Controlled Environment Production of Berries for Commercial Crops

In greenhouse and controlled environments, advanced technologies are brought together with conventional systems for efficient year-round production of berry, vegetable, and floral crops. Ongoing research at the University of Alaska Fairbanks investigates plant requirements for maximum productivity in Alaska's greenhouses. A current study has several objectives: develop cultural and management techniques for crops grown in controlled environments, including high tunnels, greenhouses, and totally controlled facilities; investigate production and capital costs and local market potential for crops produced in high tunnels; provide production protocols and techniques for high-tunnel and controlled environment production of berries and floral and vegetable crops, including how to efficiently plan, design, establish, manage, and operate a temporary or permanent controlled environment production unit. The principal investigator is UAF professor Meriam Karlsson.

For more information, please contact:

School of Natural Resources & Agricultural Sciences / Agricultural & Forestry Experiment Station Information and Publications office:

907.474.5042 (ph) • 907.474.6184 (fax)
e-mail: fynrpub@uaf.edu

or write: AFES Information, UAF
P.O. Box 757200
Fairbanks, AK 99775-7200

website: www.uaf.edu/snras/ • blog: http://snras.blogspot.com

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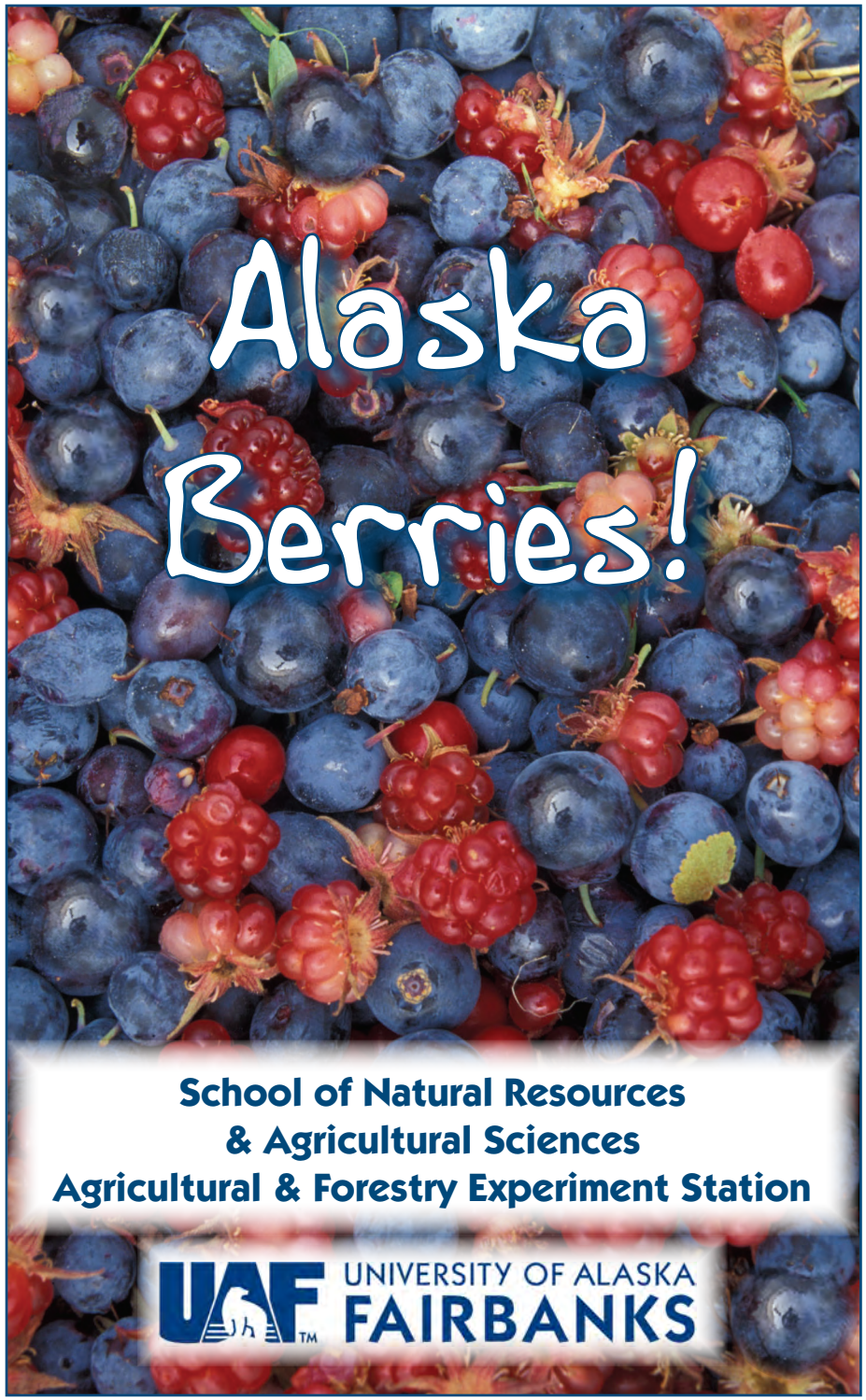
Wild berry photo courtesy of the U.S. Fish & Wildlife Service



Berry Science

When United States Department of Agriculture listed the top 20 antioxidant-rich foods in a study of commonly consumed foods,* berries took six of the top eleven spots: wild blueberries, cultivated blueberries, cranberries, blackberries, raspberries, and strawberries. Because University of Alaska Fairbanks (UAF) researchers have long suspected that long day lengths, cool soils, and sun angle affect plant characteristics such as color and sweetness, they also wondered how these growing conditions might affect the antioxidant capacity of fruits and other plants. If this capacity was elevated above that found in comparable cultivated and wild harvested plants at lower latitudes, Alaska plants and products might provide the raw materials for a growth agricultural industry in fresh, processed, and nutraceutical or pharmaceutical markets.

Antioxidants in Alaska Wild Berries

A survey of Alaska wild berries to determine the range of their antioxidant capacity showed that UAF researchers were right.* When 88 berry samples were analyzed, all of the species tested showed elevated Oxygen Radical Absorbing Capacity levels.

The Partnership

A partnership has been formed between UAF, USDA ARS, and two private concerns, Alaska Blue and Alaska Berry Growers, to bring basic and applied science together with industry to further economic development in rural Alaska. The team aims to:

* foster sustainable businesses for Alaska's rural communities;
* further investigative science through basic and applied research;
* provide educational opportunities for graduate and undergraduate students;
* develop new degree programs, and workforce training;
* bring new wealth to the state of Alaska through technology transfer and product development.

UAF Research

Because demand for nutraceuticals is high and people increasingly want healthy processed berry products and fresh berries of high quality, berry research underway at UAF ranges from biochemistry to horticulture. Commercial use of Alaska's berries requires a consistent supply, so cultivation of berry crops is critical to supplement wild harvest. Under investigation are field management practices for wild stands, propagation technology for cultivated stands, and controlled-environment production technologies.

* Journal of Agricultural and Food Chemistry, June 9, 2004

Chemical Analysis of Alaska Berries

In this research, the focus to date has been on developing an extraction methodology for blueberries, an HPLC-based analytical procedure, and a preliminary fractionating scheme. One short-term goal is to determine the cause for the chemical changes in blueberry composition during extraction procedures. Researchers will continue to identify the most important components that lead to the antioxidant activities of blueberries. As major active components are identified, best harvesting time, growing conditions, storage conditions, and shelf life of plants, extracts, and products can be determined. UAF professor Thomas Clausen is the principal investigator.

Nutraceuticals and Neurochemistry

Nutraceuticals appear to alleviate ailments associated with chronic neuro-degenerative disorders and have proven beneficial against central nervous system decline associated with aging. We lack significant information about the actual cellular targets in neuronal cells that maintain their health status or robustness. The long-term goal of this research is to identify targets within neuronal cells that interact with components of nutraceuticals and that are clearly linked to enhanced survival or robustness of neuronal cells. The research will assess effectiveness of crude blueberry extracts on neuronal survival under inflammatory stress and under chronic exposure to an environmental toxin. It will also evaluate the neuroprotection effectiveness of molecular components obtained from blueberry extract. The researchers expect to identify insult-specific cellular targets that will allow them to continue research in the area of biomarkers. At the molecular level, they also plan to assess the effectiveness of blueberry extract in preventing or alleviating oxidation of insult-target proteins. The role of antioxidants and the expression of cancer-related proteins such as VEGF will be studied in a cell culture system. Principal investigators are UAF professors Lawrence Duffy, Thomas Kuhn, and Kriya Dunlap.

Micropropagation of Lingonberries and Bog Blueberries

Methods of tissue culture propagation have been identified for lingonberry cultivars and Alaska bog blueberry for use in field establishment for cultivation of these wild berries, as well as management of wild stand for berry production. Development of a lingonberry industry in Alaska depends on development of a reliable means of propagation. This study will also provide baseline information on somaclonal variation necessary for the potential release and patenting of 'Snowball' and 'Gilmore' cultivars. UAF professor Patricia Holloway is the principal investigator.