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Published by the Sustainable Agriculture Network (SAN), the national outreach arm of the Sustainable Agriculture Research and Education (SARE) program, with funding by USDA's Cooperative State Research, Education and Extension Service.

Also available at: www.sare.org/bulletin/diversify

SUSTAINABLE AGRICULTURE N·E·T·W·O·R·K
THE NATIONAL OUTREACH ARM OF USDA-SARE

Diversifying Cropping Systems

Alternative grains and oilseeds – like, from left, buckwheat, amaranth and flax – add diversity to cropping systems and open profitable niche markets while contributing to environmentally sound operations. *– Photos by Rob Myers*

KARL KUPERS, AN EASTERN WASHINGTON GRAIN GROWER, was a typical dryland wheat farmer who idled his land in fallow to conserve moisture. After years of watching his soil blow away and his market price slip, he made drastic changes to his 5,600-acre operation. In place of fallow, he planted more profitable hard red and hard white wheats along with seed crops like condiment mustard, sunflower, grass and safflower. All of those were drilled using a no-till system Kupers calls direct-seeding.

"I look at this more diverse system as a tremendous opportunity to decrease chemical use and make more net profit per acre," said Kupers, who received a grant from USDA's Sustainable Agriculture Research and Education (SARE) program to offset the risk. Now, he puts his exuberant personality to work as an aggressive marketer of alternative crops – clearing more profits each year while achieving his goal to save soil.

"Economically, I think we're just about at that point where we can show that we can be sustainable for the short term and the future," he said. "We put no dust in the atmosphere, there's no particulate matter, if water does run off our soils, it is clean water."

Although growing alternative crops to diversify a traditional farm rotation increase profits while lessening adverse environmental impacts, the majority of U.S. cropland is still planted in just three crops: soybeans, corn and wheat. That lack of crop diversity can cause problems for farmers, from low profits to soil erosion. Adding new crops that fit climate, geography and management preferences can improve not only your bottom line, but also your whole farming outlook.

"Continued low commodity prices have gradually driven more and more people to look for other options," said Rob Myers, executive director of the Thomas Jefferson Agricultural Institute in Columbia, Mo. For some farmers, planting alternative crops has made an "immediate and significant" improvement in income, he said.

Kupers is not the only farmer who diversified his monoculture cropping system to enjoy renewed profits. Members of the Northwest Kansas Farm Management Association, for example, enjoyed average net farm incomes of $50,485 in 1998 – three times that of other Kansas growers – after diversifying their operations.

PART 1

Why Diversify?

Diverse crops bring diverse benefits

FARMERS AND AGRICULTURAL SCIENTISTS HAVE KNOWN FOR years that crop rotations can break insect and disease cycles, reduce weeds, curb erosion, supplement soil nutrients, improve soil structure and conserve soil moisture.

Diversification can also:

- soften impacts on environmental resources
- spread farmers' economic risk
- exploit profitable niche markets
- create new industries based on agriculture, strengthening rural communities
- aid the domestic economy, enabling producers to grow crops that would otherwise be imported.

This bulletin will provide you with a jumping-off point to diversify your farm, from choosing the right new crops to managing them successfully. While some alternative crops command high prices, others pay dividends by building natural resources or boosting the yields of rotational crops. And growing crops that require processing, for example, can provide jobs in your community.

Diversify to enhance profits

GROWING A DIVERSE SELECTION OF CROPS CAN EXPAND YOUR markets and offset commodity price swings. Consequently, profits won't depend exclusively on any one market, as they might, for example, when you only produce crops for livestock feed.

Buckwheat, a grain used in noodles, multi-grain breads and cereals, among other products, sells for three times the price of corn in the marketplace, making it an attractive alternative crop.

– Photo by Rob Myers

Overall, the economic picture improves with strategic diversification. Gross income for an alternative crop may be higher and production costs may drop. For example, adding legumes to a rotation reduces the need to purchase nitrogen fertilizer. Moreover, rotations that include three or more crops usually have fewer problems with pests – and less need for pesticides.

Keep in mind that post-harvest handling and transportation to *more* distant markets may increase costs. In addition, while specialty crops like fruits, vegetables, ornamentals or nuts can dramatically increase income per acre, they usually demand more intensive labor.

Diverse rotations also reduce economic risk associated with unfavorable weather or pest damage in any one crop. Despite drought, for example, you can successfully harvest such crops as amaranth, millet, safflower, sesame and sunflowers. In central Missouri, diversified crop farmer Jerry Weber grows sunflowers because they are able to use moisture present throughout the soil profile and yield "reasonably well," even when timely rains don't come. By comparison, sufficient moisture at pollination can make or break a corn crop.

"Growing different kinds of crops that have needs for moisture at slightly different times is what tends to spread your risk," Weber said. "Any time you can spread that risk is an advantage, and that's why we got involved in diversifying crops." Over the six years since Weber started growing sunflowers, they have been as profitable or more profitable than any of his other crops, such as corn, milo and soybeans.

Even if the profit from a new crop is negligible – or negative – you can still benefit economically from an expanded rotation. Labor and equipment are distributed more smoothly through the year, thereby increasing operational efficiency and decreasing payroll costs. Broader diversity also can raise the yields of traditional crops. With its deep taproot, amaranth opens up compacted soils for the roots of the subsequent crop. In one grower's fields, growing amaranth added a 5- to 10- bushel per-acre increase to the wheat crop that followed it.

In Washington, diversification enables Kupers to match his crops to his variable growing conditions as well as to a fluctuating marketplace. "There is no recipe," he said. "I know my work would be much simpler if there were, but there are simply too many variables. I take into account the weed and pest cycles, market conditions and

PROFILE

THEY DIVERSIFIED TO SURVIVE

The Beguins had one compelling reason to diversify: "We wanted to keep the ranch," said Robert Beguin of Rushville, Neb.

With only 120 cow-calf pairs on their 2,000-acre ranch, the family had depended on its trenching business to "keep everything else floating." It still does, but the Beguins' agricultural enterprises have become significantly more profitable since they went organic in 1996 and since a SARE grant helped them market their new value-added products and obtain equipment to outfit a 2,160-square foot cleaning and bagging facility.

Now the Beguins sell their cleaned, organic wheat for $6.75 a bushel rather than $2.50. They ship their brown and golden flaxseed to Internet markets, their blue corn to chip-makers, their millet to California bakers and Japanese snack-makers, their radish seed to overseas

sprout buyers, their oil and confection sunflowers to Minnesota, their dry beans in 2,000-pound totes to the West Coast and their pea seed to local cattle-feed and green-manure users. The Beguins' cowpea seed goes to customers who grow the plants, then chop them young for tender salad greens.

"That blew our minds," Beguin said.

Daughter-in-law Shelley and daughter Barb pitch in as well: They sell the family's bean-soup mixes over the Internet, at area craft shows and during community events.

MARKETING GETS EASIER

"Finding markets is pretty hard the first three years," Beguin cautions farmers considering alternative crops. "You have to spend a lot of time on the telephone. After about three years or so, they'll start calling you."

Beguin stores his crops for up to two years when the price isn't right – an advantage of producing dry grains and shelf-stable value-added products – and advises other entrepreneurs to do the same. "I won't contract millet at 10 cents," he said. "I'll let it sit in the bin for two or three years and I'll get my 20 cents out of it." His radish seed will still germinate nicely after a year and his alfalfa seed will actually sprout better.

The family's new facility – in which they also clean crops for a neighbor – allows the Beguins to sack varieties separately. They still ship everything together, filling one California-bound truck with $15,550 worth of dry edible beans, peas, millet, and alfalfa and radish seed. Not bad, especially when the cracked-grain "cleanings" have value, too – as feed for the Beguins' cattle.

The Beguins' agricultural enterprises have become significantly more profitable since a SARE grant helped them market their new value-added products.

moisture, and make decisions based on all these things."

As markets expand for diverse products, you may find more opportunities, although you might need to overcome challenges like distribution bottlenecks.

New market supply chains offer farmers new opportunities to produce more value and retain more of that value on the farm," said Fred Kirschenmann, a North Dakota organic grain grower. "An increasing number of customers want a story with the food they buy, which provides opportunities to market ecologically sound farming," he said. "The market for sustainably produced goods is there; what we need to do is develop the supply chains that connect the farmer producing those foods to the customer."

Achieve Environmental Benefits

OVER THE YEARS, THE U.S. AGRICULTURAL LANDSCAPE HAS LOST some of its natural features, from native trees along stream banks to fewer vegetative field borders. Yet the complexity and diversity of an ecosystem are at the root of its health.

Ecosystems with greater diversity are usually more stable: they withstand disturbances and can recover better than less diverse systems. The more diverse the plants, animals and soil-borne organisms that inhabit a farming system, the more diverse the populations of pest-fighting beneficial organisms a farm can support. For example, healthy soils enriched and revitalized by rotation and cover crops promote root development and water infiltration, thus are less prone to disease.

In Big Sandy, Mont., Bob Quinn attributes his farm's profitability to its soil-building and pest-thwarting four- to five-year rotations. Its alfalfa, clover and grain fields are thick with predacious lady beetles, and Quinn's last serious insect infestation was 15 years ago. Similarly, the viral diseases and root rots that used to harm the farm's grains are "mostly gone," Quinn said.

Rick Heintzman distributes golden flaxseed to consumers, hospitals and stores, boosting his crop's value to 50 times what flax would bring at the local grain elevator.

"Most people can't believe it," he added. "For many years, people thought I was spraying at night."

With no large livestock operations nearby to supply manure, the farm's primary soil improvement amendment is green manure. In high-moisture years,Quinn sows weed-suppressing alfalfa. In intermediate-moisture years, Quinn and his farming partner plant less-thirsty sweet clover with a companion grain, then disk or plow it under the next season. In very dry years, they sow green-manure peas in the fall or green-manure lentils in the spring, turning them under by the first of June.

"The rotation and soil-building program we have in place allows a great diversity in soil biology, and that's what keeps the pests in place," Quinn said.

In west central Iowa, Ron and Maria Rosmann use primarily a six-year rotation: corn, soybeans, corn, small grains and two years of alfalfa. They plant windbreaks, grassy field borders and native prairie species for pheasants and quail. Generous populations of lacewings and ladybugs indicate that the Rosmanns' commitment to biodiversity is keeping predators in balance with prey.

The Rosmanns have only used one insecticide – *Bacillus thuringiensis* against corn borers – on their farm in the past 20 years.

Community Benefits

COMMUNITIES CAN BENEFIT FROM DIVERSIFIED FARMING ventures. Direct marketing of alternative crops creates local opportunities to process, package or sell new products. Cooperatives provide ways for farmers to jointly invest in processing and marketing.

In the seven Mississippi Delta states, a SARE-funded project helped launch the Delta Enterprise Network (www.deltanetwork.org), an evolving group of farmers, entrepreneurs and others creating new business ventures, cooperatives and policy changes. DEN members assist each other in overcoming barriers to sustainable agricultural enterprises in their region, measuring their successes in sustainable, locally owned, value-added enterprises. They cite recent achievements in fresh-water shrimp, sweet potatoes, aromatic rice and organic soybeans.

DEN unites teams through statewide workshops and conferences. Transforming people and catalyzing groups is one of its fundamental objectives. "Often, people will try to start new ventures on their own," said Jim Worstell, DEN executive director. "We have this myth about the lone entrepreneur establishing businesses, but very seldom does it work that way."

Instead, Worstell said, "You have to have a team."

Community innovation grants offered in SARE's Southern Region link sustainable agriculture to rural community development. For example, a Kentucky project is increasing demand for high-value edamame soybeans through fairs, television programs and personal appearances. The result was a spike in media coverage, consumer demand and grower awareness.

PART 2
Alternative Crops

Marketing Strategies and Profit Potential

MARKETING IS PROBABLY THE MOST IMPORTANT CONSIDERATION when contemplating new crops. While conventional grain producers tend to use the relatively straightforward route of taking the harvested crop to the local grain elevator, diversified growers should not expect convenient delivery with new or alternative crops. Instead, you should consider:

- Researching the market before planting.
- Developing a marketing plan with information on prices, delivery points and sales contracts. (For help, consider *Building a Sustainable Business*. See "Resources," p. 18)
- Creating long-distance sales channels, such as the Internet.
- Establishing relationships with buyers.
- Asking retailers or wholesalers who handle similar food, feed or fiber products if they are willing to test a small quantity of a new product in the marketplace. Many growers also sell successfully to consumers; this approach may involve more cleaning, processing and packaging but often brings a higher profit.
- Receiving endorsement by a third-party verifier that advertises sustainable production systems. The Food Alliance of Portland, Ore., helped Kupers gain access to markets. "Today's consumer desires more knowledge of how his or her food was produced," he said. "My strategy is to market my production system."

Kupers spends most of his time identifying trends and tracking down the opportunities they present. He describes his marketing strategy as "listening, reading, going to the marketplaces, understanding what today's consumer is looking for and then trying to develop a product the consumer will desire." Visits to national pet store chains and discount supermarts convinced him that backyard wildlife feeding was taking off. Kupers now sells his safflower and sunflower seed to a national bird feed manufacturer-distributor in nearby Spokane, rather than paying the freight to ship it 300 miles to a processor.

In South Dakota, Rick Heintzman direct markets his golden flaxseed under the trademarked "Dakota Flax Gold" label. The healthful properties of flaxseed oil – it is high in omega-3 fatty acid, which is believed to help lower heart attack risks – and demand for linen clothing have renewed interest in flax. Heintzman manufactures, stores and distributes the product himself. By selling 1- to 50-pound packages directly to consumers, clinics, hospitals and health food stores, Heintzman boosts his crop's value to $168 per bushel. That's almost 50 times what his flax would bring at the local grain elevator.

In general, carefully written contracts are advantageous for sellers of alternative crops, said Myers. "First and foremost, farmers know they have a market. They also have a price up front, so they can better determine if they can make a profit."

Buckwheat, crambe and sesame typically are grown under contract while canola, sunflowers and nuts normally are not. Contracts are sometimes available for safflower, amaranth, millets and alternative legumes.

Some marketing contracts require delivery of a certain amount of product. If growers fail to produce that much, they may have to purchase the difference, at high cost, from another source to fulfill the contract. For more information, consult *Agricultural Production Contracts* from the University of Minnesota. (See "Resources," p. 18.)

In Regent, N.D., Vern Mayer sells all of his buckwheat, most of his flax and half of his sunflowers under contract. His buckwheat prices go up and down with the price of wheat and his sunflower prices follow soybeans, but his flax prices ripple mildly and more independently.

Compared to conventional growers, Mayer said he is "as profitable – not more – from a strictly cash standpoint. But what encourages me is that I know that what I'm doing is building my soil and reversing the decline in organic matter. There's a certain sense of pride and a certain sense of stewardship that goes along with knowing that every year your land is becoming more productive than it was before."

On the 300-acre Bryant Ranch in south central Idaho, manager Fred Brossy's profits are firmly grounded in his marketing strategy. Almost every one of his organic crops – potatoes, dry beans, wheat, hay and seed crops – "has a home – and a price – before we even plant it."

– Photo courtesy of the Brossys

Choosing alternative crops

WHEN SELECTING ALTERNATIVES, CONSIDER WHICH CROPS ARE a good fit for your climate, soils, marketing skills and proximity to buyers. Diversify your markets as well as your crops. "Don't just grow for one market," said Myers. "If one goes down, another may hold its value better." Consider:

- Finding other producers with experience growing the crops you are considering.
- Checking with university crop extension specialists.
- Posting queries on such electronic listservs as the Sanet-mg discussion group <www.sare.org>
- Visiting web sites developed by the Jefferson Institute, Appropriate Technology Transfer for Rural Areas (ATTRA) or Purdue University (See "Resources," p. 18).
- Applying for grant funding to test alternative crops or other sustainable production strategies through the SARE producer grant program. (See p. 7)

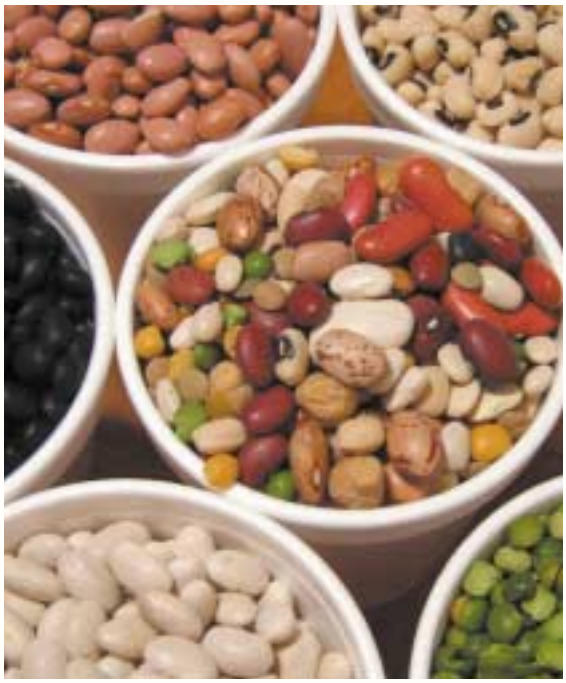
The alternative crops that follow can bring new profits into your rotation. For more information about production methods for each of these crops, see the organizations listed in "Resources," p. 18.

Sunflowers have been improved greatly through recent plant breeding efforts. They provide great niche marketing potential, from human food products to wild birdseed mixes.

– Photo by Rob Myers

Grown on 2 million acres in the U.S., dry edible beans command higher prices than soybeans, in part to cover more care in harvesting and post-harvest handling.

– Photo by Mandy Rodrigues



Pearl millet, grown on 1.5 million acres of U.S. forage lands, is being developed as a feed grain for cattle, swine, catfish and poultry. Its substantially higher protein and lysine contents – when compared with feed corn – have helped drive interest by poultry producers.

In Georgia, where most livestock producers import their grain from the Corn Belt, pearl millet's drought resistance poses a real opportunity. At the University of Georgia in Tifton, researcher Wayne Hanna is researching pearl millet as an alternative crop – and is getting two or three requests a day for seed.

"There's a tremendous amount of interest from cattle producers and wildlife people – and the poultry people are very excited about it," said Hanna, who got a SARE grant in the early 1990s to develop and test grain pearl millet hybrids. With its short maturing season and relative insensitivity to day length, pearl millet can be planted as late as mid-July, following wheat and canola.

Buckwheat and amaranth, which are ***pseudocereals***, or broadleaf plants that are ground into flour like cereal grains, are a "good choice for farmers who feel comfortable with marketing," said the Jefferson Institute's Myers. ***Buckwheat***, grown on 70,000 U.S. acres, commands several times the price of corn. Popular in Japan for "soba" noodles and in Russia for roasted "kasha," buckwheat is sold in the United States for multi-grain breads, breakfast cereals and other products. A small niche market is even developing for pillows stuffed with buckwheat hulls rather than feathers or foam.

Amaranth is produced on only a few thousand acres in the U.S. each year but has earned space on grocers' health-food shelves. Some growers also market it on the Internet. High in protein, fiber and amino acids and low in saturated fat, it is blended with wheat or other flours to make cereals, crackers, cookies, breads and other baked products.

Oilseed crops such as canola, sunflowers, flax and sesame are gaining ground rapidly as the world market expands. Typically at least 40 percent oil by weight – roughly twice as much as soybeans – alternative oilseeds are increasingly popular in edible oils and processed foods as well as for livestock, bird feeds and other non-food uses. Specialty oilseeds like meadowfoam, jojoba, lesquerella and crambe are building commercial markets as environmentally friendly, renewable alternatives to petroleum-based products.

Canola now benefits from the same price subsidies as other commodity crops and is grown on more than 1 million U.S. acres. With its low levels of saturated fats, canola oil has become a staple in many home pantries; in fact, more and more movie theatre chains are using it in their popcorn and domestic demand far exceeds supply.

New government policies that provide oilseed loan deficiency payments are improving the economics of ***sunflower*** production. Supplies are responding, especially in the northern and western Plains states, where

farmers value drought-tolerant crops. The premium market for whole "confectionery" seeds for snacks, granola bars, multi-grain breads or other baking uses about 10 to 20 percent of the crop each year. Most of the nation's 3 million acres, however, are harvested for either vegetable oil or birdseed.

Sesame's typically low yields are offset by a price that can run twice that of sunflowers and soybeans. Its oil is considered more stable than most vegetable oils and its seed – 50 percent oil and 25 percent protein by weight – is often used in baking. Domestic demand for sesame totals 100,000 acres, but only 10,000 to 20,000 acres are grown nationally, mostly in Texas and the Southwest. Sesame can also be grown in the Southern Plains and the lower Midwest.

Flaxseed is made into baked products and linseed oil while flax fibers are used in linen. Once commonly grown in rotation with small grains, it is now grown on about 500,000 acres in the U.S., mostly in north central states, where farmers are looking for fast-growing, cool-season alternative crops.

On their 300-acre livestock and grain farm in northern Illinois, Joel and Adela Rissman feed organically grown flaxseed to their cattle and pastured chickens and turkey. The layers get at least 15 percent flaxseed in their feed and the cattle get a half-pound a day. At those rates, the layers produce eggs with increased levels of omega-3 fatty acids. Kansas State University research shows that feeding flax to cattle just before slaughter results in elevated levels of omega-3 and other beneficial fatty acids in the beef, compared with conventionally grain-fed cattle. Consumption of these fatty acids is thought to lower the risk of heart attacks and strokes in humans. All three of their organic meats are "very profitable," said Joel Rissman, whose farm is 70 miles from Chicago.

As nitrogen-fixing plants, ***legumes*** play an important role in improving soil fertility. In a crop rotation, they can reduce or even eliminate the need for nitrogen fertilizer. Because they convert atmospheric nitrogen into a usable form for plant growth, the resulting higher-protein plant parts enhance the diets of humans and livestock.

A number of domesticated or native legumes have gained acceptance as ground covers or forages. Among cash crops, however, soybeans are the only widely grown legume. ***Dry edible beans*** – including navies, pintos and kidneys – usually are highly profitable, while lentil, dry pea and chickpea sales can be significant in certain markets. Lesser-known legumes include adzuki beans, sweet white lupines, pigeon peas, cowpeas and guar.

At the University of Nebraska's Panhandle Research and Extension Center in Scottsbluff, crop breeder David Baltensperger said spring-planted peas show promise as a legume green manure in Nebraska's dryland wheat-millet-fallow rotations. They produced more nitrogen than fall-planted Austrian winter peas while posing fewer weed problems. They also work well as a forage crop with some nitrogen benefit.

Annual forages are an important potential alternative for producers who want to increase or stabilize their livestock production, particularly those living in areas like the central High Plains, where under-productive, inconsistent permanent pastures often leave livestock operators high and dry. In Nebraska, a SARE-funded study led by beef specialist Burt Weichenthal concluded that whole-farm sustainability increased when irrigated annual forages – such as dryland triticale, wheat, oats, barley, sorghum, sorghum-sudangrass, pearl millet and foxtail – kept cows and calves in good body condition after their dryland pasture stopped producing.

At the University of Georgia, development of grazing-tolerant alfalfa has helped move sectors of the livestock industry toward more efficient, legume-based pasture systems. ***Alfalfa*** plays a key role by fixing nitrogen and filling its edible parts with nutritious protein. In its non-traditional forms – including sprouts for salads and nutritional supplements for human diets – alfalfa sales have increased.

Cotton has long been the only significant fiber crop grown in the United States, aside from forest products. Recently ***kenaf*** – an 8- to 15-foot tall warm-season crop whose dominant use is for office papers – has gained

Want to Research Alternative Cropping Systems?

Through its nationwide competitive grants program, SARE sponsors research and education projects to advance agricultural systems that are profitable, environmentally sound and good for communities. Since 1992, SARE also has awarded small grants for farmers and ranchers to run on-site research experiments.

SARE's portfolio of projects is diverse. Of more than 2,500 projects funded since the program's inception in 1988, many concern alternative crop production and processing systems. Visit www.sare.org to download calls for proposals, check deadlines and learn about grant requirements. (Click on "Project Reports" to access the national projects database; click on "Get a Grant" for application information.) If you do not have on-line access, call (301) 504-5236.

production acreage. Best adapted to regions where cotton is grown, kenaf is being produced on a small-scale in a few southern states and California, although the rapidly growing crop can also be harvested farther north.

Besides paper, kenaf can be processed into rope, twine, bagging, rugs and poultry house bedding. The high cost of building processing plants has been a formidable barrier to kenaf's development.

Alternative Crop Management and Challenges

MANAGING AN ALTERNATIVE CROP PRESENTS DIFFERENT challenges than raising a more traditional crop. Producers trying alternatives may need to tap into a loose network of other growers. Crop-specific organizations or newsletters can provide valuable information. (See "Resources," p. 18)

Always begin with small test plots rather than large acreages of an unfamiliar crop. Planting single rows or small patches of three or more alternative crops – multiple varieties if possible – the first year can yield invaluable information. In the second year, increase the area devoted to testing and perhaps reduce the number of varieties or crops. By the third year, it will be evident which crops and varieties offer the best potential.

Seed selection. For most alternative crops, far fewer seed varieties are available. Often, you need to look far afield from the typical seed sources. Contact crop buyers before purchasing seed to see whether they have contract stipulations for certain varieties. Obtain university variety test data or test a few varieties before planting a large acreage of a single variety of an unfamiliar crop.

Planting. Most alternative crops have not been bred for vigorous seedling growth and thus can be more difficult to establish. As with any crop, careful planting is crucial to its success. For specific planting guidelines, talk to your seed dealer, Extension educator or the organizations listed in "Resources," p. 18.

Although many summer annual crops have a reasonably wide window of planting times, especially in southern regions, winter annual crops must be planted by a specific time to survive. No-till planting is possible with many alternative crops, but mediocre seedling vigor, shallow planting requirements and lack of effective insect control can be challenges for no-till establishment.

Pest management. Pest management for alternative crops depends both on the potential marketplace – organic or conventional – and the availability of pest control tools and strategies. Since few, if any, pesticides are registered for most alternative crops, you may need to rely on organic pest control strategies such as crop rotation or biological control agents.

Harvesting. Alternative fruits and vegetables may require labor-intensive hand harvest. Mechanical harvest of alternative grains and oilseeds is usually feasible with conventional equipment, but equipment adjustments or modifications may be necessary, at least to adjust for seed size.

Some alternative grains have "lodging" or seed shatter problems that make a timely harvest especially important. Since many alternative crops do not dry down evenly in the field before harvest, some air drying of stored grain may be necessary.

Insurance. Although producers can obtain crop insurance for sunflowers and other widely grown alternative species, it is not available for some new crops. USDA disaster payments may sometimes be applied to alternative crops when droughts or other widespread crop losses occur. If federal crop insurance does not cover an alternative crop, producers can apply for "non-insured crop disaster assistance" through their local Farm Service Agency office. See USDA's Risk Management Agency website for more information. <www.rma.usda.gov/policies/>

Challenges to Diversifying Your System

Like any new venture, diversifying your farm will pose some new challenges. However, being prepared and calling on experts for advice (see "Resources," p. 18) can help you surmount most obstacles. Some of the most common include:

- Market development. Expect to conduct substantial research.
- Information on varietal performance, best management practices and post-harvest handling and storage may be hard to find. See "Resources," p. 18 for groups that can help.
- Seed selection may be limited and plant establishment may be difficult.
- Pesticides labeled for alternative crops may not be available. Diverse systems can help break pest life cycles.
- A need to modify or replace equipment. Consider that hand labor may occasionally be the only viable option.
- Harvesting, post-harvest handling and storage considerations, with possible additional costs.
- Locating local businesses and infrastructure for handling, transporting, processing, storing and marketing.
- Price swings for alternative crops. The more diverse your crop list, the better you can buffer your economic risk.
- Contracts. Sometimes contracts are not available for alternative crops every year – or at all.

DIVERSIFIED NORTH DAKOTAN WORKS WITH MOTHER NATURE

In 1976, when Vern Mayer began farming his 4,000 acres in southwestern North Dakota, he used the same wheat-fallow rotation that had become the area's agricultural two-step. "We'd plant only half the land every year," he said. "We were storing moisture in the fallow, but we were burning organic matter."

As the economics of farming tightened, Mayer and his neighbors began planting wheat – and the occasional field of oats or barley – two years out of three. As profits became rarer, most growers eliminated fallow years entirely because it failed to produce sorely needed income.

Mayer didn't simplify his rotation, however; he expanded it. In addition to spring and durum wheats, he now grows corn, flax, buckwheat, sunflowers, Austrian winter peas, crambe and either canola or mustard. With the "minimum-disturbance" tillage system he adopted a decade ago, his soils are never bare – even though his region's brief frost-free periods put the chill on double- and cover-cropping.

"CARAMEL POPCORN" SOIL CONSERVES CRITICAL MOISTURE

Mayer's soil-friendly seeding operation moves his soil just ¾-inch to the side, drops in seed and closes the slot behind it with nary a trace. "To the untrained eye, you can hardly tell the soil has been disturbed, and you haven't destroyed the networks the microorganisms have developed," he said.

Instead, his soil structure is like caramel popcorn: secretions released by the soil microorganisms bind the soil particles together, but the matrix remains so porous that the soil soaks up even heavy thunderstorms. With no streams or even aquifers to tap, Mayer is dependent for moisture on whatever falls from the sky. "In this semi-arid climate, we cannot afford to squander any of it," he said.

Nor does water still run wasted off Mayer's rolling fields, taking precious soil particles with it. "Water erosion used to be a regular fact of life on my farm," he said. "Now it's essentially a non-issue." His healthy soils conserve enough moisture so that he can grow corn for local livestock feeders; after harvest, his corn stalks – like all of his other crop residues – capture rains and snows and hang onto soil.

TO REDUCE PEST PROBLEMS, BE UNPREDICTABLE

Mayer's diverse, minimum-disturbance system also stands up well to potential pest pressures. He "cheaply and easily" controls grassy weeds like wild oats in his grains by switching to broadleaf crops. He treats seed for insects and soil-borne diseases but rarely battles pests after planting, except for cyclical grasshoppers. "That's another reason why crop rotation is really important," he said: "The leaf diseases that attack the wheat are not a problem with some of the broadleaf crops, and vice versa, so by rotating those crops we minimize those problems."

Mayer likes to plant wheat two years in a row. He also

likes to rotate out of wheat for at least two years, but his crops don't follow one another in any pre-established pattern. Mayer aims to be unpredictable, so that Mother Nature can't define – and then defeat – his system. "If you're very predictable in what you do, Mother Nature will find a combination of pests that fit that particular pattern to plague you."

When it comes to markets, it's human nature that makes it hard for Mayer to predict what will happen next. His planting decisions are consequently straightforward: If he can't identify a market for a crop, he doesn't plant it. When he knows he can get an acceptable price for a niche crop like crambe, Mayer gladly grows it. As a rule, though, he focuses on larger markets.

Mayer's Austrian winter peas go to a local buyer of bird feed ingredients, who markets them as homing pigeon food. "It is hard to believe that this industry is large enough to have this kind of demand," he said. Some of Mayer's mustard seed goes to flour millers and some to sausage manufacturers.

MORE PROFITS LIE AHEAD

While prairie soils contained 6 to 8 percent organic matter before white settlers began farming North Dakota, the region's wheat-fallow rotations stripped organic matter down to 2 percent or less. Mayer estimates that he has rebuilt his soil organic matter to about 3 percent and that this enrichment has not come at the expense of his farm's bottom line. He clears as much profit now as conventional farmers do, he said, and he'll soon clear even more. "After 10 years, we've kind of turned the corner in our productivity; in the next 10 years, the changes will be even more pronounced."

"I would never, never go back – absolutely never," Mayer said. "When you see the benefits, I just quite frankly don't understand why everybody doesn't do this."

"Water erosion used to be a regular fact of life on my farm. Now it's essentially a non-issue."

– Vern Mayer
Regent, N.D.

PART 3

Protect Natural Resources, Renew Profits

Cover Crop Use and Management

PLANTING COVER CROPS BETWEEN CASH CROPS PROVIDES A great opportunity for farmers and ranchers to diversify. In addition to improving soil quality, cover crops slow runoff, crowd out weeds, prevent nitrogen leaching, provide habitat for wildlife and beneficial organisms, and can even be grazed or harvested.

"Preventing erosion is perhaps the most obvious soil benefit of cover crops," said Marianne Sarrantonio, a professor of sustainable crop production at the University of Maine, "but providing organic matter is a more long-term and equally important goal." For more information about cover crops, see *Managing Cover Crops Profitably, 2nd Edition*, a detailed reference manual from the Sustainable Agriculture Network. (See "Resources, p. 18.)

Most farmers plant annual grasses or legumes as covers, sowing winter annuals in late summer or early fall to provide cover until the following spring. The grasses scavenge nitrogen and prevent its loss while the legumes add nitrogen to the system; mixing grasses and legumes optimizes rapid soil cover and overall soil improvement.

Although any fast-growing herbaceous plant has potential as a cover crop, seed cost or availability can be limiting. Other challenges include selecting a cover crop that will survive the winter, finding a method of low-cost seeding and developing an efficient way to kill or control the cover before planting the primary economic crop. Some tips for successful cover cropping include:

- Choose covers that are easy to plant and establish and also easy – and affordable – to kill and control.
- Satisfactory varieties should provide reliable and persistent ground cover and have no negative impact on the following economic crop – such as using up too much soil moisture or harboring pests.
- When selecting a legume, make sure it has good ability to provide nitrogen.
- To boost biomass accumulation or improve winter survival, some producers seed a cover crop before the previous cash crop has finished growing. You can overseed a cover crop with a planter early in the growth cycle of a select few crops – such as clover into wheat – and you can seed some other covers during the last cultivation.
- For appropriate crops in your region, consult *Managing Cover Crops Profitably, 2nd Edition* (see "Resources, p. 18).

Because killing or controlling cover crops is a key management consideration, many farmers favor spring oats for their ability to die reliably during cold winters. However, the longer a cover crop survives into the spring, the longer it curbs erosion or traps moisture, so other farmers select a cover that must be killed with herbicide or tilled in before they plant their summer cash crop. In Lancaster County, Pa., Steve Groff rolls down his jungle-like cover-crop mixtures of hairy vetch, rye and crimson clover with a Buffalo rolling stalk chopper before transplanting tomatoes into those 25 acres.

Some farmers prefer to suppress, rather than kill, the cover crop while the cash crop is getting established, then let the ground cover grow gradually as an understory crop. White Dutch clover, for example, provides erosion control, weed suppression, supplemental nitrogen and possible habitat for beneficial insects. This can only be done successfully with ample moisture. Don't jeopardize a cash crop by allowing the intercrop to compete for available soil moisture!

Hairy vetch is a nitrogen-providing powerhouse, a cover crop that "fixes" significant atmospheric nitrogen for the subsequent crop.

– Photo by Rob Myers

Rotational Benefits

WHETHER FARMERS ROTATE THEIR CROPS PRIMARILY FOR economic or environmental reasons, agro-ecosystems clearly benefit from a diversity of crops. Rotational crops curb erosion, improve soil structure, conserve soil moisture and help break up insect, disease and weed cycles. They also contribute soil nutrients: small-seeded

legumes like alfalfa or sweet clover are an economically competitive nitrogen source with commercial fertilizer.

In the long-term Wisconsin Integrated Cropping Systems Trial, launched in 1989, soybeans benefited from the so-called "positive rotation effect" when small grains were added to a traditional corn-soybean rotation. While the corn seemed to need only soybeans to maximize its performance, reduced disease pressure in the longer rotation bumped up soybean yields. Altogether, the expanded rotation returned $43 more per acre, on average, than the original rotation – and its income was more stable. The research was funded in part by a SARE grant. The randomized, replicated studies were conducted on two research farms – in Dane and Walworth counties – representing different climates and soil types.

In southeastern Minnesota, grower Andy Hart, using a SARE grant, provided $7-an-acre incentives to neighbors who wanted to try cover crops of oats, barley or winter rye after harvesting their peas and sweet corn. With most of southeastern Minnesota's 35,000 acres of peas and sweet corn left open to wind and water erosion for up to 10 months each year, Hart was determined to find – and encourage planting of – a better rotation.

Not only did the participating neighbors continue using cover crops, but other farmers in the area began adopting the practice as well. "They see the advantage of cover crops," said Hart. So does Lakeside Foods, a local canning company that is encouraging their use among growers.

Soil Benefits

DIVERSE ROTATIONS IMPROVE SOIL AND, THUS, CROP YIELDS. Rotations that keep crops or their residues in the ground longer provide more protection from wind and water erosion. Fields planted in small grains or hay are less vulnerable to erosion than those planted in row crops.

You can enhance the beneficial effects if you also reduce tillage. Surface residue moderates soil temperature and conserves soil moisture. Residue also builds more soil organic matter, which improves water-holding capacity and boosts populations of beneficial soil microorganisms. On the other hand, excessive tillage promotes erosion, dries soils and destroys soil structure as well as the food sources on which soil organisms depend.

In an Ohio State University study, a three-year reduced-tillage rotation of corn-soybean-wheat-hairy vetch compared favorably with the typical two-year corn-soybean system. Both were superior to the corn monoculture system, resulting in less soil erosion, less nitrate pollution and a better distribution of labor. The use of hairy vetch contributed at least 25 pounds of nitrogen per acre to the subsequent corn crop. The benefits of the three-year system can be attributed to a combination of factors, including greater diversity of crops, soil-building cover crops and small grains, and reduced tillage.

Farmers can use reduced-tillage practices in many rotational strategies. Excessive tillage promotes erosion, dries soils and destroys soil structure as well as the food sources and micro-niches on which beneficial soil organisms depend. Reduced tillage slows the turnover of nutrients, encourages diverse communities of beneficial insects and leaves temperature- and moisture-moderating quantities of crop residues on surfaces.

In Springerton, Ill., Ralph Upton received a SARE grant to test cover crops in his corn-soybean-wheat rotation. He wanted to learn whether cover crops like buckwheat, hairy vetch, rye, rye grass and sunnhemp would penetrate his compacted soil. Results have been promising. The rye grass, into which he plants corn or soybeans, put down roots 52 inches deep. The roots of his cereal rye, into which he plants soybeans, extend 48 inches below the soil surface. Upton also has measured his hairy vetch roots at 43 inches.

Comparing his fields to a neighbor's, he found that a probe went 10 inches into his ground compared to just 3 inches next door. The benefits extend to his crops, too.

"We're getting great root systems," he said. "We had corn roots down 54 inches deep where we had the cover crop and our soybeans will go down 42-43 inches."

In Wisconsin, soybeans benefited when small grains were added to a corn-soybean rotation. Reduced disease pressure bumped up soybean yields, returning $43 more per acre.

Rotations that maintain crop residue on the soil surface reduce erosion, conserve water and build soil organic matter. Using a kit, Wendell Jones, a district conservationist with USDA's Natural Resources Conservation Service, measures residue on an Iowa City, Iowa, farm.

– Photo by USDA-NRCS

Pulse crops like peas can "fix" nitrogen for a subsequent crop. After a 2001 pulse crop field day hosted by the University of Nebraska, west Nebraska farmers formed the High Plains Dry Pea Growers Association so farmers growing pulse – or leguminous – crops in the area could share information.

– Photo by Eric Nielsen

With crops able to pull moisture from subsoils, Upton has seen yield increases of 3 to 6 bushels per acre, and he expects more benefits to come. "I think the benefits of this project will be very good in the long run," he said.

Pest Management

DIVERSE, PEST-RESILIENT FIELDS CONTAIN RICH SUPPLIES OF above- and below-ground beneficial organisms. Such organisms can:

- antagonize insects and nematodes
- inhibit growth of disease organisms
- boost crops' natural defenses
- suppress some weeds by exposing weed seeds to more predators and decomposers
- release nitrogen more slowly, giving larger-seeded crops a head start in spring

Crop diversity can lower input costs, studies show. In an Ohio State University study, average per-acre costs for herbicides and insecticides were only $20 for a corn-soybean-wheat-hairy vetch rotation, compared with $36 for a typical corn-soybean system. In Alabama, scientists found that two years of switchgrass provided equivalent root knot nematode control as continuous peanuts with nematicide. In Maryland, two years of a sorghum-sudangrass summer crop, combined with poultry litter, effectively stemmed root knot nematodes in potatoes.

For more information on the many benefits of diversification to pest management, see SAN's *'Naturalize' Your Farming System: A Whole-Farm Approach to Managing Pests*. (See "Resources," p. 18)

Reduced Water Use

IN THE NATION'S DRIER REGIONS, MANY FARMERS USE rotational strategies to conserve soil moisture or harvest a crop despite drought. Many, in fact, frequently fallow their land – leaving it idle to accumulate moisture for the following crop. In 1997, 22 percent of the nation's wheat was grown in wheat-fallow rotations. Fallow periods, however, expose soil to wind and water erosion and organic matter loss. Moreover, a more diverse rotation can improve yields.

A long-term study at the University of Wyoming found that partially replacing fallow with Austrian winter peas improved water use efficiency, added nitrogen to the subsequent wheat crop and provided a nutritious forage for lambs. Researchers direct-seeded peas into wheat stubble in late summer. In late spring, they turned lambs out to graze the peas for three weeks, resulting in better gain – and profits. Planting peas every fourth year increased net return per acre from $7 to $13, averaged over the four years. Moreover, while summer fallow generally only saves 20 to 40 percent of precipitation, the peas used rain or snow otherwise lost to runoff and soil evaporation.

University of Wyoming researcher Jim Krall praises the potential for the winter-hardy medic *Medicago rigidula*. In winter annual pastures alternating with wheat, *M. rigidula* reseeds itself reliably in fall and has produced more than 3,700 pounds of dry matter per acre by mid-May.

Proso millet needs the least amount of water of any cereal. Shallow rooted, it doesn't tolerate drought as much as it evades it by maturing in 60 to 90 days after planting. Its low straw-to-grain ratio also contributes to its water-use efficiency. In moisture-limited areas of the central Great Plains, winter wheat-proso-fallow rotations provide an extra cash crop every three years. The alternative oilseeds sunflower, canola and crambe – one of the richest known sources of erucic acid, used in industrial lubricants – are all feasible in dryland rotations with winter wheat in that region.

In northern Idaho, condiment mustard's 4-foot effective rooting depth extracts more soil moisture than peas or lentils, which is helpful in low-rainfall years. All three rotation crops are very good at breaking up disease, insect and weed cycles in cereal crops, but mustard's more plentiful residue does a better job of protecting erosion-prone winter soils: studies show

it maintains greater than 50 percent surface cover, compared with 30 percent for pea and 25 percent for lentil.

Encouraging prices have prompted "steady adoption" of condiment mustard by the region's farmers, said University of Idaho extension specialist Stephen Guy.

Water Quality

In diversified systems that border sensitive waterways, riparian buffers strips comprised of trees, shrubs and grasses intercept sediment, nutrient and pesticide runoff. Forested riparian buffers help to reduce stream bank erosion, protect water quality, enhance aquatic environments and provide wildlife habitat.

According to USDA's Natural Resources Conservation Service (NRCS), buffer strips can remove up to 50 percent of nutrients and pesticides, up to 60 percent of certain pathogens and up to 75 percent of sediment that might otherwise leave a field.

"In some cases, installing buffers helps producers comply with environmental laws and regulations," said Steve Carmichael, NRCS state resource conservationist in Louisiana. "It offers an effective way a producer can demonstrate concern for the environment and a commitment to good land stewardship."

USDA offers financial and cost-share assistance to producers interested in planting and maintaining buffers through the Conservation Reserve Program and the Environmental Quality Incentives Program. See <www.nrcs.usda.gov/programs/>

PART 4
Agroforestry

AGROFORESTRY INTEGRATES TREES AND SHRUBS WITH CROP or livestock operations to create more diverse farms, ranches and communities. Research and field demonstrations of a wide range of practices from around the country prove that trees and shrubs provide numerous economic and environmental benefits.

Those benefits have not been lost on farmers and ranchers, who are employing agroforestry strategies in increasing numbers, said Greg Ruark, director of USDA's National Agroforestry Center (NAC) in Lincoln, Neb. For more information about NAC, see p. 19.

"Small producers can readily integrate many agroforestry practices into their existing operations and realize an economic benefit, both in terms of added income and reduced operating costs," he said.

Alley Cropping

PLANTING TREES AND ROW CROPS SIDE BY SIDE IN STRIPS, or alleys, offers great profit potential. By growing cash crops simultaneously with a long-term tree crop, farmers can earn annual income while the trees mature. Hardwoods like walnut, oak, ash and pecan produce high-value logs for lumber or veneer.

While configuration can vary greatly, trees usually are planted in single rows, widely spaced. The spaces allow room for the annual crops as well as easy access for farm machinery. You can grow hay, wheat, soybeans and corn, as well as many vegetables and such specialty crops as St. John's Wort, a popular medicinal herb. Consider planting a ground cover, such as a grass-legume mix, under the tree rows in a strip extending to the width of the tree crowns.

When the trees are small, the annual row crops occupy most of the field and provide virtually all of the income. Most nut crops begin to generate income within five to 10 years. As the trees grow larger and the level of shade increases, some producers plant specialty crops that require partial shade, like ginseng or goldenrod, for an added return.

Alley cropping allows a producer to grow two complementary crops – an annual crop like hay amid extremely profitable hardwoods like walnut.

– Photo courtesy of the National Agroforestry Center

By reducing evaporation, windbreaks (left photo) can improve yields. Specialty crops like shiitake mushrooms, (right) grown in the forest understory, fetch optimal prices while helping maintain a natural forest environment.

– Photos courtesy of the National Agroforestry Center

Alley-cropping systems that match the light, water and nutrient requirements of both the tree and the agricultural crops lower economic risks by diversifying farm income while providing erosion control, wildlife habitat and a diversity of niches for beneficial insects.

Windbreaks

THE USE OF TREE STRIPS TO CONTROL WIND EROSION HAS been promoted in the United States since the "dust-bowl" era of the 1930s. Many of the early windbreaks have since been cut down or have lost their effectiveness due to age.

Research has shown, however, that windbreaks provide agricultural benefits that go beyond erosion control. On a per-field basis, crop yield is almost always greater because windbreaks reduce crop transpiration and field evaporation losses.

Livestock operators can use windbreaks to provide shelter for animals. Thanks to several rows of windbreaks, a North Dakota producer maintained all of his cows during a late-winter blizzard that caused other ranchers to lose 40 to 60 percent of their herds.

Tree strips that also include grasses and legumes provide habitat for wildlife, beneficial insects and pollinating bees. Windbreaks can even help communities with harsh winters better handle the dangerous impact of winter storms and significantly reduce home heating costs.

Producers in Washington's Columbia Basin planted windbreaks to protect more than 35,000 acres of fruit orchards from wind damage, according to the NAC. One row of poplar trees planted seven to 10 feet apart provides about 600 feet of protection. Delicate apple trees benefit when fruit- and limb-damaging winds are reduced in orchards.

Silvopasture

MANY PASTURES INCLUDE AN OCCASIONAL TREE THAT EITHER grew inadvertently or is a remnant from earlier land management activity. What sets silvopasture apart is the purposeful integration of trees and pasture to gain optimum economic return. A variety of tree arrangements can create effective silvopasture systems, with animal stocking density dependent on soils, climate, and the selected tree and pasture plant species.

Recent research demonstrates that many forage grasses grow as well or better under up to 50 percent shade as they do in an open pasture. Silvopasture systems use the same acre of land for livestock grazing and growth of high-value timber. Livestock – from cattle to hogs – benefit from the shade and shelter trees provide.

Forest farming

CULTIVATING HIGH-VALUE SPECIALTY CROPS UNDER A FOREST canopy that has been modified to provide the appropriate amount of light and micro-climatic conditions can bring very good returns. Called forest farming, this practice maintains the forest's ability to stabilize soil, provide wildlife habitat, and cycle water and nutrients while modifying the forest understory. Growers adjust the amount of light allocated to the understory by thinning, pruning or adding trees. Consider growing ginseng, shiitake mushrooms and decorative ferns for medicinal, culinary or ornamental uses in a number of markets, including directly to consumers.

Field borders

FIELD AND ROADSIDE BORDERS ARE AN OFTEN-OVERLOOKED area to add plant diversity from mixed stands of native perennial plants. They provide habitat for beneficial insects and birds that prey on insect pests. The borders also help prevent wind and water erosion and help stop snowdrift. Perennial borders do not require mowing and – once established – easily outcompete annual weeds. Native perennials also add to the appearance of the landscape. Local NRCS offices can recommend an appropriate mix of plants for your area as well as establishment methods.

PROFILE

PROFITABLE PECANS WORTH THE WAIT IN MISSOURI ALLEY-CROPPING SYSTEM

On 12 acres of flood plain near Chiftonhill, Mo., Dan Shepherd helped his dad plant the family's first pecan trees nearly three decades ago. Eighteen years later, the trees produced their first harvest. "It takes a special type of person to be in the orchard business," said Shepherd. "You have to have staying power."

Shepherd planted 200 more acres of pecans in the early 1980s and another 50 or so in the late 1990s. The trees in his 1980s planting won't reach full production until 2008 or 2010.

"You have to look way down the road," he said." But at the end of that road lies a crunchy pot of golden nuggets. Shepherd's pecans—more profitable than any other nut crop he could grow—are bringing $1 a pound and yielding 1,000 pounds an acre. After costs, each acre clears $600.

INCOME FROM ALLEY CROPS MAKES THE SYSTEM WORK

Shepherd's orchard began paying its own freight even before the first nut fell from the first tree. In the 40-foot rows between his trees, he rotated wheat – which he grew – and field corn and soybeans – which a lessee grew – for more than 15 years. Since then, Shepherd has planted bluegrass for hay in those narrowing rows. "I get $75 worth of hay an acre, and I have to mow it anyway," he said.

The bluegrass is beautifully compatible with the pecans. Its shallow root system doesn't steal moisture from the trees, and its fine, smooth mat makes an easy bed from which to pick up nuts. Another plus in Shepherd's lowland location: His bluegrass doesn't mind floods.

Pecans aren't the only trees on Shepherd's north central Missouri farm. On another 125 scattered acres, he grows white oaks that he logs about every five years. A half-dozen acres of walnuts, planted in the mid-1970s, will be ready to cut in another quarter-century.

SO MANY ENTERPRISES, SO LITTLE TIME

In the meantime, the energetic Shepherd is doing much more than watching his trees and bluegrass grow. While his wife, Jan, operates a bustling farm-based store that features their products, Shepherd sells buffalo meat, occasionally raises cull beef cows for the hamburger market and has become the nation's largest producer of eastern gamagrass seed – a lush, native grass that is in demand by wildlife managers and cattle and sheep producers.

Every 10 or 15 years, when seed yield starts to decline in a gamagrass field, Shepherd will rotate into what he considers a frankly tedious rotation of corn, soybeans and wheat. "I don't care for row crop farming," he said. "I don't think I would have liked farming without the trees. When you have pecans, gamagrass, buffalo and a store, you've got stuff to do all year round."

PART 5

Strengthen Community, Share Labor

WHEN FARMERS DIVERSIFY, THEY CREATE OPPORTUNITIES FOR their communities to benefit. One way is grower to grower: Teaming up to market alternative crops can spread the workload, while co-buying seed or equipment can lower costs. Sharing knowledge, farm to farm, can enhance crop performance. Some farmers even share labor.

Sustaining communities

THE CONCEPT CAN BE RIGHT AND THE TIMING CAN BE PERFECT, but without community buy-in, Ron Doetch doubts that agricultural innovations will be adopted.

Indeed, in Midwestern communities where a "small-grains initiative," coordinated in Wisconsin and Illinois by the Michael Fields Agricultural Institute (MFAI), persuaded a single grower to include oats, barley or wheat in his former corn/beans rotation, that grower remained a solo adopter several years later. But where several growers supported one another in diversifying from corn/beans – like in DeKalb, Ill., and Burlington, Wis., – the concept of adding small grains crept, then leapt, from farm to farm.

At MFAI, executive director Doetch believes that community buy-in was grounded in intensive and extensive field demonstrations of alternative crops, such as hard red winter wheat, which produces a baking-quality flour. Interest grew among farmers who had previously raised soft white wheat. At the same time, private elevator operators perked up because demand for hard red winter wheat is greatest in the Midwest and eastern U.S.

STRENGTHENING TIES AMONG FARMERS IN NORTHERN MAINE

Catherine Albert has a New Englander's fierce commitment to community. Albert, whose forebears settled in New Hampshire in the 1600s, farms in Madawaska, Maine – a stone's throw from the Canadian border – on the 214-acre family farm homestead of her husband, Ben, and his mother, Kathren, in Aroostock County.

With soil temperatures that don't warm for planting until mid-May and frosts that start nipping crops in late August, northern Maine doesn't overwhelm its small farmers with planting options. However, Albert, who excels at pulling the community together, has made diversifying northern Maine crop options her latest priority.

Her new venture: developing Maine-grown poultry feed.

"There's a very strong interest in buying local products in our state," she said. "I buy my maple syrup from somebody in the next town. As we all realize, to survive as farmers, you need to support other farmers."

NEED ORGANIC POULTRY FEED? MAKE YOUR OWN

Catherine teaches forestry part time at the University of Maine at Fort Kent, and Ben works at the local paper mill. Together, they raise beef cattle, laying hens, turkeys, timber and conventional and organic grains, expanding their farm with tillable rented acreage. They sell their turkeys locally at Thanksgiving, and – like the milkman of yore – Catherine delivers farm-fresh eggs to their customers weekly.

But when the Alberts were sourcing organic feed for their soon-to-be-organic chickens, the closest suppliers they found were in Vermont and Quebec. They decided to produce their own.

After extensive research and testing, funded by a SARE grant, Catherine and University of Maine animal nutritionist Linda Kling developed feed formulas for the layers, broilers and turkeys. The process was not without challenges: Field corn wouldn't grown in the cold climate. Barley was no good, either—to be digestible to chickens, it needs an added enzyme. Instead, the women based their formula on hull-less oats. The formula also includes protein-rich soybeans, which Albert hopes she'll soon be able to grow. She supplements the feed with vitamins imported from Wisconsin, and, to ensure the yolks will be a "real yellow" that corn feed puts in eggs, Albert spent six months finding a certified organic marigold.

FELLOW PRODUCERS CONFIRM THE NEED FOR FEED

The Alberts will license, mix and sell their organic poultry feed to other Maine growers through their new business, which the couple calls Northernmost Feeds. Albert is optimistic: Surveys of the Maine Alternative Poultry Association and the Maine Organic Farmers and Gardeners Association revealed "strong interest from people who had 15 to 25 birds all the way up to people who raise 1,000 birds," she said.

"There are more than enough people in the state who are interested in Maine-based poultry feed to make this feasible."

It isn't just the organic poultry producers who will benefit, Albert notes. "This is an ideal opportunity for organic farmers in Aroostock County. They need to find economically viable organic rotation crops. You can't grow potatoes every year on the same piece of land."

Nor, of course, can you grow oats on the same acres every year, so Albert plans to rotate with green-manure clover and eventually with short-season soybeans. The Alberts' beef cows provide the farm's fertilizer.

Albert looks forward to the day when Northernmost Feeds is large enough to source all of its inputs locally. She's put out the word to organic potato growers that she'll buy their organic oats.

The Alberts hope the feed business will provide jobs for other members of their community, where population has declined due to lack of employment opportunities. Farming in Maine's northernmost county remains their top priority: "It comes down to what's in your blood," Albert said.

"Midwest farmers have a logistical advantage over the western Kansas farmers" where the wheat traditionally had been grown, Doetch said, and now enjoy a premium price from the elevators. "Now they're outbidding each other to buy these farmers' wheat."

A farmer-researcher-industry coalition has created a web site <www.oatlink.com> that disseminates information to growers and links them with handlers and processors of value-added grains.

"Diversifying crops diversifies opportunities for communities," said Doetch. Not only does it spark new businesses, it keeps more agricultural dollars at home. For many crops like wheat, for example, seed can be grown locally. Cleaning, warehousing and distributing can all be done locally, too.

A crop that's harvested at a time when money isn't normally rolling in can also put "a little jingle" into growers' – and their towns' – pockets, Doetch notes. While the initiative's Wisconsin and Illinois producers are loathe to spend anticipated corn or soybean dollars until their operating loans are repaid in fall, their midsummer wheat earnings buy discretionary items and maybe even a short family vacation while school is still out. "I always say that July money is worth a lot more than other money," said Doetch.

Also Consider High-Value Specialty Crops...

WHILE MANY ALTERNATIVE CROPS FIT WELL INTO ROTATIONS with traditional commodity crops, high-value specialty crops fit particular farm niches.

Specialty crops have a higher potential return per acre than commodity crops, but their intensive labor and management requirements usually restrict them to small acreages. They can be a good option for both small-scale producers and for larger farmers who can make time for them, however a number of them are perishable, needing special handling, storage and transportation and even more marketing.

Examples of high-value specialty crops include mushrooms, garlic, medicinal plants, nuts, woody ornamentals, cut flowers, native wildflower seed, and herbs and botanicals. Rare or unusual fruit and vegetable varieties often are considered specialty crops and may bring a higher price than more common horticultural crops.

Garlic Growers Share the Work and the Fun

SOMETIMES, EFFECTIVE COOPERATION SIMPLY INVOLVES another two or three growers. In Sussex County, N.J., garlic grower Richard Sisti decided to start "share-cropping" with other garlic growers to share laborious planting and harvesting and to consolidate the specialty crops for market efficiencies.

"The time saved by using the share-cropping model was immense," said Sisti. At his farm, 4,400 cloves were planted in just four to five hours; at another, 84 pounds were put in the ground in four half-days. "The biggest time savings is that you've committed to doing one thing at one time; you put the time into it and it's done." By the project's second year, two farmers were sharing a mechanical planter.

Harvests are split evenly among the share-croppers, with some garlic saved for seed and some contributed to a Sussex County Master Gardener program that makes garlic braids, swags and 15-pound wreaths.

These value-added items earned raves at the first Garden State Garlic Gathering – an event that Sisti and fellow organizers will expand to two days to accommodate spillover crowds of garlic aficionados. At the gatherings, garlic growers from New Jersey and Pennsylvania sell their garlic, seed and vinegar. They also encourage other farmers to try growing the crop and fill the shopping bags of excited consumers willing to pay six times more than they do at the supermarket.

A support-and-discussion group, web site and newsletter – all intended to help growers "avoid the pitfalls of working in isolation" – are being readied for launch. "When you're working by yourself, you spend a lot of time reinventing the wheel," Sisti said. Working together has even attracted a buyer for the group's garlic curls or scapes – flowering stems of the garlic plant that are snapped off for stir-frying, sauteing and adding to pesto.

Participants at a field day hosted by the Thomas Jefferson Agricultural Institute in Columbia, Mo., learn more about buckwheat, one crop in a host of profitable diversification options. Public education programs increase networking among producers trying new enterprises.

– Photo by Ellie Gardner

Resources

Jim Stute of the Michael Fields Agricultural Institute inspects malt barley used to expand crop rotations on 40 Wisconsin farms as part of a successful profit-generating diversification effort. The group received prices 25 percent above the state average for oats, barley and wheat as part of the initiative, partly funded by SARE.

– Photo by Ron Doetch

GENERAL INFORMATION/ RESOURCE CENTERS

Sustainable Agriculture Research and Education (SARE) program
(301) 504-5230; san@sare.org; www.sare.org. Studies and disseminates information about sustainable agriculture via a nationwide grants program. See research findings at www.sare.org/projects.

Appropriate Technology Transfer for Rural Areas (ATTRA)
(800) 346-9140 English, (800) 411-3222 (Spanish); http://attra. ncat.org. Provides information and other technical assistance to farmers, ranchers and educators involved in sustainable agriculture. See especially "Alternative Agronomic Crops," by Patricia Sauer and Preston Sullivan, an overview of the considerations involved in selecting, cultivating and marketing alternative agronomic crops, http://attra.ncat.org/field.html.

Alternative Farming Systems Information Center (AFSIC)
(301) 504-6559; afsic@nal.usda.gov; www.nal.usda.gov/afsic. Specializes in identifying and accessing information related to alternative agricultural enterprises and crops as well as alternative cropping systems.

Jefferson Institute
(573) 449-3518; www.jeffersoninstitute.org. A nonprofit agricultural education and research center that provides help on growing and marketing alternative grains, oilseeds and other specialty crops.

Sustainable Agriculture Network (SAN)
(301) 504-5236; san@sare.org; www.sare.org. As SARE's national outreach arm, SAN offers farmer-ready information through electronic and print publications. It helps farmers, ranchers, Extension educators and other agricultural professionals learn more about applying sustainable agriculture principles and practices in farm settings across the U.S.

"Tilling the Soil of Opportunity," a NxLevel™ course for agricultural entrepreneurs, is aimed at those who are thinking about starting an agricultural based venture that is not tied to large-scale commodity production. This 10–session course is taught by specially trained instructors. To find out if NxLevel is offered near you, go to www.nxlevel.org/Pages/states.html

PUBLICATIONS FROM THE SUSTAINABLE AGRICULTURE NETWORK

(To order SAN books, go to http://www.sare.org/publications/order.htm where you can download an order form. To order by credit card, or for information about bulk discounts and rush orders, contact (802) 656-0484; sanpubs@uvm.edu.

Building Soils for Better Crops, 2nd edition
$19.95 + $3.95 s/h. This 240-page book contains detailed information about soil structure and the management practices that affect soils.

Managing Cover Crops Profitably, 2nd edition
$19 + $3.95 s/h. This is the most comprehensive book ever published on the use of cover crops to sustain cropping systems and build soil. Provides all the information needed to build cover crops into any farming operation.

Building a Sustainable Business: A Guide to Developing a Business Plan for Farms and Rural Businesses
$14 + $3.95 s/h. Helps today's alternative and sustainable agriculture entrepreneurs transform farm-grown inspiration into profitable enterprises. Sample worksheets illustrate how real farm families set goals, determined potential markets and evaluated financing options – and help the reader develop a detailed business plan.

'Naturalize' Your Farming System: A Whole-Farm Approach to Managing Pests
This free 20-page bulletin helps producers – and the educators who work with them – design farm-wide approaches to controlling pests. Download a printable version from www.sare.org/publications or contact san_assoc@sare.org or (301) 504-5236.

OTHER PUBLICATIONS

Agricultural Production Contracts University of Minnesota Extension. Legal considerations involved in agricultural production contracts. www.extension.umn.edu/distribution/businessmanagement/DF7302.html

Alternative Field Crops Manual
University of Wisconsin-Extension, University of Minnesota Center for Alternative Plant & Animal Products and Minnesota Extension Service. Comprehensive source of production information on nearly 50 alternative agronomic crops adapted to the upper Midwest. www.hort.purdue.edu/newcrop/afcm/index.html.

Biodiversity and Pest Management in Agroecosystems
2nd edition, by Miguel Altieri and Clara Nicholls. Entomo-

Afternoon casts long shadows on a field of small grains, safflower and warm-season grasses at Karl Kupers' diversified farm in Harrington, Wash.

– Photo by Phil Rasmussen

logical aspects and the ecological basis for the maintenance of biodiversity in agriculture. $49.95 (soft cover), $79.95 (hard cover) from The Haworth Press, Inc., 1-800-HAWORTH; getinfo@haworthpress.com; www.hayworthpress.com.

Inside Agroforestry
The National Agroforestry Center's quarterly newsletter covers the latest agroforestry news and information. See the summer/fall 2003 issue to read about SARE's partnership with NAC. (402) 437-5178 or http://www.unl.edu/nac/ia.html

"Production Practices for Major Crops in U.S. Agriculture, 1990-97"
September 2000, USDA Economic Research Service, www.ers.usda.gov/publications/sb969

WEB SITES

www.wcc.nrcs.usda.gov/watershed/products.html
USDA Natural Resources Conservation Service Conservation Buffers web site. Provides a variety of handbooks and technical notes for farmers and ranchers on the use of conservation buffers.

www.sarep.ucdavis.edu/ccrop University of California Sustainable Agriculture Research and Education Program web site includes a cover crops database that describes the management and effects of 32-plus species of cover crops. Readers can view more than 400 different cover crop images.

www.cedarmeadowfarm.com This permanent cover cropping systems web site is maintained by Pennsylvania grower Steve Groff.

www.oatlink.com
Oatlink is a consortium of farmers, grain handlers, processors and university researchers striving to connect the production, handling and processing of value-added grain. Download the "Farmers Guide and Resource to Quality Small Grain Production," www.oatlink.com/bugrep.htm.

www.deltanetwork.org
Delta Enterprise Network is an evolving group of farmers, entrepreneurs and others who assist each other in overcoming barriers to sustainable agricultural enterprises in the seven Delta states.

ORGANIZATIONS

Center for New Crops & Plant Products
Purdue University; (765) 494-1329; www.hort.purdue.edu/newcrop. Subscribe to Purdue's New Crop Discussion Group or order Purdue's New Crop Compendium CD-ROM, a searchable resource of new, specialty, neglected and underutilized crops. (Also available by calling (800) 830-0269.) $75 + $5 s/h.

Michael Fields Agriculture Institute
(262) 642-3303; mfai@michaelfieldsaginst.org www.michaelfieldsaginst.org
A public nonprofit education and research organization committed to promoting resource-conserving, ecologically sustainable and economically viable food and farming systems.

National Agroforestry Center
USDA Forest Service and NRCS; (402) 437-5178; www.unl.edu/nac
Develops and delivers technology on a broad suite of agroforestry practices to natural resource professionals and conducts research on how to design and install forested buffers to protect water quality. The center publishes "Inside Agroforestry" newsletter and fact sheets.

University of Missouri Center for Agroforestry
(573) 884-2874; umca@missouri.edu; www.missouri.edu/~umca
An interdisciplinary research and teaching program on forestry, fisheries and wildlife, entomology, plant pathology, agronomy, animal science, agricultural economics, rural sociology and horticulture.

The Land Institute
Salina, Kansas. (785) 823-5376; theland@landinstitute.org; www.landinstitute.org
Offers a number of books and other publications on a perennial plant system of agriculture and the role of diversity in the agricultural landscape.

The Leopold Center for Sustainable Agriculture
Iowa State University. (515) 294-3711; leocenter@iastate.edu; www.ag.iastate.edu/centers/leopold. Conducts research into the negative impacts of agricultural practices and assists in developing alternative practices.

SARE works in partnership with Cooperative Extension and Experiment Stations at land grant universities to deliver practical information to the agricultural community. Contact your local Extension office for more information.

This bulletin was developed by Marlene Fritz and Rob Myers. This publication was funded by USDA-CSREES under Cooperative Agreement 2002-47001-01329 for the Sustainable Agriculture Network.

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Defines sustainable agriculture by providing snapshots of different producers who apply sustainable principles on their farms and ranches.

_____ Transitioning to Organic Production, 32 pp.
Lays out many promising conversion strategies, covering typical organic farming production practices, innovative marketing ideas and federal standards for certified organic crop production.

_____ Meeting the Diverse Needs of Limited Resource Producers, 16 pp.
A guide for agricultural educators who want to better connect with and improve the lives of farmers and ranchers who are often hard to reach.

_____ Marketing Strategies for Farmers and Ranchers, 20 pp.
Offers creative alternatives to marketing farm products, such as farmers markets, direct sales, on-line sales and cooperatives.

_____ Profitable Pork, Strategies for Hog Producers, 16 pp.
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_____ Profitable Poultry, Raising Birds on Pasture, 16 pp.
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_____ Building Soils for Better Crops, 240 pp., $19.95
How ecological soil management can raise fertility and yields while reducing environmental impact.

_____ Managing Cover Crops Profitably, 212 pp., $19
Comprehensive look at the use of cover crops to improve soil, deter weeds, slow erosion, and capture excess nutrients. (Available on CD-Rom for $10; Order both CD and book for only $24.)

_____ Steel in the Field, 128 pp., $18
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_____ The New American Farmer, 160 pp., $10
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