BioOptions

Newsletter of the Center for Alternative Plant and Animal Products Volume 3, Number 4 Fall, 1992

Sponsored by the Agricultural Utilization Research Institute, the Minnesota Extension Service and the University of Minnesota Agricultural Experiment Station

CAPAP to Exhibit at 84th Annual ASA Meeting

"New Visions, New Perspectives" is the title of the 84th Annual Meeting of the Crop Science Society of America, the Soil Science Society of America, the Clay Minerals Society, and the American Society of Agronomy. The meeting will be held in Minneapolis, Minnesota, November 1-6, 1992. The Center for Alternative Plant and Animal Products will have an informational booth at the meetings. Exhibits and scientific presentations will be held at the New Minneapolis Convention Center in Exhibit Hall 1. The exhibit area will be open 8:00 a.m. to 5:00 p.m. on Monday, Tuesday and Wednesday.

CAPAP will display materials that have been developed on various alternative enterprises. The Alternative Field Crops Manual is now complete with over 50 chapters. CAPAP symposium proceedings on lupin, amaranth, grain legumes, soybean utilization, and flowers, as well as forestry and livestock topics will be available. Other publications include white papers on canola and Belgian endive. The Alternative Agricultural Opportunities Database lists over 1500 publications. A slide set on alternative field crops has also been developed at the University of Minnesota and will be on display.

Ginseng

American ginseng (*Panax quinquefolius*, L.) is a perennial herb native to the deciduous forests of the eastern United States. Wild ginseng once thrived along most of the nation's eastern seaboard, from Maine to Alabama and west to Michigan, Wisconsin and Minnesota. It still grows wild, but it was over-harvested in the mid-1970s and was subsequently defined as an endangered species. Currently, 18 states issue licenses to export it. In Wisconsin and several other states where ginseng is cultivated, a permit is not required to export artificially propagated ginseng.

Ginseng was one of the earliest marketable herbs to be harvested in this country. Wild ginseng was one of Minnesota's first major exports. In 1860, more than 120 tons of dried ginseng roots were shipped from the state to China. American ginseng is similar to Asian ginseng, *Panax ginseng*, L., which grows wild in Northern Manchuria and has been harvested there for thousands of years.

Ginseng became a domesticated crop in the late 1800s. Attempts to produce the crop in Wisconsin in the late 1870s failed due to disease. In 1904, the four Fromm brothers from the Wisconsin township of Hamburg, near Wausau, trans-planted 100 wild ginseng plants from nearby forests onto a plot of their land and carefully duplicated the natural growth conditions. The perseverance of these early ginseng growers and the ideal growth conditions in Marathon County have made it the ginseng capital of the United States, producing approximately 10% of the world's supply of ginseng root. More than 90% of the cultivated ginseng grown in the United States is grown in Wisconsin, and 90 to 95% of Wisconsin-grown ginseng is produced in Marathon County.

It is estimated that Wisconsin grew 3,000 to 5,000 acres of ginseng in 1990, and sales of the root earned almost $70 million for farmers in Marathon County. Most of Wisconsin's ginseng growers cultivate no more than one acre of the crop annually. Most of the nation's ginseng crop is exported to Hong Kong, and is then redistributed to other locations in the Far East.

Ginseng can be a profitable crop, but it requires an enormous commitment of time, money and labor for successful commercial production. Ginseng beds in Wisconsin are usually cultivated for three years before harvest, unless disease problems mandate earlier harvest.

Ginseng is prized in the Orient for its purported curative properties. Based on an ancient Chinese legend, early emperors proclaimed it a panacea to be ingested or used in lotions and soaps. The genus name, *Panax*, is derived from the Greek *(See **Ginseng** page 2)*

*(**Ginseng** from page 1)* "panakeia," which means universal remedy. The term "ginseng" is derived from the Chinese term "jen-shen," which means "in the image of a man." Ginseng roots shaped like the human body are considered highly desirable. In particular, old roots (some may be nearly a century old) are prized because their longevity is claimed to be transferred to the person who consumes them.

Ginseng root is reputed to lower blood sugar and cholesterol levels, protect against stress, enhance strength and promote relaxation. Koreans have fed ginseng to race horses to enhance their performance on the track. Although some European and Asian studies appear to support some of these claims, American researchers remain skeptical. Ginseng is not a drug and should not be taken as such. It is classified by the Food and Drug Administration (FDA) as a "generally recognized as safe" (GRAS) food.

In the Far East, ginseng root is used in toothpaste, soft drinks, tea, candy, chewing gum and cigarettes. It also appears on the market as crystals, extract, powder capsules and is sold as the whole root. In the United States, ginseng and ginseng products are marketed in Asian food and health food stores. Most of the ginseng used in the United States, however, is imported from Korea. The amount of Asian ginseng that is imported is about equal to the amount of higher-priced American ginseng that is exported.

Ginseng seed is also marketed. Ginseng plants generally begin to produce harvestable seed in the third year of growth. It takes approximately 200 plants to produce 1 lb of seed, which may produce 5,000 seedlings.

American ginseng plants are generally started from seeds. Seedlings or roots for transplanting are available commercially, but are used infrequently. Seeds are planted in the fall and germinate in the spring. Although researchers have examined ways to break this juvenility requirement and hasten germination, it is still not understood.

First-year seedlings produce one compound leaf, 1 to 2 in. in height, with three leaflets. The plant develops more leaves, with more leaflets, each year until the fourth or fifth year. A mature plant is 12 to 24 in. tall and has 3 or more leaves, each consisting of 5 ovate leaflets. Leaflets are approximately 5 in. long and oval-shaped with serrated edges. In midsummer, the plant produces inconspicuous greenish-yellow clustered flowers. The mature fruit is a pea-sized crimson berry, generally containing 2 wrinkled seeds.

After three years of growth, the roots begin to attain a marketable size (3 to 8 in. long by ¼ to 1 in. thick) and weight (1 oz). In older plants, the root is usually forked. Wild or high-quality cultivated ginseng root has prominent circular ridges. Highest quality mature root breaks with a somewhat soft and waxy fracture. Young or undersized roots dry hard and glassy and are less marketable.

Ginseng grows best under conditions that simulate its natural habitat. It requires 70% to 90% natural or artificial shade. Ginseng thrives in a climate with 40 to 50 in. of annual precipitation and an average temperature of 50°F. It requires several weeks of cold temperatures for adequate dormancy. Ginseng generally prefers a loamy, deep (12 in.), well-drained soil with a high organic content and a pH near 5.5. Extremely sandy soil tends to produce long, slender roots of inferior quality.

Most ginseng crops are started from seed, rather than roots or seedlings. This is the least expensive way to start a plantation and may help prevent the introduction of soil-borne disease to new plantations. Ginseng requires *(See **Ginseng** page 3)*

BioOptions

is the quarterly newsletter of the Center for Alternative Plant and Animal Products at the University of Minnesota. The Center was created to aid in the development of new and alternative crop and livestock enterprises.

Director:
Ervin Oelke

Steering Committee:
Charles Blinn
William Breene
David Davis
Jay Meiske
Richard Meronuck
Vance Morey
Douglas Pratt
Daniel Putnam
Michael Schmitt

Editor:
Laura McCann

Subscription rates: U.S. and Canada $5 per year, other countries, $8 per year. Send subscription inquiries and correspondence to: Center for Alternative Plant and Animal Products, 305 Alderman Hall, 1970 Folwell Avenue, Univ. of Minn, St. Paul, MN 55108; (612) 625-5747.

(Ginseng from page 2) 3 to 5 years to produce a marketable crop from seed.

As there is an 18 month seed dormancy, freshly harvested seed cannot be used for starting a crop. It must be stratified for 18 to 22 months before planting. Seed stratification involves soaking the seed in a formaldehyde solution and in a fungicide, then burying the seed outdoors in moist sand. Most seed is already stratified when it is purchased and needs only to be treated with a fungicide and sown. Seed should not be allowed to dry out before or after seeding.

For planting seeds or seedlings, till the soil to a depth of 8 to 10 in., and remove rocks. For root planting, work the beds 12 in. deep. For best results, mix soil 1 to 1 with fiber-free woodland soil. Make beds 4 ft wide with alleys between them for walkways and for farm equipment. Mound the bed and slope the walkways to facilitate good runoff.

Shade can be provided by wooden lath sheds or polypropylene fabric. Artificial shade should be placed about 7 ft above the ground to ensure good air circulation. Do not use burlap or muslin, which can interfere with air circulation.

Ginseng seed is generally planted in the fall and covered with mulch until spring. It can also be spring-planted, but if seeding is not completed by May 1, the seed may begin to sprout prematurely. Plant seeds 1/8 to ½ in. deep and 4 in. apart in the row. Space the rows 6 in. apart across the bed. The recommended seeding rate for a 4 ft wide bed with 2 ft wide paths between beds is 80 to 100 lb/acre. To keep the seed from drying out, the beds should be covered immediately with 2 to 3 in. of straw.

Roots can be transplanted any time after the tops of the plants have begun to die back but before the ground has frozen. Plant roots at a 30° to 45° angle from the vertical, with the crown of the root 3/4 to 1 in. deep. Cover the bed immediately with 1 to 2 in. of straw. A 4 to 5 in. layer of mulch is necessary on fall transplants to prevent heaving in frost. Some of the mulch can be removed in the spring before the first shoots appear. Set seedlings 8 in. apart in each direction. Closer spacing tends to increase disease in the plantation.

Fertilizers should be applied during the dormant season at least a couple of weeks before plants emerge. Heavy use of manure or commercial fertilizers lessens the resemblance of cultivated ginseng to the wild root and hence may reduce marketability. Over-manuring may also force growth and lower disease resistance. Although little research in ginseng fertility has been conducted, common practice has been to fertilize as for other root crops. Recommended rates are about 15 lb P_2O_5/acre and 60 lb K_2O/acre for soils testing in the optimum range for vegetables (30 to 45 ppm Bray P_1 and 140 to 200 ppm soil test K).

Nitrogen needs range from 20 to 60 lb/acre, depending on soil organic matter level. Growers have tended to use lower-salt fertilizers, such as ammonium sulfate, potassium sulfate and potassium-magnesium sulfate. Although secondary and/or micronutrients are often involved in fertilization programs, little research has been conducted to confirm responsiveness.

Some growers fertilize with leaves or old hardwood sawdust or with ground-up rotted hardwood. Others prefer woodland soil or rotted leaves 4 to 6 in. deep, spaded to a depth of about 8 in. with fine raw bonemeal (1 lb/sq. yd.) worked in.

Although no improved varieties have been developed, American ginseng shows variations in certain characteristics, particularly in the roots. Plants from the northern part of the country, particularly Wisconsin and New York, are considered good breeding stock, because they furnish roots of good size, weight and shape.

Some pesticides are labelled for nationwide use on ginseng. Consult your local County Extension Agent each year to find out which pesticides may be applied to ginseng in your area. Use only approved materials and follow label directions!

Weeds can be controlled mechanically with mulching and hand weeding and chemically with Fusilade 2000.

Ginseng is susceptible to a number of fungal diseases, including Alternaria leaf and stem blight, Phytophthora root rot and foliar blight, seedling damping-off caused by *Pythium* and *Rhizoctonia*, rusty root and root knot nematode. Ginseng gardens that are cultivated in the woods may suffer less from diseases than do plantings under artificial shade.

To minimize disease problems, select a growing site with good drainage. Good air circulation is also crucial and can be attained by providing cleared areas (walkways) around the beds, relatively uncrowded spacing and control of weeds. Thin spacing also reduces the likelihood of disease spread through foliar or root contact. Wisconsin growers generally do not reuse a ginseng field for succeeding ginseng crops.

Ginseng is sometimes attacked by white grubs and wireworms. Voles and field mice may feed on the roots. *(See Ginseng page 4)*

(Ginseng from page 3)
In Wisconsin, most growers harvest ginseng the third year after planting from seed. The roots are dug in the fall and vigorously washed to remove surface soil. It is important to handle the roots carefully to keep the branching forks intact and maintain the natural color and circular markings.

Ginseng roots are dried on wire-netting shelves in a heated, well-ventilated room. Since overheating destroys color and texture, begin drying the roots at a temperature between 60° and 80°F for the first few days, then gradually increase it to about 90°F for three to six weeks. Turn the drying roots frequently. Store the roots in a dry, airy, rodent-proof container just above freezing.

Yields of dried roots from a well-managed planting average about 1 ton/acre, although greater yields are often reported. A typical seed yield is 150 to 250 lb/acre.

Ginseng growers typically invest $20,000/acre and 600 hrs of labor annually and get no return on their investment until the third or fourth year. Seed and shading materials alone can cost more than $29,000/acre. It may take 10 years to break even. An average crop might net $30,000/acre, depending on the price, which tends to fluctuate widely from year to year. Prices for dried roots range from $20 to $45/lb. Seed sells for $50 to $100/lb.

In Wisconsin, growers are assessed $0.15/lb of dried root for promotion and research, and the funds are administered by the Ginseng Board of Wisconsin, located in Wausau, Wisconsin. There are several seed and root suppliers and ginseng buyers in Wisconsin. For information, contact the Ginseng Board of Wisconsin, or the Wisconsin Ginseng Growers Association both at 500 3rd St., Suite 208-2, Wausau, Wisconsin 54401 (tel. 715-845-7300).

Information Sources:

American ginseng: buried in mystery. 1986. Martin, L.J. University of Wisconsin Extension. Rm. 3, Courthouse Annex, Wausau, WI 54401.

American ginseng culture in the arid climates of British Columbia. 1990. Oliver, A., B. Van Lierop and A. Buonassisi. Province of British Columbia Ministry of Agriculture and Fisheries.

American Ginseng: Green Gold. 1986. Persons, W.S. Exposition Press of Florida, Inc. Pompano Beach, FL

The Cultivation of Ginseng. 1985. English, J. The Herb, Spice and Medicinal Plant Digest, Vol. 3(2). Department of Plant and Soil Sciences. Massachusetts Cooperative Extension Service.

Diseases of cultivated ginseng. 1989. Parke, J.L., and K.M. Shotwell. University of Wisconsin-Madison Agricultural Experiment Station Publication #3465. 16 pp.

Ginseng: a concise handbook. 1989. J.A. Duke. Reference Publications, Inc., 218 St. Clair River Drive, Box 344, Algonac, MI 48001, 273 pp.

Ginseng: America's botanical drug connection to the Orient. 1986. Carlson, A.W. Economic Botany 40:233-249.

Ginseng: Horticulture Facts. Hill, L.L. Cooperative Extension Service. University of Illinois at Urbana-Champaign. VC-29-83.

Ginseng: industry, botany, and culture. 1987. Proctor, J.T.A., and W.G. Bailey. Horticultural Reviews 9:187-236.

Growing Ginseng. 1981 (Rev.) Duke, J.A. USDA Farmers' Bulletin 2201.

Horticulture Updates. 1989. Harrison, H.C. University of Wisconsin-Madison. January-February 1989.

Postharvest seed maturation of American ginseng: stratification temperatures and delay of stratification. 1988. Jo, J., F.A. Blazich and T.R. Konsler. HortScience 23(6):995-997.

This article was excerpted from "Ginseng" by H. C. Harrison, J. L. Parke, E. A. Oelke, A. R. Kaminski, B. D. Hudelson, L. J. Martin, K. A. Kelling, and L. K. Binning in the "Alternative Field Crops Manual" published by the Univ. of Wisconsin-Extension, and the Center for Alternative Plant and Animal Products and the Minnesota Extension Service.

Publications

Using Herbs in the Landscape has information on selecting and using herbs in a landscape plan. Environmental requirements of the various herbs, cultural information, and ornamental value are described. Different types of garden designs are illustrated. A list of commercial suppliers will help those new to herb gardening. It is available from Stackpole Books, P.O. box 1831, Harrisburg, PA 17105, at a cost of $16.95.

Alternatives in Insect Management: Biological and Biorational Approaches is a recent North Central Regional Extension publication. It provides information about pheromones, botanical insecticides, beneficial insects, and other integrated pest management topics. Request publication NCR401 and send check for $6 payable to the University of Illinois, Office of Agricultural Communications and Education, 69N2 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL 61801.

Direct and Niche Marketing of Lamb and Wool is the subject of a conference that will be held November 6-7 in Maryland (see Calendar of Events listing). The conference materials are available for purchase if you are not able to attend. Make check for $25 payable to "National Lamb/Wool Conference" and send to James B. Bell, Dept. of Ag. Econ., Virginia Tech, Blacksburg, VA 24061.

Roadside Markets (NRAES-52) and **Produce Handling for Direct Market** (NRAES-51) are publications available from the Northeast Regional Agricultural Engineering Service, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY 14853-5701; (607) 255-7654. Each of them is available at a cost of $5.50. The former covers all aspects of planning a large farmer's market including display area, preparation area, parking, zoning ordinances, signs, etc. "Produce Handling for Direct Market" discusses handling through harvest, transport, storage, and display.

Specialty Corn is the latest free factsheet in the series "A Small-Scale Agricultural Alternative" from the USDA Office for Small Scale Agriculture. Contact: Bud Kerr, USDA-CSRS, OSSA, Suite 328A Aerospace Building, Washington, DC 20250-2200; Phone (202) 401-1805, Fax: (202) 401-1804. (Note change of address!)

New Industrial Crops and Products is the proceedings from the First International Conference on New Industrial Crops and Products that was held in October of 1990 in Riverside California. The 260 page publication includes articles on jojoba, natural rubber, fiber crops such as kenaf, oilseeds, and other crops. The cost is $60. Make check payable to AAIC and send to I.P. Ting, Dept. of Botany and Plant Sciences, Univ. of California, Riverside, CA 92521.

Suppliers of Beneficial Organisms in North America, 1992 Edition is published by the California Environmental Protection Agency. The 31 page booklet lists 95 commercial suppliers of more than 126 different organisms used for biological control of pests. The booklet is indexed to help match suppliers with the specific natural enemies they sell. There is also an index of beneficial organisms, with scientific names and target pests. Free, single copies of the booklet are available from: Dept. of Pesticide Regulation, Environmental Monitoring and Pest Management Branch, Attn: Beneficial Organisms Booklet, 1220 N Street, P.O. Box 942871, Sacramento, CA 94271-0001; (916) 654-1141.

Herbal Newsletters, continued:

The Herbarist
Herb Society of America
9019 Kirtland Chardon Rd.
Mentor, OH 44060

Joy of Herbs
Box 7617
Birmingham, AL 35253-0617

Newsletter of Medicinal and Aromatic Plants
Research Institute for Medicinal Plants
H-2011 Budakalasz
P.O. Box 11
HUNGARY

Northstar News Network
Northstar Freeze Dry Mfg.
P.O. Box 409
Nisswa, MN 56468

Spice and Herb Arts
5091 Muddy Lane
Buckingham, FL 33905

Circular Series FTEA:
U.S. Spice Trade
U.S. Essential Oil Trade
U.S. Dept. of Agriculture
Foreign Agricultural Service
Room 4644-S
Washington, DC 20250-1000

Washington Insight
11000 Waycroftway
North Bethesda, MD 20852

Wedhole Chile Pepper
P.O. Box 4278
Albuquerque, NM 87196

Wild and Weedy: A Journal of Herbology
P.O. Box 508
Clark Fork, ID 83811

News Briefs

Special issue on grain amaranth: New potential for an old crop was the title of a recent issue of "Food Reviews International" (Vol. 8: 1). Guest editors of the special issue were Dr. Judith Bale of the Board on Science and Technology for International Development (BOSTID) of the National Academy of Sciences, and Charles Kauffman of the Rodale Research Center. The issue focused on the results of ten years of research on amaranth sponsored by BOSTID. The goals were to: 1) determine the conditions (soil, climate, altitude) under which amaranth could be a nutritious and economical crop, 2) identify the best varieties of amaranth and the best growing strategies for different regions, 3) develop techniques for harvesting and using grain amaranth in varied local settings, and 4) develop a base of information to support the expanded production of amaranth. Papers in this issue of "Food Reviews International" reported the advances that have been made including more productive varieties, improved cultural techniques, and new food products.

Folk medicine gets a fresh look by scientists at Georgia Tech ("Research Horizons", summer 1991), Mayo Clinic, Purdue University, and Eli Lilly Company. Folk remedies from the Southeastern U.S., South America, and Asia are being examined in the hopes of isolating potential anti-cancer compounds. According to Tony Mead of the National Cancer Institute, "Mother Nature has created some structures which no synthetic or organic chemist would've ever made in a month of Sundays". Their work focuses on finding a compound that will stop the enzymes that help cancer cells divide. The Georgia Tech group studied about 140 plants last year and about five percent of them have something of interest.

Alternative crop interest expands to Europe according to a recent article in "Ag Materials and Products", a publication of the New Uses Council which is based in Topeka, Kansas. The primary impetus for more diversity is the need to reduce subsidy programs and food surpluses. In the fiber area, hemp seems to have the most potential for the region. Diversifying oilseed production has potential because the processing facilities are already available. Sugarbeets will likely remain the primary European source of sugars and starches. The diversification effort in Europe has strong support from individual governments and the EEC. It is estimated that $150 million is devoted to new crops in Europe while the U.S. federal government currently provides about $10 million.

Old Fashioned Milk Paint is the name of a company in Groton, Mass that has recreated an ancient product ("Ag Industrial Materials and Products", August, 1992). Milk paint was used as long ago as Ancient Egypt and as recently as the mid 18th century. It consists of milk protein, lime, clay, and earth pigments. It is used by furniture restorers wanting an authentic look and by environmentally conscious consumers.

Tests show ethanol is cost efficient to produce ("Ag Industrial Materials and Products", August, 1992). Oak Ridge National Laboratory recently released a study that showed that corn-based ethanol generates at least 20% more energy than is required to produce it. This refutes criticism than ethanol is inefficient to produce. New production technologies are projected to further increase energy efficiency.

Locoweed potential source of cancer-fighting drug ("AURI Ag Innovation News"). Locoweed contains a toxin, swainsonine, that can weaken and kill cattle, sheep, horses, and other species that graze it. Medical researchers have found that it stops the growth of tumors in mice. Cancer research with swainsonine is continuing in the U.S., Canada, and Japan.

Farmers feed world, protect planet (Agri News, May 14, 1992). An Iowa project called Agriculture-Energy-Environmental Initiative has earned one of 17 of the EPA's Administrator Awards recognizing excellence in working toward a cleaner environment. The project was developed to speed up farmer adoption of sustainable management practices. Iowa farmers have reduced the amount of nitrogen fertilizer applied to corn by 20% since 1985 with no decline in yield. In another study of ground water, the percentage of wells with nitrate levels exceeding federal limits dropped from 40% of wells to 24% of wells. There were also small declines in the incidence of pesticides in the wells.

An apple a day does work according to the National Cancer Institute (Associated Press). The Institute is kicking off a 5-year $33 million program to get people to eat at least five servings of fruits and vegetables per day. Many studies show that nutrients in fruits and vegetables protect against cell damage that leads to cancer.

Calendar of Events

October 25-27, 1992 - Ecological Interactions and Biological Controls Minneapolis, Minnesota. For further information contact Nancy Harvey, Educational Development System, 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108; 1-800-367-5363.

October 24, 1992 - West Virginia Herb Conference Jackson's Mill, West Virginia. Sponsored by the Center for Sustainable and Alternative Agriculture, West Virginia University Extension Service. For further information contact Keith Dix, 2098 Agri. Sci. Bldg., P.O. Box 6108, West Virginia Univ., Morgantown, WV 26506-6108; (304) 293-4801.

November 1-6, 1992 - 84th Annual Meeting of ASA, CSA, SSA, and CMS Minneapolis, Minnesota. For more information contact the societies' headquarters at 677 South Segoe Road, Madison, WI 53711; (608) 273-8080.

November 6-7, 1992 - National Conference on Direct and Niche Marketing of Lamb and Wool Ellicott City, Maryland. For further information contact James B. Bell, Dept. of Ag. Econ., Virginia Tech, Blacksburg, VA 24061; (703) 231-6301. See ***Publications*** section if you only wish to order the conference materials.

November 6-9, 1992 - 5th National Conference on Specialty Cut Flowers Burlington, Vermont. Sessions on the production and marketing of specialty cut flowers will cover annuals and perennials, woody stems, and fresh and dried flowers. Cut flower handling, weed and disease control, and production costs will also be included. For more information contact ASCFG, 155 Elm Street, Oberlin, OH 44074; Phone (216) 774-2887, Fax (216) 774-2435.

December 13-14, 1992 - Alternative Energy Conference: Liquid Fuels from Renewable Resources Nashville, Tennessee. Sponsored by the American Society of Agricultural Engineers. For symposium information contact: John Cundiff, VPI & SU, Agricultural Engineering Dept., Blacksburg, VA 24061.

*(See **Calendar** page 8)*

Order Form - BioOptions

Please send me a subscription to BioOptions for 1993. I am enclosing a check or money order for $5.00 ($8.00 outside the U.S., Canada, and Mexico) made out to: University of Minnesota.

Send form and check to:

Center for Alternative Plant and Animal Products
340 Alderman Hall
1970 Folwell Avenue
University of Minnesota
St. Paul, MN 55108

Send my subscription to:

Name_____

Company_____

Address_____

City_____ State_____ Zip_____

Specific interest_____

Your comments about "BioOptions" would be most helpful to us. Please tell us what you like about our newsletter and how we could improve it. We also encourage you to send us information on upcoming events and new publications.

(Calendar from page 7)

January 27-30, 1993 - 8th Annual National Farm Direct Marketing Conference Portland, Oregon. Topics will include niche markets, customer relations, creative packaging, promotions, organic produce, farmers markets, employee relations, and mail order. Contact the Agricultural Development and Marketing Division, Oregon Dept. of Agriculture, 121 SW Salmon, Suite 240, Portland, OR 97204-2987; (503) 229-6113.

February 21-23, 1993 - Agricultural Research to Protect Water Quality Minneapolis, Minnesota. Sponsored by the Agricultural Research Service, Cooperative State Research Service, Extension Service, U.S. Environmental Protection Agency, and U.S. Geological Survey. Contact: Soil and Water Conservation Society, 7515 Northeast Ankeny Road, Ankeny, IA 50021-9764.

March 3-5, 1993 - International Kenaf Assn. Annual Meeting Fresno, California. Contact Mahendra S. Bhangoo, (209) 278-2255.

July 20-23, 1993 - International Workshop on Sustainable Land Management for the 21st Century Lethbridge, Alberta, Canada. Contact: Conference Services, University of Lethbridge, 4401 University Drive, Lethbridge, Alberta, CANADA T1K 3M4.

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.

Renew Your "BioOptions" Subscription

This is the last issue of this volume of "BioOptions". In order to continue to receive this information-packed publication, you need to renew your subscription. An order form is provided on the bottom of page 7.

As you know, we recently sent a survey to people that have expressed an interest in the Center over the years. We were very pleased with the positive comments about "BioOptions". If you have comments about how to improve the newsletter, or want to submit items for inclusion, we would be happy to hear from you.

Center for Alternative Plant and Animal Products
305 Alderman Hall
1970 Folwell Avenue
University of Minnesota
St. Paul, MN 55108