, United Kingdom (william.pelton@phytoformlabs.com; www.phytoformlabs.com).

STAG 103 was officially retired in place in 2020. Over its duty life, it logged 110,000 operating hours.

Historic Turbine Generator On Display

Ottawa, Kan., is home to the first combination of steam and gas (STAG) turbines to drive a single generator with one fuel source. Based on jet engine technology, one turbine was powered by the burning fuel. The other was powered by steam created by the first turbine's exhaust.

The historic system has been recognized by the American Society of Mechanical Engineers (ASME). The STAG system was the first of many, and while no longer in use, it's still in place, should it be needed.

Post-World War II, General Electric (GE) let its jet aircraft engineers use the new technology to produce electricity. Early uses included gas turbine power to drive locomotives. However, the high-frequency noise made them less than popular, and the concept was abandoned after a few years.

In addition to electricity generated by the gas turbine, exhaust heat was used to preheat water for a steam-powered generator. However, the steam was still produced by a separate boiler.

Research led to new designs and improved efficiencies, and in 1967, GE introduced the first-ever pre-engineered combined cycle generator under the trade name STAG. The city of Ottawa commissioned the first STAG unit—an 11 MW Model 103. STAG quickly gained popularity, and within four years, GE faced competition from four major manufacturers producing similar power units. Within a decade, Ottawa's leap of faith had grown into systems 50 times larger.

The Ottawa unit had a gas turbine coupled to the forward end of the generator and a multi-stage steam turbine at the rear end. The gas turbine's exhaust gas produced steam.

The STAG 103 provided all the city's power until 1979, when Ottawa began buying power off the grid. It relied on the STAG unit for backup power, along with two newer, smaller generators. When needed, it could be up to power in about 45 min.

It was started in 2001 for inspection purposes. It was found to still be in good shape and fit for duty. Some maintenance was performed. Over the past 20 years, it has been started periodically for training and equipment preservation.

STAG 103 was officially retired in place in 2020. Over its duty life, it logged 110,000 operating hours. ASME has recognized the system as a Mechanical Engineering Landmark. Such landmarks represent significant technological accomplishments. Visit the ASME Technology Library to learn more.

Contact: FARM SHOW Followup, The American Society of Mechanical Engineers, Two Park Ave., New York, N.Y. 10016 (www.asme.org/about-asme/engineering-history/landmarks) or City of Ottawa, 101 S. Hickory, Ottawa, Kan. 66067 (ph 785-229-3600; info@ottawaks.gov; www.ottawaks.gov).

Intensive Gardening Produces More With Less

If attempting to maximize garden production within minimal space, consider taking a lesson from Paris. French intensive gardening is a permaculture system based on raised beds, tight spacing, and succession planting that aims to get the most from every inch. The goal is high yields, often four to six times greater productivity than expected for the space.

French intensive gardening relies on a series of permanent raised beds, preferably oriented north to south to maximize light exposure. These beds typically sit below ground level and are created by single or double-digging the soil to a depth of about 15 in. This process forms a loose bed with a slight mound, which enhances aeration.

The ideal height above soil level varies by climate. In warm regions, beds only need to be raised an inch or two, while in colder climates, 8-in. high beds help capture more sunlight and improve drainage. In dry areas, sunken beds may be better suited to conserve moisture.

Ideally, the beds only need to be dug once. Over time, worms and cover crops help maintain soil looseness. Most beds are kept 3 to 4 feet wide, with permanent pathways around them to ensure the beds are never stepped on. This minimizes soil compaction and concentrates nutrients where plants need them most.

French intensive beds thrive with tight spacing—often two to five times closer than in traditional vegetable gardening. This works because the loose soil allows roots to grow downward, improving nutrient access. The goal is to minimize bare soil, which helps prevent weed growth. Light mulching can further suppress weeds as slow-growing plants mature.

However, this high concentration of plant life requires significant fertilization. Compost and manure are commonly used. Crop rotation is also important, especially for nitrogen-hungry plants like tomatoes, as it helps prevent disease. Overall, weed and disease issues should be minimal when the system is managed properly.

French intensive beds thrive with tight spacing that can be two to five times closer than traditional vegetable gardening.

The tight spacing allows experimentation with many growing styles, including companion planting. Consider matching short and long roots, fast and slow growers, short and tall, etc. One popular strategy is planting radishes around perimeters for a quick harvest. Likewise, some gardeners focus on compact and dwarf varieties.

French intensive gardening requires plenty of elbow work up front, but it'll reward you with abundant, consistent harvests over the long term. If you're short on space, it's a garden plan well worth attempting.