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# BioOptions

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Newsletter of the Center for Alternative Plant and Animal Products Volume 1, Number 4 Spring 1990

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and the University of Minnesota Agricultural Experiment Station

## Lupin Update

As reported in the Summer 1989 issue of "BioOptions", the Center for Alternative Plant and Animal Products has a three year research project on lupins. Highlights of the second year's research are summarized below.

Inoculation of lupins was shown to increase seed protein content from 26% to 38%, and to increase yield by 92%. Irrigation increased yield from 600 to 2200 lbs/acre but decreased protein content. Narrow rows (6") were superior to wide rows (18") under irrigation. Lupin yields are sensitive to date of planting, with yields of 2200 lbs/acre for the earliest planting date (4/19/89), and 200 lbs/acre for the latest planting date (6/14/89). Weed control remains a major problem in lupins and testing of herbicides will continue next year. The continued drought hampered on-farm research.

Over 300 fungal isolates were collected and the first incidence of *Pleiochaeta setosa* in Minnesota was reported. A lupin disease publication will be completed this year.

A lupin feeding trial with dairy cows showed no adverse effect of replacing soybean meal with lupins, and in fact showed a possible benefit to milk fat content. This result was exciting since one of the main potential uses of lupin is as an on-farm protein source for dairy farmers.

A lupin symposium is tentatively scheduled for March of 1991.

## Canola in the Midwest

Canola is a name applied to edible oilseed rape. This plant, along with 3,000 other species, belongs to the mustard family. The name "canola" was registered in 1979 by the Western Canadian Oilseed Crushers Association to describe "double-low" varieties. Double low indicates that the processed oil contains less than 2% erucic acid and the meal less than 3 mg/g of glucosinolates. Erucic acid is a fatty acid that has been related to heart disease. Glucosinolates have breakdown products that are toxic to animals. Both characteristics make rapeseed products poor candidates for animal consumption. In the early 1960s, Canadian plant breeders isolated single lines free of erucic acid and began programs to develop double low varieties.

Today, annual worldwide production of canola is approximately 7.5 million tons on 4 million acres. Canada accounts for 15% of the world production and the European Economic Community for nearly 17%. The United States produces less than 1% of the world production. Minnesota and North Dakota are the major U.S. production states with about 20,000 acres. Canola ranks 5th in production among the world's oilseed crops following soybeans, sunflowers, peanuts and cottonseed.

The main uses for canola are human and animal consumption. Like soybean, canola has both high oil content and high protein content. It contains about 40% oil and 23% protein compared to 20 and 40%, respectively, for soybean. Like

soybean, when the oil is crushed out, it leaves a high quality, high protein (37%) feed concentrate which is highly palatable to livestock. It can also be used as a forage for livestock. Canola oil is high in polyunsaturated fatty acids (oleic, linoleic, and linolenic).

Canola is widely adapted, particularly to the cool extremes of the temperate zones. Minimum temperatures for growth have been reported to be near 32°F. The crop will germinate and emerge with soil temperatures at 41°F but the optimum is 50°F. Winter annual varieties are grown where adequate snow covers or mild winters are common. Fall seeding dates need to be timed to achieve about 6 true leaves and good root reserves before a killing frost. Planting of spring varieties should begin as early as soil is dry and weather permits.

Canola does best on medium textured, well drained soils. The crop is tolerant of a soil pH as low as 5.5 and saline conditions. Canola requires approximately 16 to 18 inches of water through its growing season. Compared to other small grain crops, canola is a heavy user of sulfur.

Stand establishment is very important with canola because of its lack of early competitiveness. Seeding into a smooth, firm seedbed helps maintain a uniform seeding depth and even emergence. Canola is usually seeded with the small seed attachment of a grain drill. (See *Canola* page 2)



*(Canola from page 1)*

The best weed control practices are tillage, establishment of a good stand, and weed control in previous crops. Cruciferous weeds (wild radish, wild mustard, pennycress and shepherd's purse) are nearly impossible to control in the crop.

White mold (*Sclerotinia* stem rot) can be a serious disease after flowering in seasons with cool, moist growing conditions. Since white mold is a problem in several other crops, its occurrence in canola must be carefully monitored. Avoid planting canola following such crops as soybeans and dry edible beans or sunflower.

Many insects may infest canola at various stages of its growth. Probably the greatest problem is caused by the flea beetle, a shiny black beetle about 10 to 15 mm long which attacks canola particularly at emergence, although it can be a problem later as well. Hot, sunny weather promotes feeding damage. Most growers control flea beetles with a granular insecticide mixed with the seed, but other seed-applied formulations and postemergence insecticides are also available. Diamondback moth larvae can be a problem in dry years.

Timely harvest of canola is critical to prevent shattering. Harvest maturity can only be determined by observing the color of the seed. About 30 to 40% of the seed on the main stem needs to be brownish-red in color prior to swathing. This corresponds to approximately 30 to 35% seed moisture. The crop should be combined when it has dried to 10% moisture. Rapeseed must be handled and stored carefully.

Yields of canola in the upper Midwest have been extremely variable in recent studies. In Minnesota, yields have ranged from 150 to 2500 lb/a with oil ranging from 39 to 47%. Studies conducted at several locations in Wisconsin

have found yields of spring types ranging from 250 to 2300 lb/a, while winter types frequently have not survived the Wisconsin winters. A test weight of 52 lb/bu is generally used for canola.

Canola is sometimes marketed on a contract basis. No standard grading system exists in the U.S., (although standards are being developed and may be in place by 1990), but primary grades used in Canada are generally followed by buyers.

Compared to soybean, the costs of producing canola are higher. Most of the additional expense comes from increased fertilizer and pesticide inputs. For most areas of Wisconsin and Minnesota, transportation costs are likely to be much higher for canola than for soybean considering the lack of available canola markets. Assuming potential returns of canola at \$.10/lb and soybean at \$5.50/bu, it is apparent that canola must yield higher than any of the varieties have in the recent Minnesota and Wisconsin evaluations to be economical. Canola may be more adapted and competitive in the extreme northern portion of the Midwest where soybean yields are lower. With proper management, canola may be a potentially profitable crop for these areas.

**Other Information Sources:**

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Canola Characteristics and Production. 1986. B. D. Philbrook. Agron. Seminar Memo. Dept. of Agronomy - U.W. Madison.

Will Canola take Root in Michigan? 1987. L. O. Copeland. Crops and Soils Newsletter. Michigan State Univ., E. Lansing, MI.

Winter Rapeseed Cultural Information. 1986. L. L. Hardman. Dept. of Agronomy & Plant Genetics, Univ. of Minn. St. Paul.

*This article was excerpted from "Canola" by E. S. Oplinger, L. L. Hardman, E. T. Gritton, J. D. Doll, and K. A. Kelling in the Alternative Field Crops Manual published by the Univ. of Wisconsin-Extension and the Univ. of Minnesota, Center for Alternative Plant and Animal Products and Minnesota Extension Service.*

## 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.

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## Northern Crayfish: An Update

Jeffrey Gunderson  
Minnesota Sea Grant Extension Program  
Univ. of Minnesota, Duluth

Crayfish, also called crawfish or crawdads, are fresh-water crustaceans closely related to lobsters. They range in length from 1-2 inches up to 16 inches for a species in Tasmania. They frequent rivers, marshes and other bodies of water, living under rocks or burrowing in mud. They are an important component of the diet of many animals including otters, raccoons, ducks, and fish. Crayfish are omnivorous, eating other crustaceans, insects, worms, and fish, as well as vegetable matter.

Crayfish are used as fish bait and for human consumption. They are harvested from the wild as well as cultured commercially in ponds. Crayfish are generally harvested by trapping, although seines and lift nets can also be effective at times.

Crayfish culture is the largest aquaculture industry in the U.S. in surface acres of water under production. Acreage in Louisiana has ranged as high as 140,000 acres, with average production of 500-600 pounds per acre. Including wild harvest, Louisiana produces about 120 million pounds (80% of the world's supply of crayfish) each year from November to June. The Louisiana species are the red swamp crayfish (*Procambarus clarkii*) and white river crayfish (*P. acutus acutus*).

Aquaculture of crayfish in northern states is in its infancy but is developing. Native crayfish have become so abundant in some Minnesota wild rice paddies that they are considered a nuisance. Paddies might therefore be a suitable environment for commercial crayfish culture. It has also been suggested that small wild-caught crayfish could be grown to marketable size in culture ponds.

The current U.S. market for crayfish is primarily in Louisiana, but demand is beginning to grow elsewhere. Very few crayfish are marketed for food in the Midwest at this time. Nevertheless, crayfish production in Minnesota and other Midwestern states during the summer months could help ensure a stable 12-month supply and establish new U.S. markets.

Crayfish wild harvest and culture possibilities have generated much interest in the last year. Between 2,000 and 3,000 metric tons of crayfish are consumed annually at a festival in Sweden. Because of a crayfish plague in Europe, the availability of crayfish from those waters has declined drastically. The rusty crayfish (*Orconectes nisticus*) may be the best substitute crayfish seen in Sweden in 50 years. Swedish importers have placed a large order for rusty crayfish or northern crayfish (*O. virilis*) more than 3 1/2 inches long from the front of the head to the tail.

The rusty crayfish is not native to either Minnesota or Wisconsin, but it is now found in both states. It was probably brought in as bait. Because the rusty crayfish is much more widespread in Wisconsin, most of the wild harvest is slated for those waters.

Two of the four other crayfish species in Minnesota may also have market potential. Although smaller and not initially as highly regarded by the Swedish buyers as the rusty and northern crayfishes, *O. immunis*, and *O. propinquus* may eventually find a European or U.S. market niche. These native species, especially *O. immunis* with its large percentage of tail meat, may also be suitable for the domestic tail meat market. Tail meat from cooked hard-shell crayfish is peeled,

deveined, and sold fresh or frozen. Development of an efficient tail meat picking machine could increase the potential for economically marketing Minnesota crayfish in the U.S.

Crayfish periodically molt or shed their hard exoskeleton in order to grow. During the molting process the crayfish expands and forms a flexible new, inner shell, while dissolving and cracking the old shell. After the crayfish emerges from the old shell, the new larger shell begins to harden. The new exoskeleton remains soft for only about three hours after molting unless the crayfish is chilled or frozen. Up to 92 percent of a soft crayfish is edible compared to only 10 to 20 percent of a hard crayfish.

Soft crayfish are considered to be a delicacy and are also popular a fishing bait. Prices to the producer for soft crayfish sold as food range from \$6 to \$9 per pound. Soft crayfish sold as bait may bring \$12 to \$30 per pound at certain times of the year.

Soft-shell rusty crayfish have been produced for bait in the upper Midwest for years. It wasn't until recently, however, when Sea Grant researchers at Louisiana State University developed a recirculating shedding system, that soft crayfish were produced on a commercial scale for the food market. Production from this newly developing industry increased from 10 tons in 1987 to 50 tons in 1988. The potential food market for soft crayfish is estimated at 1,500 tons per year.

It is not known if wild-caught or cultured northern crayfish will respond to the intensive shedding system developed for Louisiana's red swamp (See *Crayfish page 4*)



(Crayfish from page 3) crayfish. Research is underway to refine the Louisiana techniques and the methods developed by bait producers for rusty crayfish to provide an economically viable soft-shell system for our northern crayfish.

Developing a shedding system for northern crayfish and a reliable market for soft crayfish would provide a use for crayfish smaller than Sweden's 3 1/2 inch minimum import size and would increase the likelihood of developing a significant crayfish industry in Minnesota and Wisconsin.

Crayfish wild harvest and aquaculture may have the potential to develop into a significant industry in Minnesota and Wisconsin. It is premature to speculate how large an industry will develop, but it is not too soon to create an awareness of the emerging issues. In any case, crayfish also offer a tasty treat to recreational fisherman.

As with any new commercialization of a natural resource, there will probably be conflicts among user groups and between users and management agencies. Openness and direct communication are important if crayfish wild harvest and aquaculture opportunities are to be realized in an efficient and environmentally sound manner. Your state Department of Natural Resources should be contacted regarding regulations pertaining to crayfish harvest, culture, transportation, and use as bait.

Well-directed research is also needed to answer the many questions that will arise as the industry grows:

- \* Can crayfish be commercially cultured in Minnesota?
- \* Can Midwestern markets be developed for crayfish?
- \* What impacts will intensive harvests have on wild crayfish and other fish/wildlife populations?

## Publications

**Wood Based Economic Development in the Lake States: Proceedings of a Symposium on Specific Forest Products Opportunities** are now available. The 202 page volume includes chapters on how to identify market opportunities, what communities can do to promote economic development and attract wood products industries, as well as information on a variety of wood-based enterprises with potential in the Lake States. The proceedings are available at a cost of \$20. Make checks out to: University of Minnesota and send to Extension Special Programs, 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

**Proceedings of the IDEAS - 1990 Conference** are available for \$18 U.S. funds or \$20 Canadian. The conference covered a wide variety of alternative enterprises and attracted over 1,400 registrants. Contact Ms. Linda Balmer, Ridgetown College of Agricultural Technology, Ridgetown, Ontario N0P 2C0.

**CRC Handbook of Medicinal Herbs** by James A. Duke of the USDA Germplasm Resources Laboratory is now available. This 696 page book includes the common and scientific names, chemical content, present and historical uses and applications, processing, distribution and economic potential, toxicological agents and degree of toxicity, poison symptoms, treatment and antidotes, along with references to the original literature for 365 species of medicinal herbs. The cost in U.S. funds is \$235 (\$265 outside the U.S.). For further information, contact: CRC Press, Inc., 2000 Corporate Blvd. N.W., Boca Raton, FL 33431.

**Directory of Specialists in Herbs, Spices and Medicinal Plants** is a compilation of names, addresses, and telephone numbers of experts in the field. It is available for \$8.00 from Lyle E. Craker, Dept. of Plant and Soil Sciences, Stockbridge Hall,

University of Massachusetts, Amherst, MA 01003.

**Shiitake Growers Handbook: The Art and Science of Mushroom Cultivation** was written by Paul Przybylowicz and John Donoghue of Northwest Mycological Consultants. It clearly describes and illustrates the underlying scientific principles governing the behavior of shiitake and presents detailed, practical techniques. It is available for \$21.95 postage paid from NMC, Dept. S., 702 NW 4th St., Corvallis, OR 97330.

**Aridus** is the quarterly bulletin of the Desert Legume Program of the Boyce Thompson Southwestern Arboretum and the University of Arizona. It presents information on desert legumes with potential both in the U.S. and around the world, as well as information on the activities of the Desert Legume Program. Subscriptions are free. Contact: Desert Legume Program, 2120 East Allen Road, Tucson, AZ 85719.

**Aquaculture Magazine** is a trade publication that provides information and articles on all aspects of aquaculture worldwide but with major emphasis on the U.S. This monthly publication is available for \$15 per year. Contact: Aquaculture Magazine, P.O. Box 2329, Asheville, NC 28802, (704) 254-7334.

**Canola Proceedings** from the 1990 International Canola Conference held April 2-5 in Atlanta will be available July 1 from the Potash and Phosphate Institute (PPI). Thirty-three speakers from Canada, the U.S.A., England, China, and West Germany covered diverse aspects of canola breeding, production, marketing and use. Cost is \$12 (\$15 outside the USA) from PPI, 2801 Buford Highway, Suite 401, Atlanta, GA 30329. Make checks out to PPI.



## News Briefs

**Findings from a year of research with luffa gourds** were presented in the March/April issue of "Missouri Farm". Luffa gourds produce a fibrous sponge at maturity which is used in bath and beauty products. C.D. "Chuck" DeCourley from the University of Missouri-Columbia studied the production and quality characteristics of 19 varieties of luffa gourds. One variety had high quality fiber and another had satisfactory quality but neither of these had economic yields. Continued variety trials and research on cultural practices are needed.

**Angelica - Plant from the north** appeared in the Spring issue of "The Herb, Spice and Medicinal Plant Digest". Angelica (*Angelica archangelica* L.) is an herbaceous, aromatic, biennial herb used in northern Europe as a food and medicinal plant since at least the 12th century. It is commercially produced in Belgium, Germany, Hungary, and other northern European countries. Extracts of the plant have been used to treat a variety of ailments including nervous diseases, fever, and tobacco addiction. The fresh leaves are used in cooking. The seeds and roots are used in cosmetics and as a flavoring agent in beverages and liqueurs. The essential oils are used in perfumes, soaps, salves, and shampoos.

**A review of some antimicrobial compounds isolated from medicinal plants reported in the literature, 1978-1988** appeared in "Phytotherapy Research", volume 3, issue 4. M.C. Recio, J.L. Rios and A. Villar have reviewed 181 references on anti-microbial extracts, including essential oils and other active principles. A table includes the scientific name of the plant, the plant part, spectrum of activity, dose, active principle, and extraction method.

**Farmer's corn smut becomes gourmet's 'maize mushroom'**, Mexican truffle or *huiltacoche*, according to a Words by Wire article. The black fungus that grows on ears of corn may turn into the next nouvelle cuisine sensation. Christina Arnold, owner of El Aficionado, a company in Manhattan that specializes in Mexican foods, has been paying up to 50 cents each for the infected ears. Last year she bought over 3,000 lbs of corn smut and thinks there is a market for 100,000 lbs. Mexican cuisine includes over 2,000 recipes using *huiltacoche*. Victor Lefever, a sweet-corn grower from Pennsylvania, says that harvesting the fungus can be tricky. It requires hand-picking the ears before the infected kernels explode. They must be handled gently and quickly refrigerated.

**Cheap money for adapting in the March issue of "Successful Farming"** stated that farmers in Iowa can obtain up to \$200,000 in low-interest production loans for horticultural or alternative agricultural crops or livestock. The Linked Investments For Tomorrow (LIFT) program has loaned more than \$7 million to 231 Iowa farmers since its inception in 1986. The interest rate is 2-4% below normal farm production loans. Texas has a similar program and Colorado is establishing a low-interest loan program for agricultural diversification. Other states are considering similar programs.

**Wild rice plus beef equals better burgers** in the Spring "Minnesota Science" reported on research conducted by Phil Minerich, Paul Addis and Richard Epley. Adding cooked wild rice to ground beef before shaping produces a tasty burger with less fat. Uncooked patties are also less likely to turn rancid in the freezer than regular hamburger. Wild rice contains natural anti-oxidants.

**Tobacco leaves can be processed to produce a high-protein, low calorie powder for use in a variety of foods**, according to a recent "Journal of Commerce" article. Shuh Sheen, a researcher from the University of Kentucky, indicated that tobacco leaves are a better source of protein than eggs, cheese, or milk. The protein has a balanced amino acid profile and has several useful functional properties.

**Biomass: Sustainable energy crop of the future** was the title of an editorial in the March/April issue of "agro-ecology" published by the College of Agriculture at the University of Illinois. Folke Dovring and Robert Herendeen indicate that methanol from biomass can become a major energy source in this country. Biomass energy has a net zero effect on atmospheric carbon dioxide. Energy yield per unit area is much larger than with ethanol from grain. Corn yields 300 gallons per acre of ethanol, but hay crops can yield 800 gallons per acre of methanol. The Alternative Motor Fuels Act passed by Congress recommends methanol as the propulsion fuel of choice for the future. Biomass crops would also prevent soil erosion; permanent grasses could be grown on moderately erodible land and medium rotation trees on steeper slopes.

**A fat-like gel** has been developed by scientists at the USDA research lab in Peoria according to a report in "AgriWeek". It is made entirely from oat flour or bran. Enzymes are used to isolate the soluble fiber and convert it to a white powder which becomes a smooth, tasteless semi-solid gel when mixed with water. It may be a potential substitute for fat in refrigerated products such as frozen desserts and salad dressings. It is tentatively named "Oatrim" (See *Briefs* page 6)



(Briefs from page 5) and could be on the market in 2-3 years.

**A plant to produce construction particleboard from cereal straw** is planned for Redvers, Saskatchewan according to "AgriWeek". The \$8 million facility will use a process developed by a Swedish firm. Capital costs are about one-third that of a typical particleboard plant.

**Feeling faint?** was the title of an article on Tennessee Fainting goats in the May/June issue of "Missouri Farm". When they are scared, they stiffen up and fall to the ground. This results from myotonia, a muscle defect caused by a recessive gene, which makes the muscles contract when they are frightened or even just when they walk fast. These unusual goats trace back to 1880 in Marshall, Tennessee when a drifter named Tinsley sold the original goats before leaving town. They have easy-going personalities and good reproductive characteristics. Fainting goats are in demand and sell for \$350 to \$900 and more.

**Mesquite - A world food crop** appeared in the February issue of "Aridus", the bulletin of the Desert Legume Program at the University of Arizona. Mesquite is a term for a few dozen species of trees and shrubs of the genus *Prosopis* originating in the New World. It is a nitrogen fixing legume which thrives in regions too arid for most agriculture. The pods and foliage of many species are edible. The seeds can be ground into a flour and used in breads and other foods. Coarsely ground pods and foliage can be used for animal feed. Mesquite is also used extensively for fuelwood.

## Letters

### Regarding Plantago and Psyllium

*Plantago ovata* is a desert species of Plantago commercially grown in the desert areas of northwestern India under winter rainfall and/or irrigation. In the United States it has been produced in the desert areas of southern Arizona. It has also been experimentally grown in southern California and the tri-city area of Washington State. However, successful production has been confined to southern Arizona with high temperatures, low humidity, and absence of rainstorms in April and May when plantago is harvested. Rainstorms can easily shatter ripe seed to the ground.

In Arizona I have conducted a research and development program on *Plantago ovata* for over 35 years. This research was with USDA and the University of Arizona until 1984 and on my own since then. The varieties of *Plantago ovata* from India have good seed quality, but because of their other plant attributes are unadapted for production in the United States. I have been successful in developing improved varieties by using germplasm from *Plantago insularis*, a species native to Arizona. In my breeding program I have made improvements in frost tolerance, plant height, seed size, seed shatter resistance, mucilage content, root rot resistance, and taste. In production research, I have been concerned with agronomics, mechanization, and utilization. There are still questions in regard to weed control. Although there have been a number of commercial efforts in the past, the main impediment has been that plantago may be imported cheaper than it can be produced. However, with increased yields with improved varieties and greater demand for "psyllium husk", commercial production is expected in the future.

David D. Rubis, Ph.D.  
Consultant

### Adzuki: The Rest of the Story

Yesterday one of my people gave me a copy of "BioOptions" issues 1 & 2. I was attracted to the article in Volume I, #2, Fall, 1989 entitled "Anatomy of a Specialty Crop - The Adzuki Bean Experience" by Breene and Hardman. Having been intimately involved in the processing of adzuki beans into ann powder, I want to respond and provide your readers with "the rest of the story".

In retrospect, the "Little Company" survived the adzuki bean "international incident" and has flourished. It has grown to include an ingredient marketing arm, Zumbro, and a second processing plant in Owatonna. Sales passed \$10 mm in 1989 thanks to the effort of 90 mostly locally grown employees in one of Minnesota's economically depressed counties. The "Little Company" paid off its contract for deed with the "defunct creamery" in 1989. The patrons of the Vernon Coop Creamery Assn. received their money - unheard of in past creamery failures. Come see the real "Minnesota Miracle" for yourself.

Interest in adzuki bean processing continues. In recent years I have been approached by two adzuki farmers asking for help, especially to circumvent the arrogant Japanese trading companies they must deal with to sell their beans.

By the way, the "Little Company" is interested in your program and would like to participate. We are currently working with two entrepreneurs on further processing of crop alternatives.

In closing, remind the good doctors, Breene and Hardman, that the Jerusalem Artichoke is not dead but lives! Just wait and see!

Eugene H. Sander, Ph.D.  
President, IFP, Inc.



## Calendar of Events

**June 19-20, 1990 - Corn Utilization Conference III** St. Louis, Missouri. Sponsored by the National Corn Growers Assn. and Funk Seeds International. Contact Ann Beirne, National Corn Growers Assn., 1000 Executive Parkway, Suite 105, St. Louis, MO 63141-9938; (314) 275-9915.

**June 30 - July 3, 1990 - HERBS '90** Baltimore, Maryland. 5th Annual Conference and Trade Show, sponsored by the Int'l Herb Growers and Marketers Assn. Contact: Maureen Buehrle, Exec. Director, P.O. Box 281, Silver Springs, PA 17575; (717) 285-4252.

**July 9-10, 1990 - "Organic" Meat Symposium** Minneapolis, Minnesota. Sponsored by the Center for Alternative Plant and Animal Products, and the Minnesota Extension Service. Objectives are to 1) discuss federal regulations concerning "organic" meat, 2) review conventional and

organic production methods, 3) Present marketing and pricing strategies for organic meat, and 4) serve as a forum for discussion. Contact June Rogers at 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108; (612) 625-1214.

**July 10-12, 1990 - Seventh North American Blueberry Research Workers Conference** Portland, Oregon. Contact Charles A. Brun, 2400 T St., Vancouver, WA 98661; (206) 696-8411.

**August 23-25, 1990 - 4th National Amaranth Symposium: Perspectives on Production, Processing and Marketing** Minneapolis, Minnesota. Sponsored by the Center for Alternative Plant and Animal Products, Minnesota Extension Service, Rodale Press, Inc., the Amaranth Institute, and the Institute for the Development of Amaranth Products. For further information

contact Nancy Breneman, 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108; (612) 625-2722 or (800) 367-5363.

**September 1-3, 1990 - World Sheep Festival and Rare Breeds Expo.** Bethel, Missouri. Includes Grand National Sheep Shearing Contest, Midwest Sheep Dog Classic, National Hair Sheep Conference and Exhibition, and Fiber Arts contests. Rare Breeds Expo will include Dexter cattle, goats, horses, hair sheep, water fowl, llamas and game birds. Contact Clyde Burch, World Sheep Festival, Bethel, MO 63434.

**September, 1990 - Symposium on Medicinal and Aromatic Plants** Florence, Italy. Contact: P. Tetenyi, Research Institute of Medicinal Plants, P.F. 11, H-2011, Budakalasz, HUNGARY.  
*(See Calendar page 8)*

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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. Articles for the newsletter are also welcome.



*(Calendar from page 7)*

**September 23-26, 1990 - Grown with Pride in the U.S.A.: The Business of Growing Specialty Cut Flowers** Ventura, California. Sponsored by the Assn. of Specialty Cut Flower Growers. The conference is open to anyone involved in the production or marketing of specialty cut flowers. Contact Abbie Blair, Gilroy Flower Farm, 1090 Denio Ave., Gilroy, CA 95020; (408) 848-2135.

**October 1-5, 1990 - International Triticale Symposium** Passo Fundo, Rio Grande do Sul, Brazil. Contact CNPT/EMBRAPA, P.O. Box 569, 99001 Passo Fundo RS Brazil.

**October 8-12, 1990 - First International Conference on New Industrial Crops and Products** Riverside, California. Sponsored by the Assn. for the Advancement of Industrial Crops and the Univ. of California, Riverside. Abstracts of paper and poster presentations are due July 1st. Contact Cindi McKernan, Dept. of Botany and

Plant Sciences, University of California, Riverside, CA 92521; (714) 787-3423, Fax (714) 787-4437.

**October 22-26, 1990 - Int'l Symposium on Goat Production** Tallahassee, Florida. Contact: Claude McGowan, Room 202 Perry Paige Bldg., Florida A&M University, Tallahassee, FL 32307; (904) 599-3546.

**January 8-10, 1991 - Southern Biomass Conference** Baton Rouge, Louisiana. The theme is "Strategies for Biomass Commercialization". The organizers are soliciting oral and poster presentations. One page abstracts are due by July 1, 1990. Contact Michael Buchart or Tommie Landry, Louisiana Dept. of Agriculture and Forestry, P.O. Box 3334, Baton Rouge, LA 70821; (504) 922-1280.

**February 21-24, 1991 - Sixth National Farmers Direct Marketing Conference** Parsippany, New Jersey. Recommendations for topics or speakers to be included in the program are welcomed. Program

brochures will be available this fall. For further information, contact Morris Fabian, Rutgers Cooperative Extension, P.O. Box 231, New Brunswick, NJ 08903.

**April 12-16, 1992 - Second International Food Legume Research Conference** Cairo, Egypt. Contact Dr. A.E. Slinkard, Crop Development Centre, University of Saskatchewan, Saskatoon, Sask. S7N 0W0 CANADA; phone: (306) 966-4978, Fax: (306) 343-1025.

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