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BioOptions

Newsletter of the Center for Alternative Plant and Animal Products
University of Minnesota

[redacted]

BioOptions Library

This issue of the BioOptions Library features Blueberries. Blueberries are at their peak in Minnesota now - so eat and enjoy.

Next time, the BioOptions Library will outline production practices and market issues for Deer Farming.

Start your own library of alternative agricultural or forest related opportunities by collecting the tear-out topic summary. Your library will grow with each issue of BioOptions and/or by requesting information from the Center.

Wanted: Ideas for Rural Enterprise

The Blandin Foundation recently awarded a $1 millon grant to the University of Minnesota to help finance the development and transfer of new technologies to companies based in Minnesota. Half of the funds will be awarded to projects involving collaboration between rural companies and university researchers to develop and commercialize new technologies. Eligibility requires that the projects have promising potential for commercial application outside the metropolitan area. Of special interest are proposals that list a company's present capabilities and the possibilities of additional new products or processes based on cooperative research with the U of MN. Contact: Albert Riley, Blandin Foundation, 100 Pokegama Ave. N, Grand Rapids, MN 55744 or Tony Strauss, ORTTA, Univ. of MN, 1100 Washington Ave S, Suite 210, Minneapolis, MN 55415 (see MN Technology, Summer 93).

Hay Power

The U.S. Department of Energy (D.O.E.) predicts that renewable biomass energy crops will provide a significant portion of future fuel needs in America. This is good news for farmers. Crops grown specifically for the production of energy provides a major new market for agriculture.

To make electricity from biomass you could burn it, making steam that would drive a steam turbine which in turn produces electricity. Most of the electricity produced in America today is made by burning fossil fuels (coal and natural gas) and some biomass (usually wood waste products and garbage).

A new, more efficient way to convert mass to electricity is through a process called gasification. Plant matter (biomass) placed in a chamber under pressure and at high temperature (over 1500°F) is converted to gases (over 95% conversion). These gases (largely methane and hydrogen) are called synthesis gases (syngas). Combustion of the syngas drives a combustion turbine and produces electricity at higher efficiency than can be achieved in steam turbine systems. Not only is the production of electricity more efficient but it also may be done on a much smaller scale than is typical for steam turbine coal power plants.

Northern States Power Company (NSP), Minnesota's largest electric utility, has submitted a proposal to D.O.E. to conduct a cooperative cost-shared study to determine the feasibility of establishing a biomass fueled (continued on page 4)

Deer Farming

Peter Bingham, Minnesota Deer Farmers Association

I was a member of the California State Police department for eleven years and served as a legislative lobbyist representing police officers on law enforcement issues before recently moving my family to Minnesota to find a better lifestyle.

We chose Red deer farming because it is a developing industry with promising long term growth potential. Red deer are the most successfully farmed cervidae in New Zealand and I wanted a proven species for our farm. We were the first recipients of the Minnesota Department of Agriculture's sustainable agriculture grant program. Our alternative livestock project is a demonstration that Red deer can be profitably farmed. (continued on page 3)

The Edible Soybean Market

The production of edible soybeans and/or soybean products, especially for the Japanese market, is an opportunity that Minnesota soybean growers and processors may wish to carefully consider. Japan is the world's largest single consumer of soybeans for food. Also, the Japanese market seems willing to pay a premium for top quality. Understanding the buyer's needs and quality requirements is the first step in improving sales and profitability in all business dealings.

The University is currently evaluating several Japanese soybean varieties that have been selected for a specific food use. (continued on page 3)

Director's Column

by Erv Oelke

Last May, the USDA's Alternative Agricultural Research and Commercialization (AARC) Center in Washington,D.C. announced that the Northern Regional Agricultural Utilization Consortium (NRAUC), a group of public and private organizations based in Minnesota, North Dakota and South Dakota, has been designated as one of the first two regional centers for AARC. This presents a significant opportunity for the tri-state area to lead in new uses for agricultural products. The University of Minnesota's Institute of Agriculture, Natural Resources and Human Ecology is a member of NRAUC as is Minnesota's Agricultural Utilization Research Institute (AURI).

The mission of AARC is to assist emerging industrial products/processes involving the use of agricultural (traditional and new crops, animal by-products or forestry) materials. Mark McAfee of AURI indicates that according to Dr. Paul O'Connell, AARC Center Director, a major part of regional center work will be developing public-private partnerships to submit applications to the national center. One of our (CAPAP) roles at the University of Minnesota is to assist in University of Minnesota-private partnerships to enhance diversification in rural Minnesota. Our Center has collaborated with AURI on a number of projects. I see this collaboration continuing especially in the advancement of ARRC within the state.

In the June 8 Federal Registrar, AARC invited applications for project funding and on June 23, Director O'Connell sent to us a packet of forms for pre-proposals and full proposals. All proposals must be submitted by August 31, 1993 for the next round of funding. Pre-proposals are shorter and are reviewed by AARC to see if the idea merits a full proposal. Full proposals can also be submitted by anyone. For more information, individuals can contact Patricia Dunn at (202) 401-4173. We will also share the information we received with anyone who is interested. CAPAP can also assist in preparation of both a pre-proposal or a full proposal. CAPAP looks forward to this exciting opportunity to improve rural Minnesota by enhancing industrial uses of existing or new commodities.

BioOptions has grown. We are excited about expanding from eight to twelve pages. This will allow us to provide even more information to our subscribers. The twelve pages are packed with more articles and have allowed us to add some new features. One new feature, Information Desk, gives you an idea of the wide variety of information requests we receive at the Center. Please contact the Center when you need information. We are here to help you.

NEW USES COUNCIL

The New Uses Council was established in 1990 and its members have played an important role in informing policy makers in Washington of the economic and environmental benefits of renewable resources and establishing the Alternative Agricultural Research and Commercialization (AARC) Center in the U.S. Department of Agriculture. Council Chairman, Jeff Gain, recently testified before a U.S. Senate Committee calling for the formation of a national renewable resource development policy. Each day $160 million is spent to purchase foreign oil while the federal government spends billions of dollars each year to idle cropland due to lack of market demand. It is shortsighted and costly to make industrial products and transportation fuels from imported petroleum when they could be produced from domestically abundant renewable resources. It will require a concerted national effort and a new way of thinking to develop innovative environmentally superior industrial and non-food consumer products made from renewable resources.

Ag Industrial Materials & Products is a quarterly trade publication published by the New Uses Council that is devoted to covering the latest developments in the rapidly growing field of new non-food industrial and consumer products made from renewable agricultural materials. To become a member or receive a sample copy, contact Bruce Abbe, Managing Editor, C/O Communicating for Agriculture, Inc. 2626 East 82nd St. #325, Minneapolis, MN 55425, (612) 854-9005, FAX (612) 854-8458.

The New Uses Council held a meeting at the Earle Brown Center, University of Minnesota, St. Paul Campus on August 10. Representatives of farm, agribusiness, industry and higher education attended the meeting. According to Bruce Abbe, this was the first in a series of state-by-state meetings to inform key businesses and agricultural leaders about this 3-year-old national coalition organization and to engage in discussion about how we might all work together to achieve a bold new vision to improve farm income, add new jobs and business in rural areas through market development of environmentally-improved renewable resource products.

Deer Farming (continued from page 1) Cervidae farming has become a six to eight million dollar industry in Minnesota. The American consumer is looking for a lean red meat and farm raised venison is rich in iron and low in fat making it competitive with the white meats. As Americans become more health conscious, venison provides an alternative to traditional red meat.

I worked with deer industry groups to organize a massive legislative effort to place deer farming under jurisdiction of the Department of Agriculture. Major legislation was passed this last session by the Minnesota State Legislature to allow Minnesota farmers to farm cervidae (deer). This comprehensive legislation defines deer farming as a farmed livestock under the State Department of Agriculture and the Commissioner of Agriculture shall promote the commercial raising of farmed cervidae and select an advisory committee made of up industry, associations, Board of Animal Health, Trade and Development and the University of Minnesota.

This legislation allows the establishment of a Minnesota development and aid program that may support applied research, demonstrations, financing, marketing, promotion, breeding development, registration and other services for owners. Information on farmed cervidae is to be included in the Department of Agriculture's statistical reports on Minnesota agriculture. There is currently no other state that has this extensive legislation to create a new alternative livestock industry.

Currently in New Zealand, there are 5,000 deer farmers raising 1.3 million deer, most of which are Red Deer. New Zealand has an estimated 100 million dollar deer industry. Many New Zealand deer farmers are diversified with dairy, sheep or cattle. In 1991, New Zealand exported approximately 671 tons of venison to the U.S. supplying 85 percent of the venison consumed by Americans. In 1993, the New Zealand Game Industry Board launched an intensive two million dollar marketing campaign to increase their sales to American consumers.

As agriculture planners, researchers, economists, entrepreneurs, academicians, extensions agents and veterinarians, we seldom see a whole new livestock industry created at its beginning stages. The opportunity for the various departments within the university and the Dept. of Agriculture to combine talents to build an infrastructure to assist this industry comes perhaps once in a lifetime.

As the cervidae industry grows, sound strategies need to be identified for both short and long term goals. For example, printed information involving this industry needs to be developed and distributed to the general public. As our agriculture becomes more global, we must diversify if our farmers are to have economic stability.

For further info contact: North American Deer Farmers Assn., 9301 Annapolis Rd. #206, Lanham, MD 20706
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Peter Bingham, Minnesota Deer Farmers Assn.
RR1 box 262, Randall, MN 56475 Phone (612) 749-2197

Edible Soybeans (continued from page 1). These varieties were made available to the University by a private soybean processing company for the purpose of general evaluation of the adaptability of high yielding Japanese varieties to life in Minnesota. Specific results by named variety from these trials will remain with the owners of the seed. General information and results will be presented in the next issue of this newsletter.

The American Soybean Association estimates that the market for identity preserved (IP) beans is expanding and currently exceeds 4 million bushels. Although this represents but a small portion of the over 50 million bushels of soybeans (No.1 light-colored hilum and No.2 yellow) imported by Japan, IP varieties such as Vinton should command a higher price in the marketplace.

Before venturing into this market, a producer should become very familiar with all aspects of production and marketing of IP beans. Identity preserved beans must be handled separately from other beans and are usually cleaned, graded, and bagged in the country of origin and then shipped by container to Japan. Additional handling costs and generally lower yields of IP beans, marketing strategy, and increased risk factors must be carefully considered before planting.

A discussion of market options "Marketing Food Quality Soybeans in Japan" has been published by the American Soybean Association and is available by writing to 540 Maryville Centre Drive, Suite 400, P.O. Box 419200, St. Louis, MO 63141-9200.

If you are interested in further information about this high-value soybean market, contact the Center and we will keep you up to date.

JUST MY OPINION

Agriculture in Minnesota and across the nation needs to diversify into higher-quality, higher-value crop production. This generally means less quantity more quality. The opportunities to diversify are out there. Every operation in the state needs to find its own niche and move a portion of total production into that niche. Long-term survival on the farm is what's at stake. CVH

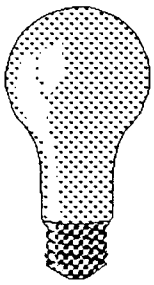
"I'd rather be a failure at something I enjoy than be a success at something I hate."

- George Burns

Hay Power (continued from page 1) electric power generation system at NSP's existing coal-fired power plant in Granite Falls, Minnesota. NSP will contract with the University of Minnesota, the Institute of Gas Technology (IGT), Tampella Power Corporation (TPC), and the Westinghouse Electric Corporation (WEC) to provide the specific information required to determine the feasibility of a proposed biomass energy demonstration project.

The University of Minnesota is committed to this evaluation of a potential biomass energy project as part of ongoing research and development efforts to improve the sustainablity of energy production and for the major opportunity that biomass energy crops provide for agriculture.

BIOMASS ENERGY



Plants capture energy from sunlight and use it to build complex structures out of carbohydrates, proteins, and lipids. The energy stored by plants in these structures can be released and converted to other forms of energy by a number of processes including: combustion, digestion, and by a process called gasification.

The National Biomass Power Program goal set by D.O.E. is to produce 6,000 MW_e of additional biomass energy by the year 2000. This requirement demands that the agronomic capability of the fuel feedstock be well established now. Production practices, seed supply or planting stock, and harvest technology are all critical aspects of the biomass fuel supply system. Alfalfa, as a major component in conventional agricultural rotations, has the potential to provide a stable biomass fuel supply, improve profitability for farmers, and open the door for other biomass sources, like short rotation woody crops, to contribute to the total biomass fuel supply.

Benefits from including alfalfa in the rotation include: increased yield from other crops in the rotation, reduced external inputs of fertilizers, lower overall production costs (fossil fuels inputs), and distinct environmental benefits in terms of reduced soil erosion, improved soil tilth, increased soil organic matter levels, and reduced potential for nitrate leaching. The integration of an alfalfa biomass energy crop into traditional agricultural cropping systems provides a dedicated energy fuel supply that is here today. It is the direct symbiotic linkage of the benefits to production agriculture and the reliable supply of biomass for energy production that will make this system work.

THE CONVERSION TECHNOLOGY

The proposed biomass gasification process is a pressurized, air-blown, single-stage fluidized bed gasifier. The RENUGAS™ process (developed by IGT and licensed to TPC) has been designed to operate at pressure, uses single-screened feedstock, uses no catalyst, and is mechanically simple to operate. Process development tests in a 10 ton-per-day process development unit have been conducted in Chicago with a variety of biomass sources, including alfalfa. These tests have demonstrated high carbon conversions and high thermal efficiencies with a low production of condensible products. The RENUGAS™ process can handle a wide range of biomass materials from whole-tree-chips to finely chopped sugarcane bagasse.

The process was developed with a lockhopper and a pressurized feed hopper with live-bottom metering screws to meter the feed into a high-speed injector screw that transports the feed into the fluidized bed gasifier. Spherical beads of non-attriting aluminum oxide material are used as an inert fluidized bed medium to provide smooth fluidization of the bed with excellent backmixing and also to provide a large heat capacity in the bed. These beads are well-suited for storing and exchanging heat between the simultaneously occurring exothermic and endothermic gasification reactions in the fluidized bed.

By using a deep fluidized bed of the inert material in the RENUGAS process, the residence time of the biomass char is increased which achieves high carbon conversion. Also, feeding the biomass near the bottom of the fluidized bed close to the air distributor aids in the rapid reforming of the condensible biomass devolatilization products as they are formed. Pressurized operation of the fluidized bed promotes smooth, stable fluidization dynamics with high biomass throughput rates. The pressurized clean fuel gas is well-suited for gas turbine power production systems.

An efficient and reliable hot gas cleaning system is a key technology requirement for the successful integration of a biomass gasifier with a combustion turbine for high-efficiency power generation. The fuel gases derived from biomass will contain contaminants which could lead to corrosion, erosion, and deposition in the combustion turbine. Therefore, a gas cleanup system, including particulate removal, and possibly alkali removal, is needed. Particulates must also be removed to meet emissions standards.

Initial review specifies a plant utilizing a Westinghouse combustion turbine power generation system. The combustion turbines used for electricity production are very similar to the turbine engines on commercial jet liners. Because of civilian and military investments in combustion turbines for aircraft the efficiency of these engines has increased dramatically in the past several years.

BIOMASS PRODUCTION

Minnesota farmers currently produce over 6.9 million tons of alfalfa hay per year, the fourth largest production level of alfalfa in the country. However, alfalfa covers less than 6% of Minnesota's total cropland.

The proposed biomass shed (the area where alfalfa production for biomass is expected) is defined as the area within a 50 mile radius of Granite Falls, Minnesota. This region of southwestern Minnesota depends primarily on cash crop agriculture. The farmland within the counties included in the shed currently produce 2.8, 2.6, and 0.34 million acres of corn, soybean, and alfalfa, respectively. The size of the average farm in the shed is 580 acres. The shed currently produces (1.4 million tons/year) nearly four times more alfalfa biomass than would be required for a 1000 ton/day biomass energy production facility. Alfalfa yield levels in southwestern Minnesota average 4.5 tons/acre/year.

Biomass producers will be experienced, operating farmers in the biomass shed. These farmers will be motivated to start producing or increase their production of alfalfa to increase profitability, and reduce risk through diversification as well as other tangible economic and environmental benefits. The estimated average annual return per acre to the farmer from a conventional corn/soybean rotation is $39.13 without government payments and $62.99 per acre with government corn payments.

Pre-feasibility study economic analysis based on current economic conditions in southwestern Minnesota and using a value for the alfalfa of $60/ton to the grower,the projected average annual return per acre over a 7-year biomass rotation (four years of alfalfa followed by two years of corn and then soybeans) is $63.10 without government payments. Average annual return including government corn payments is estimated at $76.73.

This analysis indicates that the biomass rotation would be more profitable for the farmer than the conventional corn-soybean rotation with or without government program payments. Future reductions in government program payments, as are likely, would further increase the profit spread for the biomass producer over the conventional rotation.

The economic benefits of the biomass rotation are directly attributed to the inclusion of a perennial legume in the rotation. Reduced input costs of the biomass rotation compared to the conventional rotation combined with minor yield increases for corn and beans in the biomass rotation result in increase profits for the grower.

The benefits of including alfalfa in a rotation are well documented. However, increases in total alfalfa production have been limited because of the problems associated with shipping alfalfa long distances (hundreds of miles in some cases) to reach markets and a declining dairy market for average quality hay. High regional demand for alfalfa, such as that provided by a biomass power plant, will stimulate production and allow producers to achieve the economic and environmental benefits described.

THE ALFALFA COOPERATIVE

A proposed farmer-owned "Alfalfa Cooperative" (AC) is one example of a potential business arrangement that will be examined in this feasibility study. The AC contracts with growers to produce alfalfa. The AC separates the alfalfa into stem and leaf fractions at a facility integrated with the power plant. Densified alfalfa stem fraction is sold under a long-term guaranteed purchase agreement to NSP as a uniform high quality biomass fuel (about $35/ton). The alfalfa leaf fraction is sold as a relatively low-cost ($125/ton or more) high protein, high-energy feed supplement.

The ability to separate a value-added leaf meal product from the stem-fuel should help make alfalfa biomass fuel competitive with other alternative fuels. Market options for the leaf fraction and possible product mixes will be evaluated in the study. Alfalfa processed into pellets/cubes has major market potential both in this country and overseas. The removal of the lower feed value fraction (stems) should help to improve the nutritional quality and value of the pelleted/cubed leaf product.

The potential local alfalfa leaf meal market for dairy cattle is very large. As part of this study,we will also evaluate the potential for alfalfa leaf meal to become a valuable component in swine and poultry diets.

The AC is an ideal example of value-added processing, a strategy that has been touted as the way and the hope for the future for American agriculture. The economic development associated with this industry has the potential to revitalize sagging rural economies.

The inclusion of alfalfa in traditional corn/soybean agricultural rotations will contribute significant resources to the agricultural land base, has the potential to provide a low-cost high protein feed supplement for dairy farmers, and a dedicated biomass fuel supply for energy production. A possible joint venture between the utility and the AC would provide the necessary financial stability and long-term contract opportunities necessary to make the AC a success.

Biomass fueled power plants will be smaller than typical fossil fueled plants. Smaller plants distributed on the transmission system will reduce grid and capacity upgrade requirements and also distribute business opportunities for growers and the utility to cooperate on co-product opportunities, like the AC. This integration of renewable biomass energy production systems within sustainable agriculture production practices is the key to a viable dedicated fuel supply system.

For more information on this feasibility study and/or to have input into this effort to establish sustainable biomass electricity production in Minnesota,contact the Center.

CENTER PROJECTS

Promoting the Benefits of Economic Diversity in Rural America

The Consortium for Plant Biotechnology Research (CPBR) has issued a request for proposals that initially requires only a short (2 page) abstract outlining your project (due October 1, 1993). This funding opportunity for plant biotechnology and biomass energy research projects provides a better-than-average chance for success. The CPBR, formerly the Midwest Plant Biotechnology Consortium, does require an industry sponsor although the research that has been funded in the past tends toward basic rather than applied projects. The Center will assist University researchers in obtaining an industry sponsor. A meeting is planned for Friday September 24, 1993 to bring together researchers and potential industry partners. Dorin Schumacher, Director of CPBR, members and potential industry members of the consortium and researchers will have a chance to discuss this year's projects. For more information on CPBR contact: Burle Gengenbach, Professor, Agronomy and Plant Genetics or the Center.

Biomass Energy Researchers please contact the Center so that we may include you in the Biomass Energy Database funded through the CPBR (see above). The production of energy from biomass has the potential to transform American agriculture. All biomass energy research areas are included.

Woody Agriculture - Team meeting was held at the Forest Resource Center in Lanesboro, MN. Cooperating states for this project include Minnesota, Iowa, Nebraska, and Kansas. The overall goal of this project is to return a portion of the agricultural landscape to perennial woody plants. Hazel (Corylus spp.) can be grown to serve as a field windbreak that also produces a high value hazelnut crop. Further funding for this effort is being sought from the Minnesota Institute for Sustainable Agriculture (MISA), and other agencies.

Development 94 features alternative agricultural opportunities for persons in the 7th Congressional District of Minnesota. The Center is co-sponsoring this up-coming event in Detroit Lakes, MN, which last year attracted over 3000 people.

Alternative Fiber Paper Production - making paper/paper products from native plant fibers is an opportunity to create high value paper products for specialty markets. This is not technically difficult, offers unlimited artistic challenge, and is inexpensive to undertake. For more information on paper making contact the Center.

"PRO" Funding Opportunity - Pesticide Reduction Options The Agricultural Utilization Research Institute (AURI) has a request for proposals that is due September 1,1993.

The Center is willing to help prepare proposals for this grant. Contact Judy at (612) 624-4217 for more details.

"Nothing makes a person more productive than the last minute."

- Unknown

Where knowledge is not the limiting factor, roadblocks to the commercialization of a good idea may simply reflect a lack of communication between producers, consumers, government and the university. Let's build some bridges. All projects require a commitment of resources, both time and money. Your interest and comments regarding specific projects are invaluable to us as we determine how to allocate our limited resources. We are in this together. cvh

BLUEBERRIES (Half-High)

HISTORY

The blueberry is one of only two commercially cultivated fruit crops native to North America. Interest in blueberries as a cultivated crop began about a century ago, and after some initial work by Frederick Coville, leader of the first blueberry breeding program for the USDA and George Darrow his successor, the industry developed rapidly. Land thought to be useless for agriculture was found to be ideal for blueberry cultivation.

There are several species of blueberries native to North America, and many more hybrids, but most commercially grown blueberries are one of three types: highbush, lowbush, and rabbiteye. The highbush blueberry, *Vaccinium corymbosum*, is the major cultivated species in North America. Plants are typically 6-8 feet tall and produce large fruit. Highbush is native to the eastern United States but Michigan is the leading commercial producer. The lowbush blueberry, *Vaccinium augustifolium*, which grows wild from Minnesota to Maine and southward to West Virginia, is low statured with small fruit. Lowbush is grown commercially, primarily in Maine and Eastern Canada. The rabbiteye blueberry, *Vaccinium ashei*, is native to northern Florida, southeastern Georgia and southeastern Alabama. Plants may be 6-20 feet tall and are grown commercially in the southeastern United States. Rabbiteye blueberries will not survive in Minnesota.

In the late 1960's, the University of Minnesota initiated a blueberry breeding program to develop large fruited, low statured, productive, high quality blueberry cultivars, referred to as half-high, that would withstand Minnesota winters. In 1983, the first two cultivars from this program, Northblue and Northsky, were released and the first commercial blueberry plantings were established in Minnesota in connection with the breeding program. In 1986 Northcountry cultivar, and in 1990 the St. Cloud cultivar, were also introduced.

USES

Commercially produced blueberries are sold primarily as fresh or frozen blueberries or are used in a wide range of value added products such as jams, pie-fillings, yogurt and muffin mixes. In Minnesota, there are over 100 acres of commercial pick-your-own blueberries (half-high cultivars). Blueberry plants are also used in naturalized landscaping.

CULTIVATION

Half-high blueberries may be planted in either spring or fall, although spring is preferable to benefit from spring rains and to avoid loss of plants due to frost heaving. Bees pollinate blueberries. The only half-high cultivar that requires cross pollination is the St. Cloud, but it is strongly recommended that plantings contain two or more cultivars. The benefits from cross pollination include larger berries and earlier ripening. Blueberries require moist but well drained, light textured, acidic soil with high organic matter. Choose a frost-free, level or gently sloping site in full sun with good air circulation. Surface and internal soil drainage are essential, since only a few hours of standing water may injure or kill the plants.

Planting problems, such as root damage from bushes that are planted too shallow or too deep or roots failing to grow out of their original pot configuration, may result in poor plant growth and reduced plant longevity, that can show up several years after planting. Cultivation should be no more than 2 inches deep since 90 percent of blueberry roots are in the top 8 to 12 inches of soil.

A form of winter protection for shoots and flower buds is necessary for optimum productivity since temperatures of -25°F to -30°F may cause damage. Natural snow offers the easiest and best protection. For half-high cultivars in northern Minnesota, a minimum of 18 to 24 inches of snow (row covers may also be used) is necessary to ensure dependable production.

Insects, diseases, deer browsing and bird predation may cause significant losses. Growers should engage in pest management practices, such as protective netting or fences, appropriate to their area.

ENVIRONMENTAL REQUIREMENTS

The most critical factor in successful blueberry growth is the soil pH. A soil pH of 4.5 to 5.5 is considered optimal. If soil pH is higher than 5.8, growth and development of the blueberry plant is likely to be reduced and foliage may turn yellow; plants will die if the pH remains too high for an extended period of time. The pH of the soil should be tested before planting and if the pH is over 5.8, the existing soil should be amended with sulfur or mixed with acid peat. Soil pH should be maintained by the addition of acid-forming fertilizers such as ammonium sulfate.

Irrigation is also essential to maximize blueberry production. Blueberries require frequent, light supplemental irrigations since the root systems are fibrous and shallow (8 to 12 inches). New root growth of young starter plants may be reduced by soil conditions which are either too dry or too wet, and because plants may wilt quickly in hot dry weather until established, careful

soil moisture monitoring is necessary. Lack of adequate water at key times, such as when plants are young or during hot stressful times when fruit is developing, will significantly reduce yields and plant growth.

YIELD & PERFORMANCE

The yield of half-high blueberry cultivars depends on the cultivar grown and growing conditions. Yields average from 1 to 5 pounds per bush for Northsky plants to between 3 and 15 pounds per bush for Northblue, Northcountry and St. Cloud. Plant yields will be higher and berries will ripen earlier and be larger if more than one cultivar is planted due to cross-pollination. Production also varies dramatically depending upon winter damage. Northblue plants will produce from 3 to 12 pounds of fruit per plant in the southern portion of its range, but will only produce from 1 to 6 pounds of fruit per plant in the northern portion of its range due to winter injury problems.

PRODUCTION & MARKETS

Blueberries are suited to a variety of marketing methods including wholesale or direct. Blueberries may be marketed independently but many growers join grower co-operatives to increase the efficiency of their advertising budgets. The wholesale market consists of fresh blueberries sold to retailers, food manufactures or institutions, primarily by larger producers or co-operatives due to the larger volume of blueberries required by the buyer. Direct marketing consists of roadside or on farm sales including pick-your-own.

Fresh blueberries prior to sale are classed into either U.S. No. 1 or Unclassed categories. No. 1 berries must be similar in color and shape, mostly clean of dirt and other foreign material and over half the berry surface must be colored blue, bluish-purple or bluish-black. Berries must not be overripe and should not be wet from the juice of other berries. Blueberries are also classified by size according to the number of berries in one cup; U.S. No. 1 may not exceed 250 berries per cup. There are also limits on the number of damaged blueberries allowed per cup. Frozen berries are graded A, B, C, and D based on point system with points given in three categories: color, absence of defects, and character (firmness and fleshiness). Berries graded B or less for character are unable to be graded A, regardless of the total points.

Growing blueberries is a long term investment. The grower has invested a lot of time and several thousand dollars into site preparation, purchase of initial and supplemental plants, irrigation, and pest control before the plants begin fruiting in their third to fifth year . Results of economic feasibility studies of half-high blueberries after nine seasons indicate that, in Minnesota, pick-your-own blueberry production should attain cumulative profitability 10-12 years after planting.

There is considerable risk involved due to winter injury and associated affects on weakened plants. Results to date emphasize the importance of site selection to maximize winter protection. Suitable soil pH, soil type and drainage, practices such as use of wind breaks to encourage good snow catch, use of row covers for winter protection, proper handling of plants at planting, and a long term commitment to production are all factors affecting grower success. Overcoming production problems can result in profitability due to the demand and high prices paid for the fruit. Half-high cultivars, planted in Minnesota, should remain productive for 30 years or more with proper site selection and cultural practices.

by Bethany Davidson, CAPAP,

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Twin Cities Campus

Center for Alternative Plant and Animal Products
College of Agriculture

340 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108

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PUBLICATION LIST

CAPAP Publications:

(Send check to the Center at the above address.)

Alternative Agricultural Opportunities: A Bibliography (106 pages)		$ 5.00
Alternative Crops for Minnesota (116 pages)		10.00
Alternative Field Crops Manual (chapters covering over 50 different crops)		45.00
Bio-Options (quarterly newsletter, annual subscription)	in the U.S.	8.00
	outside the U.S.	10.00

Research-Based Production Guides:

(Send check to the Center at the above address.)

Lupin, Production and Utilization Guide (27 pages)	10.00
Production of Belgian Endive (Witloof) in Minnesota (25 pages)	5.00
Prospects for Canola in Minnesota (37 pages)	10.00

Proceedings:

(Send check to Extension Special Programs, 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.)

Commercial Field Production of Cut and Dried Flowers (207 pages)	20.00
Grain Legumes as Alternative Crops (194 pages)	20.00
Shiitake Mushrooms (217 pages)	20.00
Soybean Utilization Alternatives (427 pages)	30.00
Deer Farming (47 pages)	11.00
North American Dairy Sheep Symposium (192 pages)	17.00
Organic Meat Symposium (96 pages)	17.00
Wood Based Economic Development in the Lake States (201 pages)	20.00
Amaranth: Production, Processing and Marketing (200 pages)	20.00
Prospects for Lupins in North America (191 pages)	20.00
Value Added Meat Products (54 pages)	10.00

Make checks payable to the **University of Minnesota.** Indicate publication titles and quantity of each publication requested. Don't forget to include your name, return address, and zip code.

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ADDITIONAL SOURCES

The following list contains additional sources for information on alternative agricultural opportunities.

Agricultural Library Forum
National Agricultural Library
Attn: Karl Schneider
Room 111
Beltsville, Maryland 20705
(301) 344-2113.

Appropriate Technology Transfer for Rural Areas
(ATTRA)
P.O. Box 3657
Fayetteville, Arkansas 72702
(800) 346-9140

Center for Alternative Plant & Animal Products
University of Minnesota
340 Alderman Hall
St. Paul, Minnesota 55108
(612) 624-4217

Marketing & Transportation Research Branch
TMD/AMS/USDA
Attn: Julie K. Anton
Room 2955-S
P.O. Box 96456
Washington, D.C. 20090-6456

Missouri Alternatives Center
628 Clark Hall
Columbia, Missouri 65211
(314) 882-1905

Office of Small Scale Agriculture
Attn: Howard W. Kerr, Jr.
USDA
Aerospace Building, Suite 342
Washington, D.C. 20250-2200
(202) 401-4640

The Ohio State University
Dept. of Agr. Econ. and Rural Sociology
Attn: Kelso L. Wessel or Debra S. Britton
2120 Fyffe Road
Columbus, Ohio 43210
(614) 292-6413 or -6924

Rural Development Center
Kirkwood Community College
6301 Kirkwood Blvd., S.W.
Cedar Rapids, Iowa 52406
(319) 398-5699

Small Farm Enterprise Project
Attn: Claudia Meyers
University of California, Davis
Davis, California 95616
Davis, California 95616
(916) 757-8910

Successful Farming
Attn: Tammy Hagerty
1716 Locust
Des Moines, Iowa 50336
(515) 284-2853

NEWSLETTERS

Ag Opportunities
Missouri Alternatives Center
University Extension
628 Clark Hall
Columbia, Missouri 65211
(314) 882-1905

Small Farm News
Cooperative Extension
University of California
Davis, California 95616
(916) 757-8910

Small-Scale Agriculture Today
Office for Small-Scale Agriculture
USDA/CSRS/SPPS
14th & Independence Ave SW
Washington, DC 20250-2200

Department Highlight
Food Science & Nutrition

Steering Committee Representative - Dr. Bill Breene

Several faculty members in the Department of Food Science and Nutrition are engaged in research involving alternative plant products or alternative uses of plant products or plant derivatives. Dr. Breene's group, in cooperation with Dr. Dan Putnam of the Department of Agronomy and Plant Genetics, analyzed seeds of about 20 accessions each of Minnesota grown amaranth and camelina for proximate composition, trypsin inhibitor activity and B-glucan content, as well as examining the extracted oils for fatty acid and vitamin E (tocopherol and tocotrienol) profiles. The group also developed procedures for extracting and chemically modifying amaranth starch.

Other projects in the lab include 1) the use of twin-screw extrusion processing to produce pelleted feeds for aquaculture (walleyes and rainbow trout) in which a major portion of the protein is supplied by soybean meal, corn gluten meal and wheat flour and/or gluten rather than fishmeal, 2) extraction and stabilization of corn zein from corn gluten meal for use as a protective coating for foods, 3) composition, functionality and possible food ingredient uses of wet and dry-process full-fat soybean flours, 4) extraction, characterization and purification of oil from avocados, 5) pasting properties of amaranth starch in the presence of various plant-derived gums, 6) study of factors influencing the shelf stability of sunflower nuts and hazelnuts and 7) the feasibility of producing an extruded snack food product containing Jerusalem artichoke flour.

Dr. Paul Addis' group recently reported that the addition of hydrated wild rice to breakfast pork sausage improves the shelf life of the product during frozen storage by providing antioxidant properties while also increasing palatability and decreasing total fat content.

Dr. Joe Warthesen is studying ways to make a more stable carrot extract to be used as a concentrated source of carotenes. The dried product would be added to foods as a natural coloring agent and source of vitamin A. Dr. Bill Schafer has screened carrots and others members of the Umbelliferae family e.g., parsley, celery, parsnip, fennel and dill for the presence of naturally occurring antimicrobial chemicals.

Nutritionist Dr. Marla Reicks and her group are studying the anticarcinogenic properties of compounds in the essential oils of citrus fruit, garlic, carrots and parsley.

Nutritionist Dr. Dan Gallaher's group is studying the effects of genestein, an isoflavone found in high concentrations in soybeans on reducing colon cancer in carcinogen-treated rats. They are examining the activity of an isolated form of genestein as well as that of a soybean product containing a high level of genestein.

Steering Committee

Charlie Blinn, Forest Resources
Bill Breene, Food Science and Nutrition
Dave Davis, Horticultural Science
Dick Levins, Agricultural and Applied Economics
Jay Meiske, Animal Science
Richard Meronuck, Plant Pathology
Dave Noetzel, Entomology
Doug Pratt, Plant Biology
Dan Putnam, Agronomy and Plant Genetics
Mike Schmitt, Soil Science
Bill Wilcke, Agricultural Engineering

Director

Erv Oelke, Agronomy and Plant Genetics

BioOptions Editor, Judy Day

Administrator, Chris Hanson

To get on our mailing list and receive BioOptions our quarterly newsletter send $8 U.S. or $10 outside U.S. to:
The Center for Alternative Plant and Animal Products (CAPAP), University of Minnesota
340 Alderman Hall, 1970 Folwell Ave., St. Paul, MN 55108 phone: 1(612) 624-4217 fax: 4-4941

VETCHING VETCH

Dan Putnam, William Breene and Dave Somers

Vetch (*Vicia sativa*), masquerading as lentil or pea, may be a health hazard. It has come to our attention over the past six months that several varieties of "common vetch" are being sold on the international market as "split red lentils", "masoor dahl" and "Chinese white pea". Vetch mimics common crops such as pea (*Pisum sativum*) and lentil (*Lens culinaris*), which are nutritious and safe, and some weed species; but seldom has vetch reached so far into the food chain as in this situation.

Common vetch is a vigorous, fairly high yielding grain legume which has historically been used as a cover crop, for prevention of soil erosion or as animal feed. It sometimes occurs as a weed in lentil crops. However, in recent years, there have been large shipments of split or whole vetch seed into the U.S., Egypt, Jordan, Turkey and India. A recent sale of vetch as "Chinese red lentil" resulted in a legal suit by an Egyptian importer against an American company for breech of contract. We have also found vetch, labeled "masoor dahl" or "red lentil", sold in shops in Minneapolis.

Vetch produces a high-protein seed, but the seed also contains other compounds which should be of concern when used for human or animal food. These include considerable quantities (about 0.5%, dry basis) of a neurotoxic amino acid (Beta cyanoalanine and its glutamyl derivative) which has been shown to kill baby chicks in seven days, cause nervous disorders, reduce growth and increase mortality in rats. In addition, vetch contains the causative agents for the disease favism, which manifest as anemia in those individuals with glucose-6 phosphate-dehydrogenase deficiency, a genetic trait. Favism can also result from eating favabeans (*Vicia fava*), but the problem is that vetch sold as a "lentil mimic" or potentially a "pea mimic", does not allow affected individuals a chance to avoid vetch as they do favabeans.

We have been a part of a group of scientists at the University of Minnesota, along with scientists from the Universities of Manitoba, Illinois and Connecticut, and the USDA that have studied this phenomena over the past several months. The neurotoxin, as well as vicine and convicine, was present in all the samples we collected of *Vicia sativa* seed that were being sold for human consumption. In addition, some samples had not softened after five hours of cooking in boiling water. It is the unanimous judgement of this research group that it is clearly unadvisable for vetch to be used as human food at this time. Although no cases of poisoning of humans have been unequivocally recorded, with the exception of some sketchy reports from India, the laboratory studies clearly point to a food safety problem with this grain. We are now trying to determine whether this type of vetch is responsible for a mysterious neurological disease in Cuba which has affected up to 45,000 individuals.

Australia and China have been the primary exporters of vetch for human food. Last year, Australia placed stricter regulations on the export of vetch making sure it was called vetch rather than lentil. This year, the Australian Grain Legumes Committee reluctantly declared that vetch should not be considered safe for human consumption. This was primarily the result of the efforts of Dr. Max Tate, a scientist at The University of Adelaide, who published the article 'A Mess of Red Pottage' in Nature (October 1, 1992) describing the difficulties with the neurotoxin. To our knowledge, China is continuing to export vetch for human consumption, perhaps to Cuba.

However, in spite of the difficulties of using vetch as human food at this time (the neurotoxin, favism, and the long cooking time), it is our view that vetch should continue to be examined seriously as a potential human food. It is high yielding, disease and drought resistant and more vigorous than lentil. There is certainly an incentive to research possible genetic or industrial approaches to detoxification. The development of a vigorous, high-protein, safe vetch would benefit cultures whose members consume large quantities of peas and lintels, especially since lentil tends to be low yielding and disease susceptible. Our experience shows us that development is best accomplished through early concerted research efforts rather than large-scale, premature experimentation with human subjects in the marketplace.

For more information on this problem write to Daniel H. Putnam, Department of Agronomy and Range Science, University of California, Davis, CA 95616, or William M. Breene, Dept of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108, or Dave Somers, Department of Agronomy and Plant Genetics, University of Minnesota, St Paul, MN 55108.

"Never forget the cultivation of the earth is the most important labor of man. When tillage begins, other arts follow. The farmers, therefore, are the founders of civilization." Daniel Webster

News Briefs

Alcohol from Aspen (Timber Producer) The job of NREL is to find a process for producing ethanol from biomass. Hybrid popular is one major source of biomass. NREL is planning a pilot scale ethanol fuel plant that would use 40 tons per day of hybrid poplar chips. Plans are being made to build a plant in the Midwest. Biomass should provide a considerable part of future liquid fuel demand.

Agriculture getting boost from flowers (Agri News, June 24). Environmental horticulture and floriculture are some of the fastest growing sectors in U.S. industry. The green industry involving flowers and decorative and environmental plants has more than doubled its sales between 1982 and 1991 and are producing over 370,00 jobs with a payroll of over 1.8 billion. All 50 states grow green industry crops.

Lesquerella, being developed by USDA scientists, may become a commercial crop by 1997. (Seeds & Crops Industry, January, 1993). Lesquerella produces an oil that can be used to make waxes, resins, plastic, nylon, lubricants and cosmetics. USDA is working on crop production and industrial uses for the oil. For more information contact: Anson Thompson, USDA-ARS Water Cons. Lab, 4331 E. Broadway Rd., Phoenix AZ 85040; (602) 379-4356.

The Mississippi River is the largest, longest river in the USA; third largest in the world. Its tributaries drain 41% of the continental U.S., 1.25 million square miles. Narrowest point: about 4 feet at its origin, widest point: 3 1/2 miles,just north of Clinton, Iowa.

Cash for Wood Chips (Minnesota Technology, Summer 1993). The State of Minnesota is buying wood chips to fuel heating systems in several state institutions. Wood-product companies should contact Stephanie Selb at the Minnesota Department of Adm. at (612) 297-2304 for an application to be placed on the state bid list.

Kenaf shows potential (Quarterly Report, Oct.-Dec. 1992). Tests show that kenaf harvested 60 to 80 days after planting in central Oklahoma yielded about three tons of dry matter per area, including leaves and stems. Kenaf could challenge alfalfa as a high-protein livestock feed and give farmers a second crop on winter wheat acres from Kansas to the South. When kenaf was harvested at 123 days, crude protein levels lowered but dry matter yields rose to almost six tons per area.

Ag Cancer Study (Seed & Crops Industry, May, 1993). A ten-year epidemiologic study of farmers and their families has been started by the National Cancer Institute, the Environmental Protection Agency and the National Institute of Environmental Health Sciences. This health study will identify and evaluate factors that may explain previously reported high rates of cancer among farmers.

Ordinary ginger helps motion sickness (MPLS Star Tribune, July, 1993). New studies show ginger to be as effective as anti-motion drugs without causing drowsiness. Use powdered ginger capsule, preserved or candied ginger, Ginger Brew or just before trip time grate raw ginger in a stir-fry dish.

Perot to help reorganize the troubled USDA (Seed & Crop Industry, June, July 1993). The General Accounting Office has accepted Ross Perot's offer to supply his expertise and business contacts to help government auditors decide how best to trim the bureaucracy at the Agriculture Dept. and other federal agencies. Auditors said "the department's estimated 110,000 employees now approach the 21st century in an organization more suited to the Great Depression."

Camelina, an ancient European crop, could be making a comeback. It is used in lubricants, fuels, adhesives and other products. For article on research contact our Center.

Soybean oil for the hydraulic fluids market (Ag Innovation News, July 1993) is being researched by the University of Northern Iowa in Cedar Falls. Soy-based fluids have many possible uses but Lou Honary, a researcher at UNI, is interested in hydraulic fluids for the food processing industry where contamination is a problem.

Wanted: Hedgerows would be a valuable benefit to the environment at little cost to anyone. For information contact: Eric Ronneberg, Forest Resource Center, Rt 2, Box 156A, Lanesboro, MN 55949; (507) 467-3583.

US Consumers spend 10 cents of every after-tax dollar for food, compared to 18 cents in Canada, 37 cents in Mexico, 41 cents in Brazil, 40-45 cents in Europe, 63 cents in the former Soviet Union, and 67 cents in China, according to Louisiana State Univ.

Perennial Legumes for Non-Food Uses and Energy crops (Seed & Crops Industry, May, 1993) could be used as a way to improve future cropping diversity and profits, according to Donald Wyse, Director of the Minnesota Institute for Sustainable Agriculture. Alfalfa is a perennial legume that could reduce tillage and soil erosion. Paper pulp, plastics and pharmaceuticals are some non-food uses.

The American Association of Small Ruminant Practitioners (AASRP) was established in 1968 to promote education and scientific programs in the field of small ruminants (sheep, goats, and llamas. For information about membership, contact: Phyllis Larsen, AASRP, 1674 Ellis Hollow Rd., Ithaca, NY 14850; (607) 539-6181.

Seed Savers Exchange (SSE), non profit tax-exempt group is trying to save old-time crops from extinction. Contact: Kent Whealy, SSE, 3076 N Winn Rd., Decorah, IA 52101.

INFORMATION DESK

Welcome to a new feature of BioOptions. One of the Center's most important functions is to provide information. We receive requests daily on subjects ranging from alpaca to zucchini. To give you an idea of some of the information we have available we will give you a sample of the questions we have recently received. We encourage you to write or call us with questions of your own. We maintain a library on alternative crops and animals and will be happy to send you copies of articles (10 cents/page).

We have received numerous requests for information on growing **ginseng**. According to the publication *American Ginseng Trends* sales activity of ginseng was weak through December of 1992. Approximately 20 percent of the 1992 Wisconsin crop, 300,000 pounds, remained in storage due in part to the expected devaluation of the Chinese yuan. China is the largest market for American ginseng and a drop in the value of the yuan makes imported ginseng more costly to Chinese customers. Prices for high quality ginseng peaked at $52 per pound during October and November while average and low quality ginseng sold at prices between $30 and $40 per pound.

For those of you that have requested information on **emus/ostriches** we now have acquired some additional articles that you may find informative.

We had a recent inquiry for information on **alpaca** but have few articles on this subject. If you raise alpaca or know of a source of information that may be useful to our readers please contact the Center.

In response to recent requests for information on **hydroponics**, we have added additional articles to our files. Contact us if you are interested in this growing industry.

We get numerous requests for information about in specialty mushroom production. Virtually all specialty mushrooms are sold fresh. The value of the 1991-92 specialty mushroom crop amounted to $17.2 million, 22 percent over the previous season.

If you would like an idea of the information available in our files we have the *Alternative Agricultural Opportunities: A Bibliography* which lists over 1600 articles available in our files. Cost is $5.00 and can be obtained from the Center.

The University of Minnesota, including the Minnesota Extension service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation.

"We have to have people who are going to think in entirely different ways. I like to say, Ready, fire, aim! That means get going and adjust your focus after you've begun to move." Earl Bakken

National Alternative Fuels Conference

Held in June of '93 in Milwaukee, WI

Over 300 people from 36 states and Canada attended this conference to learn about advances in alternative fuel research and development. Reduced dependance on foreign oil (energy security), the economy, and the environment are the three E's driving this national effort to replace petroleum fuels. Alternative fuels include: compressed natural gas (CNG), liquid natural gas (LNG), methanol, ethanol, electric vehicles, biodiesel, and propane.

A soydiesel (soybean oil) powered vehicle was on display from the United Soybean Board. Soydiesel is probably the closest alternative liquid fuel in price to its petro-based competitor. If petroleum prices would increase only moderately, farmers would enter the very large liquid fuel market in the U.S.

The next issue of BioOptions will look in more detail at Alternative fuels including ethanol, discussing economics, the Metropolitan Transit Commissions experiment with neat ethanol powered buses, and much more.

Publications

The Alternative Field Crops Manual is a joint publication of CAPAP, the Univ. of Minnesota Extension and the Univ. of Wisconsin Extension. The 3-ring binder with over 50 crops provides information on the production of many minor or new field crops some of which may be considered as alternatives to traditional farm crops. Cost is $45. Contact: CAPAP, 342 Alderman Hall, 1970 Folwell Ave., St. Paul, MN 55108; (612) 624-4217.

Freshwater Fish Pond Culture and Management by Marilyn Chakroff discusses how to establish and maintain small scale fish pond operations. It provides information on planning, site location, selecting fish, construction, preparing and managing the pond, harvesting and preserving the fish, standard problems and suggested solutions. For more information contact Storey's Books for Country Living, (800) 441 5700.

New Crops: Exploration, Research Commercialization is the proceedings from the second national New Crops symposium that was held in October of 1991 in Indianapolis, IN. Cost is $90.00. The 770 page publication is available from John Wiley & Sons, Inc. 605 3rd Ave. New York, NY 10158-0012, or order on toll free-line (800) CALL WILEY.

Sustainable Agriculture Directory of Expertise - 1993 lists over 700 people and groups that you can contact for advice on building healthy soil, broadening your arsenal of pest-control tools, diversifying cash flow, and much more. Cost is $14.95. Contact: Sustainable Agriculture Publications, Hills Building, Room 12, Univ. of Vermont, Burlington, CT 05405.

The 1993 Midwest Vegetable Production Guide for Commercial Growers is a 113 page book now available from Purdue. Contact: Media Distribution Center, 301 S. Second St., Lafayette, IN 47901.

A Small-scale Agriculture Alternative, USDA-OSSA offers free factsheets, 2 pp. each on Beekeeping, Brambles, Dessert Vines, Exotic Fruits, Foliage Plants, Angora Goats, Sheep, Shiitake Mushrooms, Specialty Corns, Specialty Potatoes, Strawberries and Woodlots. Contact Bud Kerr, USDA-CSRS, Suite 328A Aerospace Building, Washington, DC 20250-2200; (202) 401-1805.

Proceedings of the National Extension Compost Utilization Conference held in Minneapolis, MN in June of 1993 is now available. Cost is $25. Contact: Ext. Special Programs, 405 Coffey Hall, 1420 Eckles Ave., Univ. of Minnesota, St. Paul, MN 55108-6068.

Highbush Blueberry Production Guide is the first comprehensive guide to growing highbush blueberries for new and experienced blueberry growers as well as farm advisers who assist them. The 200 page guide covers all aspects of blueberry productions: planting, maintaining the site, harvesting handling, marketing, etc. Cost is $45. Contact: NRAES/55, Cooperative Ext., 152 Riley-Robb Hall, Ithaca, NY 14853-5701; (607) 255-7654.

Industrial Crops and Products is a new journal published by Elsevier. Cost is $181 per year. Contact: Judy Weislogel, Elsevier Science Publishers, PO Box 945, Madison Square Station, New York, NY 10160-0757.

Proceedings of the 1993 Ohio Asparagus School. Cost is $7.00. Contact: Carl Cantaluppi, Ohio State Univ. OSU-Piketon Research and Extension Center, 1864 Shyville Road, Piketon, OH 45661.

A Special Report on Small Farms is an article in the March-April 1993 issue, Vol. 47 No. 2 of California Agriculture. Single copy price is $2. Contact: Janet White, Div. of Agriculture and Natural Resources, Univ. of California, 300 Lakeside Dr., 6th floor, Oakland, CA 94612-3560.

American Ginseng Trends is a newsletter published bi-monthly. Cost is $28. Contact: Yvonne M. Duwe, Future Concepts, Inc., PO Box 1982, Wausau, WI 54402-1982; (715) 675-4898.

Bramble Production Guide is a 189 page publication written by 17 authors in 7 states. Topics include site selection and preparation, plant selection, planting, pest and weed control, postharvest handling, marketing and more. Cost is $38.00. Contact: NRAES/55, Cooperative Ext. 152 Riley-Robb Hall, Ithaca, NY 14853-5701; (607) 255-7654.

Commercial Hydroponics by Innerspace Adventures is a video that covers up-to-date information on hydroponic vegetable production: management of hydroponic greenhouse, equipment needed, growing systems, crop varieties and etc. Cost is $29.95. Contact: CropKing, Inc., PO Box 310, Medina, OH 44258.

Proceedings of the 1992 Association of Specialty Cut Flowers Growers Conference in Burlington, VT. Cost is $25. Contact: ASCFG, MPO Box 268, Oberlin, OH 44070; (216) 774-2887.

Common Sense Pest Control by William Olkowski is available from Acres USA, PO Box 9547, Emmaus, PA 18098.

Marketing: A Practical Guide for Fish Farmers by S. Shaw focuses on the various marketing, customer relations and advertising strategies fish farmers should consider. Contact: AgAccess, (916) 756-7177.

Audiotapes on workshops from the 1993 Farmers' Direct Marketing and the 1993 Ecological Farming Conferences on marketing, organic farming and management. Contact: Richard Reese, Audio Productsion, 8806 S. Lake Steves Road, Everett, WA 98205.

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CALENDAR OF EVENTS - Notify the Center of events of interest and we will publish that information for you.

August 14, 1993 - Red Deer Farm as an Alternative Income Seminar and Farm Field Day Randall, MN. Contact Peter Bingham, RR1 Box 262, Randall, MN 56475; (612) 749-2197.

August 15-18, 1993 - North American Agroforestry Conference Ames, Iowa. Contact Dr. Richard D. Schultz at (515) 294-7602.

August 17-18 - Minnesota Alfalfa and Forage Expo Freeport, Minnesota. Contact Neil Martin, 201A Agronomy Bldg., U of MN, St. Paul, MN 55108; (612) 625-3747.

August 21-22, 1993 - 6th Annual National Meeting of the Amaranth Institute Fargo, North Dakota. Contact Patricia Rayas-Duarte, ND State University, Fargo ND 58105-5728; (701) 237-8092.

August 30-September 2, 1993 - First Biomass Conference of the Americas: Energy, Environment, Agriculture, and Industry Burlington VT. NREL, 1617 Cole Blvd., Golden, CO 80401; (303) 231-1158.

September 14-15, 1993 - The Sixth National Urban Forest Conference Minneapolis, Minnesota. Contact Peggy Sand, Minneapolis/St. Paul Conference Headquarters at (612) 772-7562.

September 17-18, 1993 - The 10th Anniversary MN Food Assn Celebration St. Paul, Minnesota. Contact MFA at (612) 644-2038.

October 12-16, 1993 - Association for Farming Systems Research-Extension North American Symposium Gainesville, Florida. Contact AFSRE/NA, U of Florida/DOCE, 1221 NW 22 Ave, Gainesville, FL 326091-3476; (904) 392-1701.

November 1-3, 1993 - Shiitake Mushroom Symposium Huntsville, Alabama. Contact Dr. Cathy Sabota or Ron Williams, Alabama A&M Univ, PO Box 967, Normal, AL 35762; (205) 851-5710.

November 5-6, 1993 - 10th Annual Hydroponic Grower's Conference Orlando, Florida. Contact: Cropking Inc., 1-800-321-5656.

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