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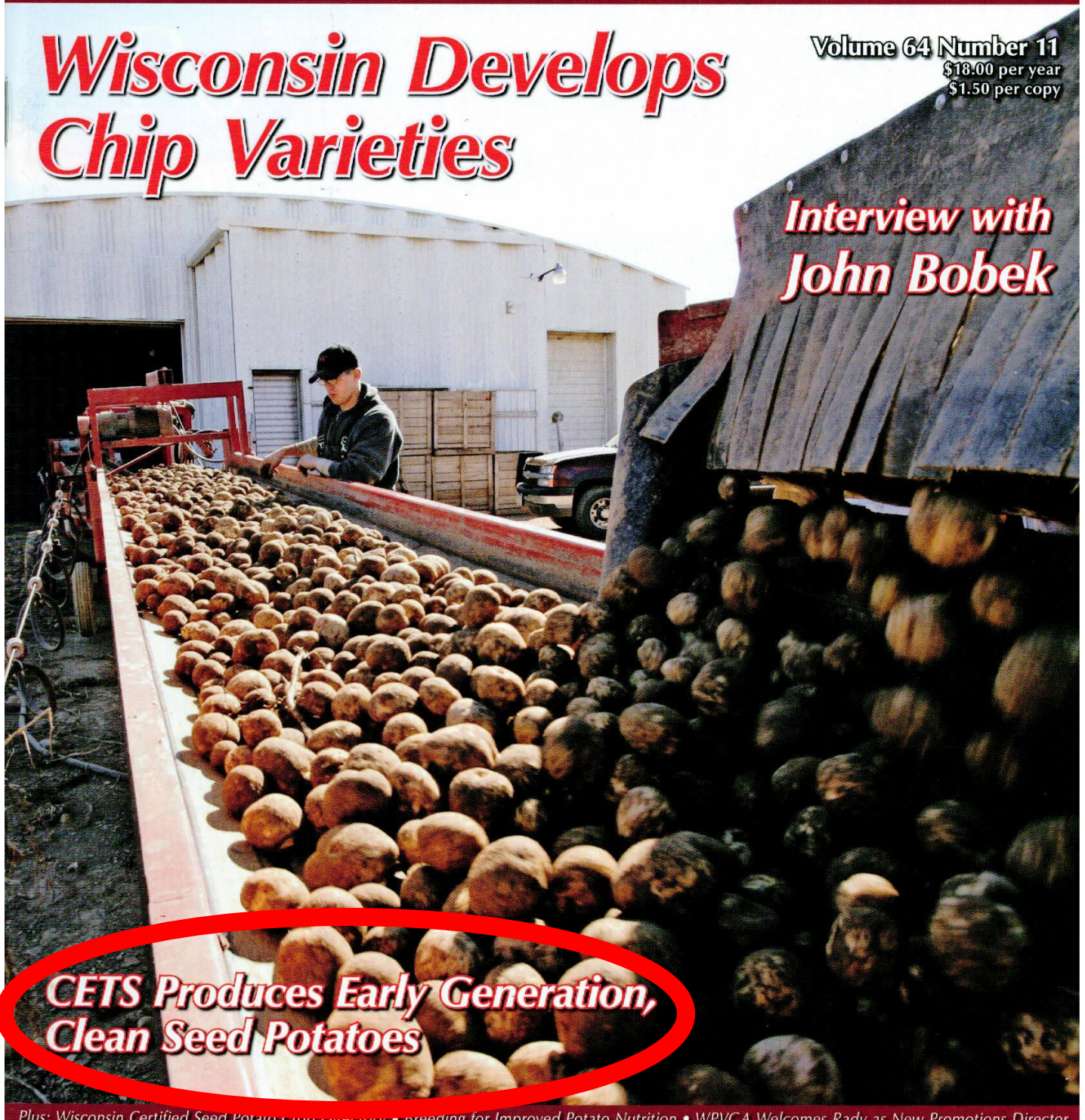
Wisconsin Develops Chip Varieties

Interview with John Bobek



CETS Produces Early Generation, Clean Seed Potatoes

Plus: Wisconsin Certified Seed Potato Crop Directory • Breeding for Improved Potato Nutrition • WPVGA Welcomes Rady as New Promotions Director

ANNUAL SEED ISSUE

CETS Uses Cutting-Edge Technology to Produ

AstroTubers™ have the lowest pathogen level of any comparable seed potato and can be mul

by Tamas Houlihan, Managing Editor

Ask any potato grower what the most important aspect of his operation is, and the answer you'll get is: "It all starts with the seed."

High quality, disease-free seed potatoes are a critically important component of all viable potato operations. Worldwide, a major emphasis is currently being placed on seed production systems that limit or reduce the number of field multiplications or generations originally derived from disease-free tissue culture plantlets. Numerous field tests and replicated research studies have confirmed the value of limiting the number of field multiplications.

A Wisconsin-based company, CETS (Controlled Environment Technology Systems) LLC, is able to produce disease-free minitubers from tissue culture plantlets, known as AstroTubers™, which are a type of seed potato used in the earliest generation of potato production.

"AstroTubers™ have the lowest pathogen level of any comparable seed potato and can be multiplied at a much faster rate," says Dr. Raymond Bula, co-owner of CETS LLC (www.cetstech.com), with the corporate office located in Sussex, Wisconsin, and the production facility located in Grand Marsh, Wisconsin. "Current greenhouse and screenhouse methods are limited and contain a high probability of inadvertent insect or virus infestation. CETS offers a much faster, more dramatic advancement over traditional methods."

CETS offers seed potatoes derived from AstroTubers™ that meet or exceed Wisconsin foundation and certified class requirements. In addition to providing the AstroTuber™ technology, CETS can supply Astrotubers™ of any potato variety specific to a grower's request, including organic. Also, the controlled environment system allows for simultaneously growing different quantities of more than one variety.

Pictured are CETS Partners (L-R) Ray Bula, Ray Gieringer, Janina Petrick and Research Pathologist Fernando De La Calle with a tray full of AstroTubers™. In addition to providing the AstroTuber™ technology, CETS can supply Astrotubers™ of any potato variety specific to a grower's request, including organic.

"We offer growers the tools to grow," says Bula, "from technology, to training, to production. This includes a license for the use of our proprietary Controlled Environment software and technology. Using a computer-controlled environment, our patented technology makes possible the ultra-high-speed production of up to six AstroTuber™ harvests per year in any climate, anywhere in the world. Essential to our pioneer technology is the original software we've developed to regulate the consistent production of seed potato stocks 56-63 days from planting of cuttings from the disease-free tissue culture plantlets."

Tissue culture plantlets are used as the source material for production of the AstroTubers™. Disease-free tissue culture plantlets are obtained from the Wisconsin Certified Seed Potato Program, University of Wisconsin-Madison, other state and federal potato improvement programs, and the World Potato Genebank in Sturgeon Bay, Wisconsin. CETS CEO Janina Petrick says it is possible to obtain essentially any potato variety in the world. Production of Astrotubers™ of proprietary varieties requires the approval of the appropriate organization.

"The key to the future of the potato industry is improved varieties," says Petrick. "New or improved varieties

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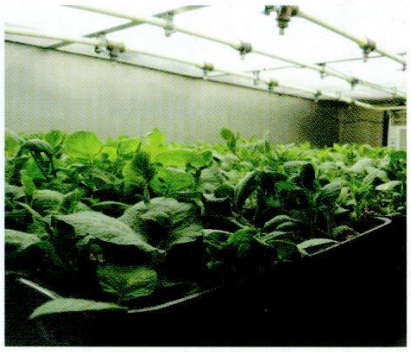
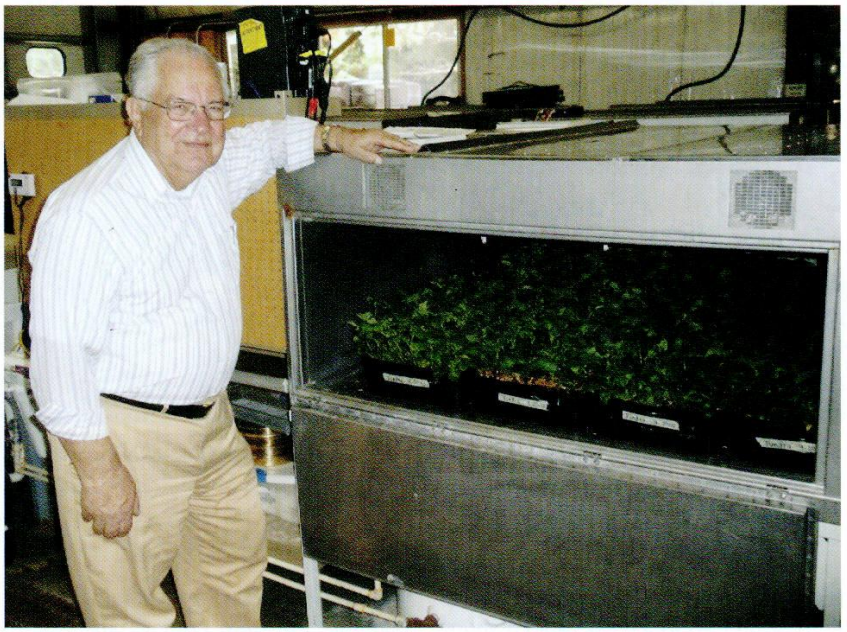
tiplied at a much faster rate



Mother plants are pictured in a phytotron. CETS offers seed potatoes derived from AstroTubers™ that meet or exceed Wisconsin foundation and certified class requirements.



Ray Bula is pictured with a phytotron containing disease-free seed potato plants.

offer huge potential to address current industry challenges such as obesity or acrylamides, and new industrial uses of potato starch and protein. They also create new opportunities for better tasting, more nutritious or unique potato dining experiences. We are able to obtain test-tube plantlets of virtually any variety that are absolutely clean of pathogens, to be used as mother plants. These high-quality new potato cultivars can be rapidly increased to commercial quantities." Petrick is quick to point out, however, that long-standing, traditional potato varieties are also available, as well as organic or genetically-modified materials.

To produce the minitubers, CETS uses 140 test-tube plantlets which are planted in 24 trays located in one controlled environment chamber, known as a phytotron. This phytotron will house the mother plants which are the source of the stem-cutting planting material for the production of minitubers for one year.

Stems of the mother plants are ready for cutting three-to-four weeks after planting the tissue culture plantlets. Stems from the mother plants are cut into one or two node sections and planted in trays with a special rooting substrate. Prior to planting, the stem cuttings are soaked in an indoleacetic acid solution to stimulate root formation. The substrate is free of pathogens and is composed of vermiculite and coconut husk material.

Planted cuttings are placed in additional phytotrons, with optimal environmental conditions controlling the light, temperature, irrigation and fertilization, depending on the plant's growth stage. After a period of growth, a hormone solution is applied to enhance tuberization.

"All phytotrons are connected to a computer from which you can set the parameters of the environment, depending on the specific stage of plant development," said Bula.

This unique environmental conditions sequence program coupled with a computer program developed by Bula is designed to maintain the optimum environmental parameters to support growth and development of plants throughout the production cycle. There is little need for any maintenance or staff; and in the event of a power failure, the plants can endure without consequences up to 48 hours. This system, which requires very little space for nuclear stock production, also provides the ability to quickly propagate a potato variety currently in the highest demand.

As a requirement for eligibility in the Wisconsin Seed Potato Certification Program administered by the University of Wisconsin, CETS must submit a sample of AstroTubers™ for disease testing representing one percent of the total for any specific variety (which is a much higher percentage than that required of traditional certified seed producers). These tests must be conducted prior to planting any of the AstroTubers™ in the field.

CETS Uses Cutting-Edge Technology...

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FG1 seed potatoes derived from AstroTubers™ are harvested at Bula-Gieringer Farms in mid-October.

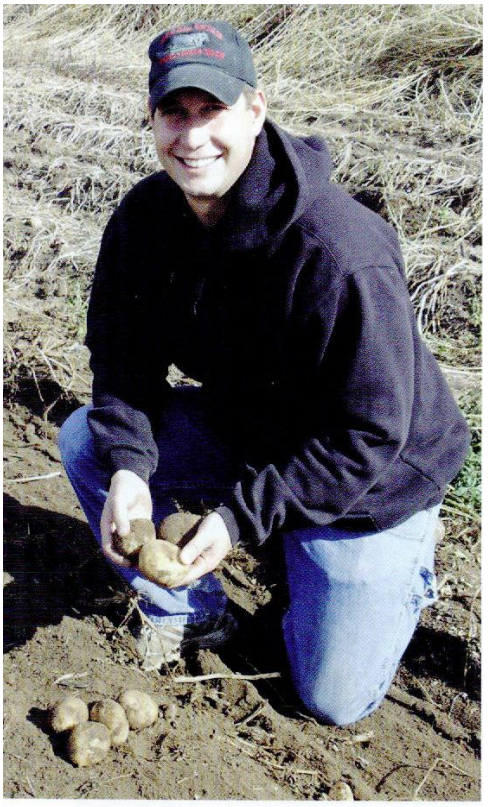
A harvest sample of a small trial of the Tundra variety seed potatoes derived from AstroTubers™ at Bula-Gieringer Farms.

"Extensive testing for a number of important diseases has confirmed that CETS' seed potato production system produces disease-free minitubers," said Bula. "Using the polymerase chain reaction (PCR) technique, as well as the enzyme-linked immuno-sorbent assay (ELISA) technique, all samples tested negative for the most important viruses infecting potato fields in the U.S. These include potato leaf roll virus (PLRV), potato virus A (PVA), potato virus M (PVM), potato virus S (PVS), potato virus X (PVX) and potato virus Y (PVY). The samples also all tested negative for the presence of the organism that causes bacterial ring rot."

Another requirement of the Wisconsin Seed Potato Certification Program is that all seed material that passes field inspection must also be submitted for winter grow-out tests in Florida. The results of these grow-out tests on tubers produced in the field derived from plantings of AstroTubers™ have also been entirely free of disease.

Another benefit of the computer-controlled phytotrons is the fact that they are environmentally friendly. "We recently developed the use of LED lights in the chambers and we are documenting the energy savings, which is quite significant," said Bula. "We control the foliar feeding and irrigation schedule such that there is never any standing water in the chambers, thus we never get foliar diseases, such as Early or Late Blight, on the plants. Also, pythium can be prevalent in NFT (hydroponic) systems; it's aquatic and floats in water so you have a difficult time getting rid of it. We've never experienced pythium in our phytotrons, nor have we had any root or foliar diseases."

AstroTubers™ are harvested from the stem cuttings after 56 to 63 days of growth in a controlled environment phytotron. They range in size from 6 to over 25 millimeters. They are then sorted into three sizes: larger than 25 mm (over one inch); 12 to 25 mm (1/2 to 1 inch); and 6 to 12 mm (1/4 to ½ inch). The sorted AstroTubers™ are stored at a low temperature until planting in the field. The AstroTubers™ will sprout when planted in the field in the same manner as traditional potato tubers. Planting 12 to 15 thousand Astrotubers™ per acre will result in a yield that is commensurate with normal potato production yields. The harvest from the AstroTuber™ field is termed FG-1. The FG-1 production is planted another year in the field to produce FG-2 material. The FG-2 material is of sufficient volume that it can be sold to commercial potato growers. This seed production system makes available high quality seed potatoes that have been multiplied in the field for only two generations.



Shawn Bula of Bula-Gieringer Farms is shown with a representative sample of one hill of FG1 Tundra seed potato tubers. He said the Tundra seed averaged close to 425 cwt./acre.

CETS Uses Cutting-Edge Technology...

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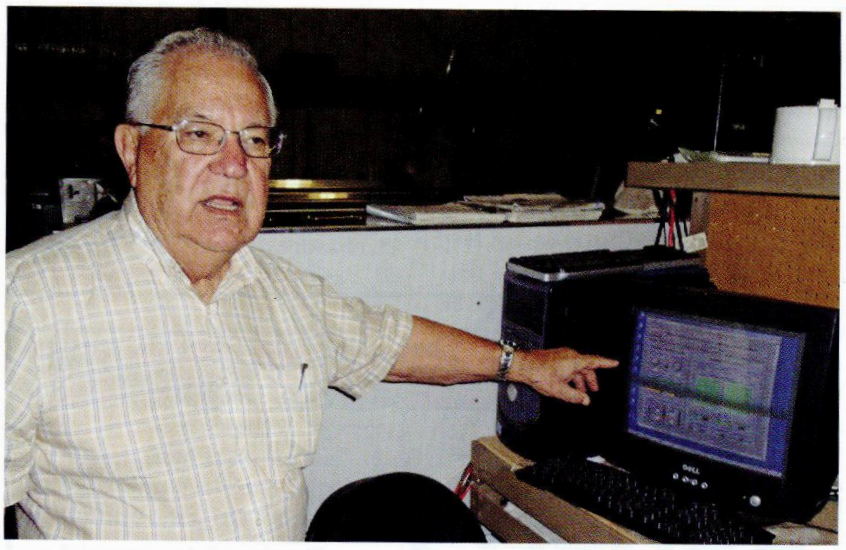
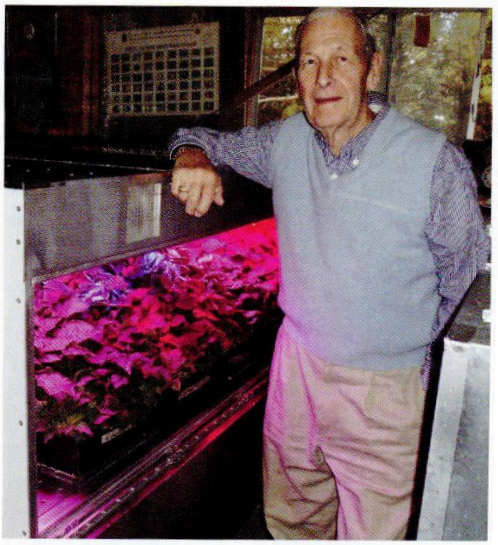


Ray Bula of CETS, LLC points to a computer that is used to control growth chambers, called phytotrons. The phytotrons maintain the optimum environmental parameters to support growth and development of potato plants throughout their production cycle.



CETS LLC Partner Ray Gieringer is shown near a growth chamber that features new LED lighting, which produces a significant energy savings.

In addition to the rapid increase of high quality seed potatoes, the patented phytotrons can be operated in any climatic area and during all seasons of the year. "We fabricate and sell the phytotrons to farms all over the world," said Petrick. "We sold our system to a 22,000-acre farm in Russia and another in the Ukraine. Our system is better than a greenhouse, because with greenhouses, you can't control the sun, the clouds, the rain, etc. We control everything in the phytotrons."

Petrick said the system is simple and economical. "Dr. Bula can teach anyone how to use the system properly in two weeks," she said. "It's very simple to learn. The phytotrons are made in America, and they're stainless steel so they last a very long time. The only maintenance required is on the lighting. We also provide technology advancements and updates, specifications and guidelines for housing and equipment, and extensive hands-on training with regard to growing strategies, harvest and computer use. To ensure a grower's success, we provide support for our systems throughout the initial startup period. We have found that the CETS system will pay for itself within four years."

Ray Gieringer, a CETS LLC Partner, is also a former Circuit Court Judge and co-owner of Bula-Gieringer Farms in Grand Marsh, one of the largest potato and vegetable operations in Wisconsin. The farm raises over 10,000 acres of potatoes, green beans, seed corn, sweet corn, peas, field corn, soybeans and sweet potatoes. Gieringer said the farm planted its first crop of AstroTubers™ this year and will use the harvested tubers as seed for next year's crop. "Bula-Gieringer Farms has the intention to produce its own seed," Gieringer said. "When we started CETS, a lot of people said 'you can't do it,' but we've proven that we can do it, and do it well. And we're capable of growing any potato variety. We have patents on the chambers and the procedures. We're proving it up." CT