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Farm & Home **RESEARCH**

South Dakota State University • College of Agriculture & Biological Sciences • Agricultural Experiment Station



cow-calf business

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The cover:

Photo by South Dakota Tourism. See page 4 for story on cow-calf operations.

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Director's comments

BY KEVIN KEPHART

Director, South Dakota Agricultural Experiment Station

We are up to the challenges

There is a lot riding on the cow-calf industry in South Dakota. Many people view beef production as one of the low apples that can be easily reached and picked from the value-added tree.

There is good reasoning behind this viewpoint. In round figures, we export half of our feeder calves and half of our feed grains. Meanwhile, our potential economic value is captured in other states. The quality of our cattle is renowned, further underscoring the importance of our cow-calf producers.

I think the article on Dr. Barry Dunn's research carries a lot of good news for cow-calf operations in South Dakota. Some of the practical take-home messages of this article are:

- We should not focus solely on production indicators or net income.
- Profitable managers had a common theme; they worked to maximize key production components within the constraints of their resources. In essence, they were not over-invested.
- One key production component seems to be weaning rate.

The interesting finding was that the successes of cow-calf operations were independent of the size and location of the operation. At the very least, this article is quite thought provoking. Some may conclude that East River and West River cattle producers have comparable opportunity for success ... and comparable risk for failure. My conclusion is that bigger is not always better and that increased value can be captured from our herds.



Kevin Kephart

As important as our cow-calf operations are, there's one resource that is unquestionably more important, our children. This issue of *Farm & Home Research* carries good news about our kids too. The South Dakota Cooperative Extension Service has been a national leader in the Character Counts! program. Tuning in young people to the importance of personal behavior has reduced dishonesty, alcohol abuse, vandalism, and intolerance.

I'm also encouraged that an increasing number of people are growing horticultural crops in our state. The article entitled "Grape Growers" has a lot to offer any interested reader. Science, history, and learning through the examples and efforts of others blend well and will hopefully spark more interest in South Dakota's new grape industry.

Finally, this issue includes a story on a scientist's work on a huge challenge for the livestock industry. The U.S. Environmental Protection Agency plans to implement new rules on nonpoint source pollution that will impact the state's animal feeding operations. One component of the new rules is to focus on the discharge of phosphorus through livestock manure. Improved efficiency in the management of phosphorus is now an added challenge to the livestock industry. Enhanced retention of dietary phosphorus is an approach presented in this issue.

Agriculture has enormous challenges to face. Answers to these challenges can be discovered, however. I hope this issue of *Farm & Home Research* shows our proactive approach in finding solutions to just a few of agriculture's challenges. ♦

What it takes to prosper in the

cow-calf business

M

ost other businesses in the U.S. average a 10% return on assets. Cattle producers average 2%.

In the past 30 years, other parts of the economy prospered. Over half of cow-calf producers in South Dakota and neighboring states went out of business.

These are actual numbers that Barry Dunn, Extension range livestock production specialist at SDSU, can back up with research.

Why are cow-calf producers having such a hard time?

“You hear a lot of reasons,” Dunn says. “The decline in demand for red meat. Too few exports of beef. Too many imports of beef. Vertical integration in the industry. Overproduction. Property taxes too high, restricted federal-land grazing rights, strict environmental regulations. No younger family member to take over the farm.”

But the producers who have stuck it out face the exact same problems, Dunn emphasizes. They also have taxes to pay, federal and state regulations, oversupply and underdemand in the market. How do they manage to hang on? How can some of them even flourish?

by **Mary Brashier**

The answer is a one-liner: They treat their cow-calf operations as a business.

“I’m the first to say that being a farmer or rancher in South Dakota and raising cattle truly seems to be a special calling, setting us apart in some indefinable way. And I like fresh air, space, and ‘way of life’ as much as any South Dakota cattle producer. But those good things don’t pay the bills. Being a cattle producer is not an entitlement.”

Dunn believes there are none better than most South Dakota cow-calf producers when it comes to production efficiency. However, he thinks some have a problem with “managerial efficiency.” This is a serious juggling act between the investment of assets, the inputs and outputs of the production system, and the market place, he says.

“Over time, we’ve looked at lots of measurements—weaning weights, yields, bushels, pounds, whatever. That’s production efficiency. But production efficiency stops short. It’s only part of the profit equation.”

The biggest part of the cow-calf equation is assets—the investment it takes to generate pounds or yield.

“Net income has been the measure of profitability for many years. But which would you prefer: generating \$35,000 of net annual income with a million dollar investment or generating \$35,000 net with a two million dollar investment?

“We found producers who were able to reach very high levels of income with very low levels of investment. That’s the true measure of managerial efficiency.”



Preserving their anonymity, Dunn divided producers in his research project into three groups—high-, medium-, and low-profit. Producers of all sizes fell into each category. “The power of the information collected from those groups is amazing. It shows there’s no advantage to being big.”

- Net income in the high-profit group pays off all debt in 10 years and provides \$35,000 a year for family living from 200 cows.
- Net income in the medium-profit group of producers pays \$35,000 for family living, but it takes 972 cows to do it and no debt can be paid off.

“The big difference between these groups is not in production but in investment.”

Dunn knows cow-calf producers. His family has ranched in South Dakota since his great grandfather received his Indian allotment in the 1800s. He was a rancher himself for nearly 20 years before completing his Ph.D. and returning to teaching and Extension.

“Cattle producers put in long hours of back-breaking physical work and they worry too much for their own good health, and they always try ‘just a little harder.’

“I know they are really sensitive to comments from Extension specialists and Extension educators. But we’re not saying, ‘Work harder.’ We’re saying, ‘Slow down long enough to consider all the resources you have and how you can combine and use them to generate wealth. Spend a little more time with your bookwork, look at

your whole operation. See how all the parts fit together.”

His work is based on information collected over 8 years from 185 cow-calf enterprises in eight Plains states. Eddie Hamilton, SDSU veterinarian, and Duane Griffith from Montana State University compiled most of the raw data, although Dunn had a hand in that, too.

“We found producers who were able to reach very high levels of income with very low levels of investment. That’s the true measure of managerial efficiency.”

—Berry Dunn
SDSU Extension range
livestock production
specialist

Producer participation in the Standardized Performance Analysis (SPA) program was entirely voluntary.

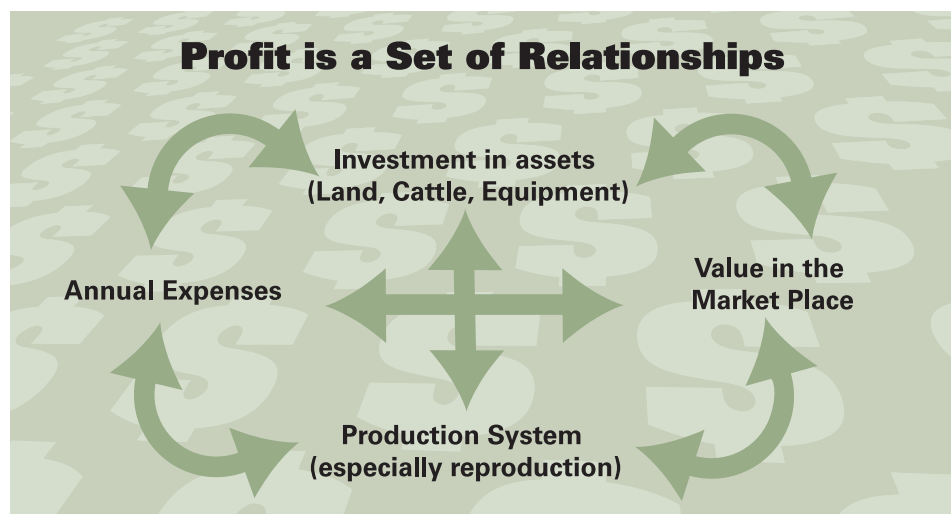
SPA is a system built to analyze individual beef production enterprises. More critical to this study, it is also a standardized information collection system. Dunn found and used 23 different production measurements that described cow-calf enterprises.

In a nutshell, the enterprises making money had the same weaning weights, death losses, pregnancy percentages, and replacement rates as enterprises that were barely scraping by or going deeper into debt.

High-profit enterprises, however, had higher weaning rates, lower investments, lower total costs, higher revenues, and higher net incomes. These translated into double-digit returns to assets (ROAs).

Were these high-profit enterprises the big operators? The answer: It didn’t matter.

“Herd size was one of the measurements. We had herds from 20 to 4,995 cows. Size made absolutely no difference. We found producers of all sizes who were extremely efficient at generating net income for family living with relatively small investments compared to the average.



“Those with government lands weren’t more profitable than those with deeded land. Those on the eastern side of South Dakota who had cornstalks weren’t more profitable than those in the west.

“It boiled down to people who were able to take the resources they had and manage them to create wealth.”

If these most successful operators had any secret, it was that they “worked” the market place. They bought inputs cheaper, they produced calves that weighed the same as those of other producers, but they sold their calves at a higher price.

“By watching when to buy, they managed to pay less for things like baling twine, machinery parts, breeding stock. Their calves were worth more at weaning, perhaps because of uniformity, better sorting, better genetics, better health, or because they were what the market wanted at that particular time.

“The calves didn’t weigh more, but they brought more, substantially more.”

Profit, Dunn says, depends on relationships between investment, production system, expenses, and the market place.

The relationships can be juggled. For example:

- If the producer has high annual costs, he must have high production and/or high income.

High-profit producers in the study “were actually building up their grass inventories instead of mining their natural resources,” says Barry Dunn. They didn’t need to rely on overstocking to increase their returns to assets.

- If he has low production levels, he must have low costs and/or high income.

- If he has low income, he must have low annual costs.

“The one component that is the big driver,” Dunn says, “appears to be the level of investment. Investment can drive annual interest payments, repairs and maintenance, higher production, labor, and depreciation, and many other things.

“If you overinvest, pretty soon you’re spending more than you counted on. More equipment means more repairs and maintenance, more gas or diesel to burn up. If you borrow money to buy a tractor, you’re paying interest, depreciation is going to be higher than on your older tractor. And because you’ve got it and you need to pay it off, the natural tendency is to increase production. That may only get you in deeper trouble.”

If blizzards regularly strike during calving season, Dunn continues, the answer may not be a new or remodeled calving barn. It might be to calve at a time when the weather isn’t as harsh.

A 1970s SDSU study showed the average calving date for 495 ranches was April 27. “In our data set it’s March 1. In that space of time, we’ve moved calving 60 days closer to

the beginning of the year. That increases winter feed costs for sure and increases the chances of death loss.”

There are options open, other paths to consider, in almost every managerial decision, Dunn says. “The main difficulty is in recognizing them.”

Dunn knows that his message does not go over well with many producers. “It’s natural to not want to admit you’ve overinvested or that you don’t see the relationships of investments, expenses, production, and the markets.

“They think that reducing inputs would lower their standard of living.

“My response to that is we’re talking about raising the family standard of living. Maybe we lower the cow’s standard of living a little, but she can take it—we tend to think of our live-

stock first and put off the farm home appliances and painting and upkeep for another year.”





How can a producer—any size—lower investment? He could consider:

- extending the grazing season, feeding less hay,
- cutting down on supplements by raising higher quality feed,
- renting rather than owning,
- changing time of calving,
- increasing bull-to-cow ratio, or
- running bulls a year longer.

It boils down to “watch the details” in every part of the operation.

“It’s an individual thing. Other than in the market place, there is no competition in being high-profit; you’re not standing on somebody else’s shoulders; your neighbor can increase his profits without hurting yours. We all have an opportunity to drive our costs down, keep our investment low, keep good levels of production.”

Most producers have a measure of net income, Dunn says, “but few of them measure their return to assets.”

Net income is a measure of quantity sold, dollars received, and total expenditures. “It is too easy to think

‘bigger is better,’ if you let net income drive your decisions,” Dunn says.

Return to assets (ROA) is annual net income divided by average total assets. ROA measures the return to invested capital, owner labor and management, and family living expenses.

“It is the most inclusive measurement of profitability we know of.”

The theoretical downside is that a producer could increase his ROA in the short run by abusing the farm’s resources. Dunn reports, however, that the high- and medium- profit groups had the same stocking rate.

“The high-profit producers were actually building up their grass inventories instead of mining their natural resources.”

Calculating ROA and increasing managerial efficiency is made easier by the programs FINPACK and SPA offered through the Extension Service, Dunn says. “There are also workshops, meetings, one-on-one visitations, shortcourses available for the producer who wants to improve managerial efficiency and stay in business.

“The bottom line: You can generate more income by improving efficiencies at the size you are now.”

Dunn is not a lonely voice preaching in the wilderness. His statistical model explained 82% of the variation in the study while other scientists were predicting he might be able to account for only 50%. Counterparts in Nebraska and Illinois also are finding similar results.

“And when I speak to producer groups, especially out of state, I’m well received. They intuitively know managerial efficiency makes sense. But most of them are in a jam and they really don’t see the way out.

“My response would be: Give it a chance; look at the whole set of relationships between investment, production, expenses, and market.

“Across South Dakota and the Northern Great Plains, high levels of profit are available to a producer with lower-than-average levels of investment, at least average levels of production, lower-than-average total expenses, and higher-than-average market values for the calves they produce.

“These are the folks who will prosper in the cow-calf business. I really believe that.”

Dunn can be reached at 605-688-5455 or barry_dunn@sdstate.edu ♦

In nationally recognized South Dakota project:

Character Counts!

by Stephanie Misar

Respect Fairness Citizenship
Caring Trustworthiness Responsibility

Of the 85,000 South Dakota youth in the 4-H program Character Counts!, a good number of them are less likely to lie, cheat, drink alcohol, steal, and vandalize than they once did.

This is no idle boast.

It is documented by surveys over the past 3 years that show a noticeable improvement in the character decisions of South Dakota youth after participating in the program.

A sample of over 7,000 youth from six counties, representing rural, urban, and reservation populations, were evaluated as part of a 10-year commitment to determine the program's effectiveness.

Rachelle Vetter, former state Character Counts! project leader, said the South Dakota project is so successful that other states and organizations nationwide have adopted the evaluation materials.

The Josephson Institute of Ethics, JIE, the non-profit organization initiating the Character Counts! concept, calls the survey results "the most thorough, scientific study yet" of Character Counts! The program is conducted in 40 states.

"The Institute has incorporated South Dakota's evaluations into a portion of their National Character Development Seminars. Individuals throughout the nation are hearing about our evaluation processes," Vetter said.

"Our evaluations are the most effective middle and high school tools in the country and are used as examples by other Character Counts! trainers."

Character Counts! began in South Dakota in 1996 under the direction of Cooperative Extension Service (CES) Youth Development/4-H. The partnership of CES/4-H and the South Dakota 4-H Foundation brings Character Counts! to communities and schools. Local coalitions carry out the program.

Four years earlier, JIE's founder, Michael Josephson, gathered a national coalition of youth professionals, ethicists, and educators to formulate Character Counts! Their charter:

"Character is built on the consensus that no matter how diverse opinions, personalities, or backgrounds, there are ethical principles that clearly define people at their best, because they are the very foundation of a free and democratic society."

Recognizing that character is not hereditary and not formed automatically without the active participation of the individual, the group built an educational framework based on six universal pillars that would strengthen youth character: trustworthiness, respect, responsibility, fairness, caring, and citizenship.

Gary Heusel, South Dakota's 4-H project leader at the time and one of the original Aspen coalition members, brought the program to South Dakota. South Dakota was one of the first states to adopt Character Counts! into 4-H and Extension use

The evaluation procedures created by Rachelle Vetter, former project leader for the South Dakota Character Counts! program and her colleagues are being adopted across the country. Vetter moved out of state in fall 2001.





Character Counts! may have started in 4-H programs, but it has been supported by schools and citizen and faith groups. Parades, poster displays in store and bank windows, and table tents in restaurants remind youth and adults alike that Character Counts!

and 2 years later was first to analyze the program's impact through evaluations.

Extension educators in all 67 of South Dakota's counties work with the program in some way, and over 2,500 adults and 700 youth have been trained to incorporate Character Counts! into youth and adult settings.

Character Counts! uses tried-and-true successful teaching methods—discussion groups, role playing, art projects, and more—to introduce the six pillars in classes ranging from elementary to high schools. The language of Character Counts! is consistent and repeated throughout all grades; repetition is a proven learning method.

Seventeen counties currently have Character Counts! coalitions, and through the work of three regional coordinators, Character Counts! is now branching out into the community. CES/4-H leaders bring together school teachers and administrators,

parents, guardians, after-school and youth groups, faith communities, child-care providers, and other citizen partners to deliver Character Counts!

To measure the impact of the program, baseline data—a sort of pre-test of middle and high school youth—had to be collected before the project even started. The surveys were funded by the South Dakota 4-H Foundation and developed by scientists in the SDSU Rural Sociology Department.

The pre-test survey showed:

- 83% of youth lied to their parents,
- 50% drank alcohol, 23% used illegal drugs,
- 84% allowed someone to copy their work,
- 12% broke into homes or property,
- 54% believed in today's world, lying and cheating are necessary to succeed,
- 49% believed they have no ethical obligation to help others, and

- 60% believed that people who take ethical shortcuts are more likely to succeed.

As similar questions are asked in successive surveys—they are self-reported and remain anonymous to encourage honesty in answering—the changes over the years “provide information about which attitudes and behaviors may need more concentration, which behaviors are changing, and the level of need for the Character Counts! program,” Vetter said.

“The results from these surveys provide us with a snapshot of student behaviors and attitudes at a given time,” added Marcey Moss, CC! evaluator. “Over the past 3 years we have been able to describe trends in those behaviors and attitudes that are consistent with the six pillars of character.”

Separate surveys are also conducted with grades 1-6 and 7-12 teachers who use Character Counts! on a regular basis.

Students improved their character after 3 years in the program.		
	1998	2000
<i>"I told a lie to a parent."</i>	93%	70%
<i>"I told a lie to a teacher."</i>	52%	34%
<i>"I drank an alcoholic beverage."</i>	49%	33%
<i>"I let someone copy my work."</i>	84%	62%
<i>"I broke into another's home or property."</i>	11%	6%
<i>"I teased someone because of their race, ethnicity, or religion."</i>	19%	11%

Although it is still early in the evaluation process, comparisons can be made and evaluators believe that the progression in results and behavior change are encouraging.

The numbers show the program is successful, but there is still room for improvement.

“We’ve found that there still needs to be more focus on training teachers, bringing parents and community businesses into the program, bringing the program to reservation communities, and suiting the curriculum to high school students,” said Vetter.

In third-year evaluation results, there were also some “red alert” areas.

On the question, ‘It’s okay to do whatever it takes to succeed as long as you don’t hurt other people,’ third-year results were closer to baseline data than in the second year.

On the question, ‘In today’s world, people often have to lie or cheat to succeed,’ fewer students disagreed with the statement than in the 2 previous years. The aim of the

program is for more students to disagree each year, so improvement is needed in this area as well.

Over 500 Native American children on South Dakota’s reservations participated in Character Counts! this last year.

The year began with a statewide Native American youth educator training in La Plant on the Cheyenne River Reservation. Educators from Pine Ridge, Rosebud, and Standing Rock reservations also attended. As a result, over 200 other individuals were additionally trained at sessions in Kyle and Flandreau.

Implementation of the program with Native American audiences was assisted by grants from the Bush Foundation; Children, Youth and Families At-Risk (CYFAR); the Knight Foundation; and by CES grants.

CES has hired two Native American curriculum writers to work with regional

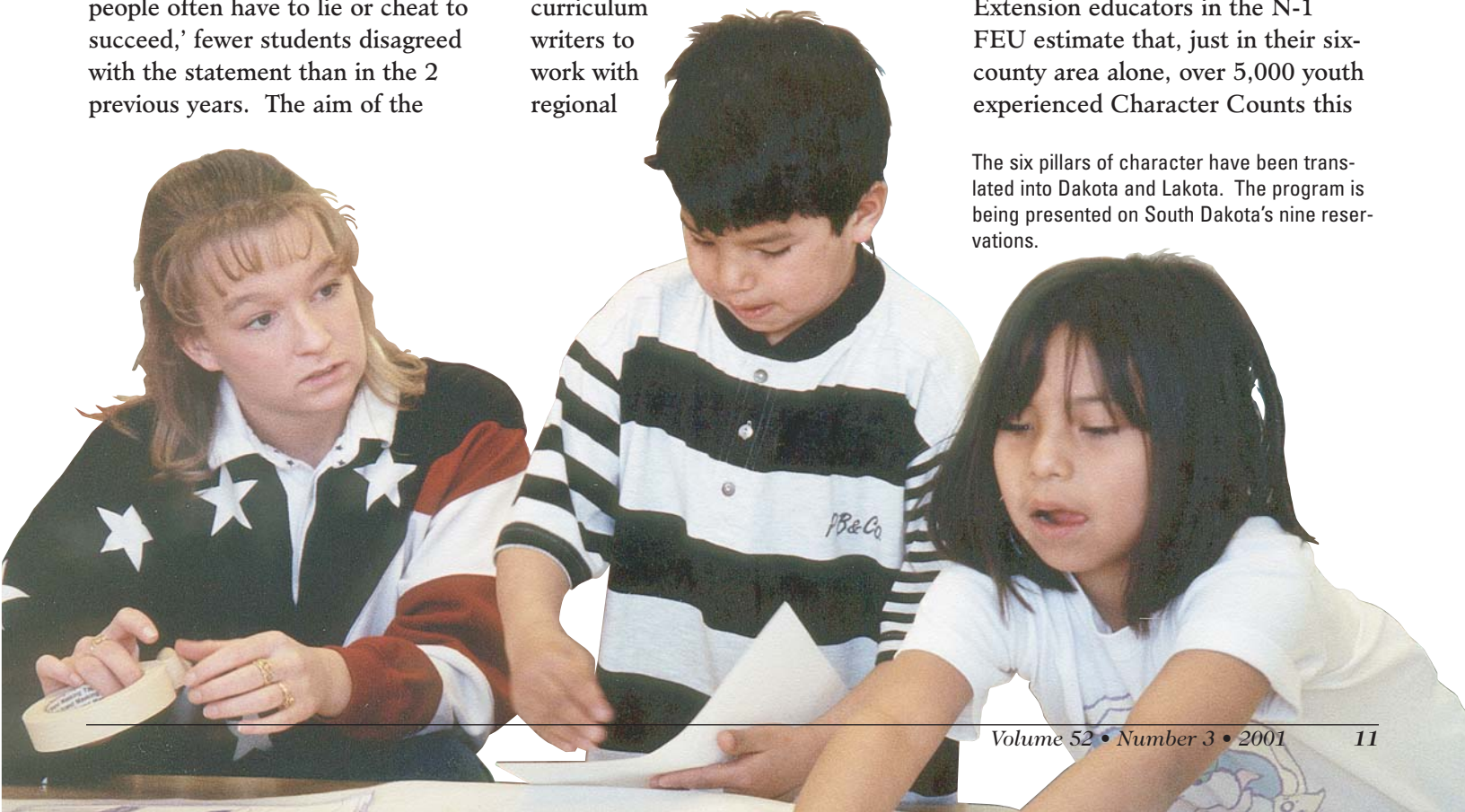
Character Counts! coordinators, Extension educators, and community volunteers from South Dakota’s nine reservations. They will weave together Native American values and the six pillars of character for youth ages 4-18. The pillars have already been translated into traditional Dakota and Lakota language.

Avital part in the success of the program is the involvement of schools, citizen groups, and faith communities throughout the state. “A lot of communities really buy into the program. There has been such warm reception of Character Counts! right from the beginning,” said Vetter.

In the CES North 1 Field Education Unit (FEU) (Moody, Miner, McCook, Lake, Kingsbury, and Brookings counties), over 20 area schools, their after-school programs, and numerous other pre-school and 4-H clubs participate in Character Counts!

Extension educators in the N-1 FEU estimate that, just in their six-county area alone, over 5,000 youth experienced Character Counts this

The six pillars of character have been translated into Dakota and Lakota. The program is being presented on South Dakota’s nine reservations.



Six pillars of character

1. **Trustworthiness.** It includes the behavioral qualities of honesty, integrity, reliability, and loyalty. Not lying or deceiving is not enough.
2. **Respect.** Our moral obligation is to treat everyone with respect, whether the respect is deserved or not, not because the other people are human beings, but because we are. Respect includes civility, courtesy, dignity, tolerance, and acceptance.
3. **Responsibility.** We are answerable for our behavior. Responsibility includes accountability, pursuit of excellence, and self control.
4. **Fairness.** Fairness is a process; it is how we arrive at a judgment. It involves impartiality and an open mind in decision making. The decision itself will probably always be unfair to somebody, but that is not the issue.
5. **Caring.** Ethics is, in the end, about our responsibilities toward others. Caring for "humanity" is easy; but caring for an individual you don't agree with is what counts.
6. **Citizenship.** The good citizen obeys the laws, volunteers, cooperates, stays informed, protects the environment.

Abstracted from Josephson Institute of Ethics Character Counts! web pages. The JIE describes itself as a nonpartisan, nonsectarian coalition of schools, communities, and nonprofit organizations working to advance character education by teaching the Six Pillars of Character. See <http://www.charactercounts.org>

For more information on becoming involved with youth and Character Counts!, call 605-688-4946 or the National Character Counts! Coalition at 1-800-711-2670.



Entertainer Phil Baker helped introduce Character Counts! to 1,300 students in three counties.

past year, in addition to 80 4-H club leaders, who meet once a month to talk about the impact of character.

"Training the trainer" is an important part of the program, Vetter said. "Once trainers learn the curriculum, the message spreads even more widely." She says this is particularly valuable when teens become involved with teaching the Character Counts! curriculum to youth.

A hundred teens from N-1 were trained in the Character Counts! curriculum, and have taught it to elementary and pre-school children. Teens comment that they are more aware of their own actions when younger kids are watching, because they know they need to set good examples.

According to one teacher, "The whole school is speaking the language of character everywhere: in the classroom, on the playground, and in sports."

"The behavior on the playground has improved since Character Counts! has come to our school," said a playground supervisor. "The kids are

policing themselves. Character Counts! has made my job easier."

The program is also affecting adults. Community businesses display the "pillar of the month" in offices and restaurants in all six N-1 counties.

Last year, 1,300 students in the CES North 2 FEU (Beadle, Hand, and Spink counties) joined entertainer Phil Baker in Character Counts! kick-offs in Huron, Miller, and Mellette. Baker blended music and the pillars, leaving educators, school officials and community leaders pleased with the event and the Character Counts! program.

After the event, one teacher said, "It's a fantastic program everyone can benefit from, even adults. I like having a common vocabulary with all the other grades. When I comment about an aspect of character, such as trustworthiness, everyone knows what I am talking about no matter what context it is in."

The Miller school administration requested continuing programming for upcoming years, and several schools have asked how to become more involved with Character Counts!.

"Character Counts! youth are on the right track toward to the future," Vetter said. "As Character Counts! founder Michael Josephson says, 'Kids are 27 percent of our population, but 100 percent of our future. Which way they go depends on us.'"

"Character Counts!, with the partnership of South Dakota CES and 4-H, is helping our youth build character that will last a lifetime."♦

Grape growers



*have language of their own:
Foxy. Earthy. Valiant*

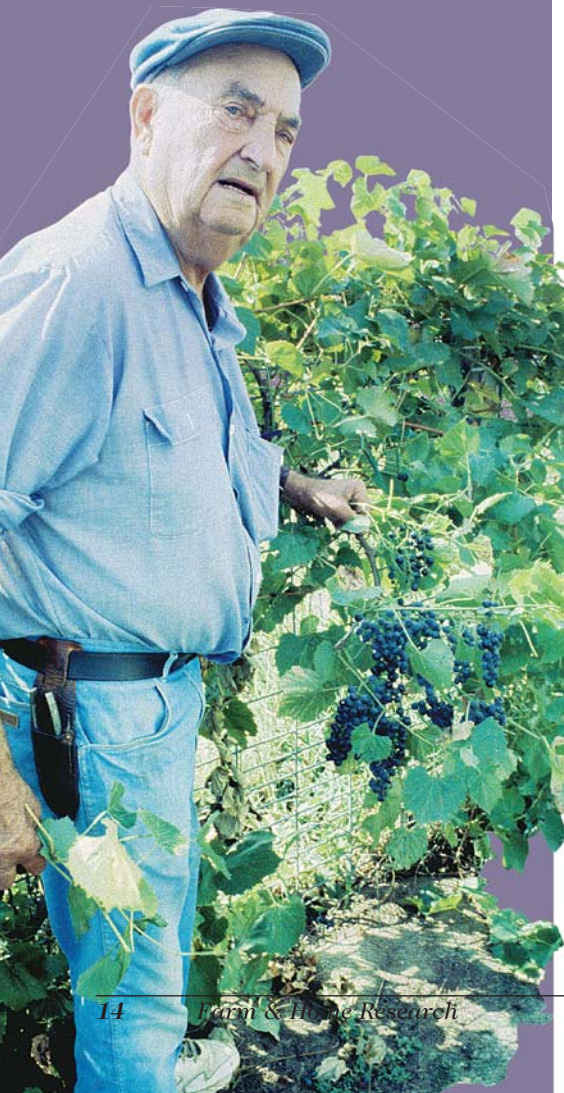
by Lance Nixon

F or a fruit breeder on South Dakota's alternately frozen and sun-baked prairies, it was a challenge: to come up with a grape tough enough to endure those temperature extremes.

Ronald Peterson, now a retired SDSU horticulture professor, confronted the problem head on, by crossing a hardy wild grape from Montana with one from New York. In the opinion of one veteran Minnesota grape grower, the result may be the hardiest grapevine anywhere.

Not surprisingly, Peterson chose to name his new grape 'Valiant.'

Valiant is one of the grapes that fares best in South Dakota's climate, and an increasing number of growers across South Dakota are selecting and growing it.



Though SDSU released the Valiant grape in 1983 with little fanfare—“a hardy blue grape for the North developed by SDSU” is how a bulletin of that year characterizes it—

Peterson's work is now coming into its own. Valiant is one of the grapes that fares best in South Dakota's climate, and an increasing number of growers across South Dakota are selecting and growing it.

Anne Fennell, SDSU horticulture professor, recommends Valiant for juice, jellies, and jams. She said it makes an acceptable wine, although she rates other northern varieties—perhaps not quite as hardy—higher as quality wine grapes.

Valiant's greatest tribute may lie in the fact that the very first commercial winemakers in the state, Eldon and Sherry Nygaard of Vermillion, named their operation “Valiant Vineyards,” partly in its honor.

The Nygaards signaled the beginning of South Dakota's wine industry when they planted their first vines near Viborg in

1993. More recently, they have opened the Buffalo Run Winery resort in Vermillion. Two more wineries have since begun operations: Prairie Berry in Rapid City and Schade Vineyard of Volga. At least two others may be in the works, people in the industry say.

The Nygaards, like Peterson, had a hunch wine-making might become an industry in

South Dakota, in part because of the sometimes blistering summers, which are not unlike what grapes endure in some major wine-making regions.

“I thought the grape had great potential to tolerate our conditions without a lot of pampering,” Peterson said. “I thought if grapes liked the heat of the West Coast and central California, maybe they'd do well here, too. I never anticipated that it could be a huge industry, but I thought it had potential on a small scale.”

Plenty of grapes tolerate heat, but those that can take the cold are harder to find. Peterson looked for wild grapes adapted to northern North America as the logical ones to have cold hardiness.

He considered northern Manitoba, then decided against it. Because snow cover is plentiful there, he reasoned that those grapes would have more insulation from the cold and perhaps be less hardy than some varieties on the Plains farther south.

He turned to Montana.

“I thought that grapes that can live through Chinooks might actually be hardier for our conditions because they get a lot of fluctuating temperatures. They'll get subzero temperatures followed by temperatures well above freezing and then bitter cold again,” Peterson said.

He hiked the Missouri River bottoms in Montana and listened to American

George Leslie of rural Aurora grows Valiant and Swanson Red on his farm and bottles homemade wine for his personal use.

Indian women in the town of Wolf Point who told him that wild grapes did not thrive along the Missouri River west of Culbertson. This suggested to Peterson that he had found some of the hardiest grapes in the Northern Plains.

Peterson made this walk in the late 1950s. About 95% of the wild grapevines he found were dead. He attributed this to two reasons: the Missouri River dams had ended the annual spring flooding that had once helped the vines flourish, and ag chemicals applied on nearby crops by aerial spray planes had drifted to other plants.

“We would not have had those grapes if I’d waited much longer,” Peterson said. “I went back there again probably 20 years ago and there weren’t any grapes. A young man I talked to at one of the ranches wasn’t even aware there had been wild grapes in the area.”

Back at SDSU, Peterson put the Montana wild grape to good use, crossing it with a New York state variety called Fredonia. “This is one of the hardiest grapes from the eastern part of the country, but it’s not dependably hardy out here.”

Veteran Minnesota grape grower John Marshall of Lake City used the Valiant as one of two main grapes—the other is the variety Bluebell—when his Great River Vineyards began producing Minnesota’s first commercial grape juice in 1994.

Ronald Peterson, former professor and head of the Horticulture, Forestry, Landscape and Parks Department, introduced Valiant to the South Dakota public in 1983.

“Valiant is known to do well out west and in more arid climates than Minnesota. It is, as far as I know, the hardiest vine known,” Marshall says. “A friend of mine in Manitoba tells me it has survived temperatures below -40 Fahrenheit many times and prolonged periods below -30 Fahrenheit without bud injury. No other vine will do this.”

Nevertheless, Marshall said the Valiant isn’t quite right for Minnesota’s moist conditions.

“It is highly susceptible to downy mildew and black rot and thus in a humid climate difficult to grow,” Marshall said. “It is nevertheless a good grape, making a good, fresh grape juice, good grape jelly, and a fine home wine. The clusters and berries are too small and the appearance not right for it to be a commercial table or eating grape, but it tastes fine, and as a home table grape in a climate where local grapes are rare or not seen, it would be quite a contribution.”

Marshall thinks Valiant may be the forerunner of an expanding viticulture in dry regions such as the Dakotas, Wyoming, Montana, and the prairie provinces of Canada where grape growing and winemaking are rare.

Nygaard also has found some drawbacks with the Valiant. According to him, it has a “foxy nose.”

“It’s difficult to make wine with it because it has a foxy aroma, an earthy smell. Some people just love it so we still make it, we still raise it. We have found other wine grapes that make a more marketable wine.

“I don’t think you can beat the Valiant grape for grape juice and preserves. Great color, great flavor, but once you ferment it, you seem to get that foxy aroma. There is that one complaint.”

But Jim Schade, who operates Schade Vineyard near Volga, the state’s third licensed winery, said Valiant makes up the largest portion of his 450 vines. Schade not only makes a straight



Valiant wine by extending it with water and sugar to lessen the foxy taste, he also blends Valiant when making wines of other fruits such as plums or chokecherries. His buffalo berry wine is about half Valiant, for instance.

Prairie Berry, a Rapid City-based winery that specializes in wines made from fruits other than grapes, including many native fruits, also is experimenting with some Valiant blends, vintner Sandi Vojta Keck said.

Schade said the reason for choosing Valiant is simple. He's committed to using only South Dakota fruit, and Valiant is far more durable than even some hardy Minnesota varieties. "It's bulletproof in the Upper Midwest," he said. "If you're concerned about survival, you plant Valiant. It's easy to get it to grow and I probably get 90 to 95% survival."

The Valiant isn't SDSU's only contribution to grape growing. Fennell points out that the noted plant explorer Niels Hansen—for whom the N.E. Hansen Experiment Farm near Brookings and Hansen Hall on the SDSU campus are named—actually released 32 varieties of grapes in 1925, taking their names "from the Sioux Indian language."

In a 1927 SDSU bulletin, Hansen made it clear that his goal was the same one that Peterson had in mind

a generation later: finding a grape hardy enough for the plains and prairies.

Hansen clearly was impressed by the success of the Concord grape in

Hansen made it clear that his goal was the same one that Peterson had in mind a generation later: finding a grape hardy enough for the plains and prairies.

the eastern U.S. But, he noted, "the Concord grape and its offspring, great as they are, will not help South Dakota and the prairie Northwest since even with careful winter protection they are not sufficiently hardy. ... So I began crossing the wild grape of the Dakotas with some of the choice tame grapes. The work was a success. I now offer for the

first time thirty-two of these seedlings. All are hardy at Brookings without winter protection of any kind. This marks the beginning of a new era in grape culture for the prairie Northwest."

Hansen gathered wild grapes from the Missouri River near Pierre and also near Bismarck, N.D. But he used wild grapes from South Dakota as a parent in only two of his varieties, Teopah and Nompah. Perhaps with the goal of hardiness in mind, he used North Dakota wild grapes as parents in 13 varieties. Sixteen varieties came from crosses with a cultivated grape—most often a hardy Minnesota grape called Beta.

Hansen, famous for his journeys to far corners of the world as a plant explorer, also introduced what is called the Sungari grape in 1926 from seeds he'd obtained traveling in northern China in 1924.

Anne Fennell, SDSU horticulturist, left, and research assistant Kathy Mathiason are probing the genetic makeup of different grapes for variations in winter hardiness. Fennell is also in the early stage of assembling a web site for South Dakota grape growers.



Grapes: your choices

Interested in growing grapes? Try one of these.

Some of these grapes require winter protection to survive in South Dakota. Cultivars needing winter protection should be removed from the trellis, placed on the ground, and covered. Only cultivars designated as hardy can be left up on the trellis throughout the winter.

Table, juice, and jelly grapes

Valiant: Hardy. Blue. Good juice, jelly, or table grape. It has a tendency to overbear; may need cluster thinning.

Beta: Hardy. Blue. Flavorful jelly, acceptable juice.

Bluebell: Hardy. Blue juice or fresh table grape, large berries, ripens mid-September. May have iron chlorosis problems at a soil pH >7.5.

Elvira: Moderately hardy. White juice or wine grape. Foxy flavor, acidic.

Swenson Red: May need winter protection. Red table grape, large berries, thin edible skin, seeded, fruit keeps well in refrigerator.

Worden: Hardy. Blue table and juice grape. Early ripening Concord seedling.

Red wine grapes: Some of these cultivars are also used as table or juice grapes.

Frontenac: Hardy. Excellent wine grape for this region, ripens mid-late September. Cherry flavor, sugar develops early; wait for acidity to come down before picking. Good disease resistance and 2,4-D tolerance.

St. Croix: Hardy to about -28F. Roots are susceptible to damage in open winters. Matures mid-September, low acid, needs cluster thinning to keep good sugar levels. Prune to short canes.

Marechal Foch: French-American hybrid. Needs winter protection. Ripens early, has small clusters and berries. Leave longer canes for optimal production. Produces a burgundy style wine or a true rosé if handled properly.

White wine grapes: Some of these cultivars are also used as table or juice grapes.

Kay Gray: Hardy. Vigorous white grape, cane prune, harvest grapes before full maturity. The must is susceptible to oxidation; avoid exposing juice, must, and wine to air.

La Crosse: Winter protection needed in most South Dakota locations. White wine grape with Seyval Blanc parentage.

St. Pepin: Winter protection needed in most South Dakota locations. White, early ripening, makes a German style wine. Also good juice or table grape. (Requires cross pollination with another variety).

Seyval Blanc: SV 5-276 French-American (FA) hybrid. Needs winter protection. Produces quality dry white wine. Ripens mid-September. Vigorous, you need to prune to short canes or spurs and cluster thin.

Sources

Double A Vineyards Inc / 10275 Christy Road / Fredonia NY 14063 / ph 716-672-8493

Lake Sylvia Nursery / 13835 51st Ave / South Haven MN 55382

Northwind Nursery & Orchards / 7910 335th Ave NW / Princeton MN 55371-4915 / ph 612-389-4920

Foster Grapevines Concord Nurseries, Inc / 10175 Mile Block Rd / North Collins NY 14111-9770 / ph 1-800-223-2211

Hansen may have been flat-out wrong about the “new era in grape culture for the prairie Northwest,” or he could have been simply decades ahead of his time.

It wasn't until the 1990s that commercial grape growing began to take root in earnest in South Dakota, thanks in good part to the Valiant

grape developed by Peterson. But it is testimony to Hansen's skill as a breeder that his varieties are still interesting to growers.

“N.E. Hansen was a visionary and man of great contributions,” says Marshall, the Minnesota grower. “I am now offering his Chontay for commercial sale as it is extremely hardy and

grows well. It is an important improvement over Beta (developed in central Minnesota in the late 19th century by crossing a wild riparia with Concord) in berry and cluster size and growth character.

“However, when fully ripe it has a very strong flavor, and I suggest it be picked early and a little tart. Then it

Not like growing corn ...

South Dakota's tiny wine industry continues to grow, with three farm wineries now licensed by the state and many growers planting vines.

The 1997 census of agriculture showed nine farms in South Dakota growing grapes, the South Dakota Agricultural Statistics Service said, up from six farms in 1992. Several more growers have started grapes since that last census, using hardy vines developed at SDSU, the University of Minnesota, and some other northern locations.

But there's a lot to think about before deciding to plant vines. It's not quite the same thing as growing corn, warns Anne Fennell, SDSU horticulturist. She summarized the issues a would-be grape grower must consider.

- **Site selection:** Grapevines require full sun. Southeastern, south, and southwestern slopes provide the best sun exposure. A loam, sandy loam, or clay loam with a pH of 6.5 to 7.5 is ideal. Avoid heavy clay soils, very sandy soils, or low, poorly drained sites. Also avoid low-lying areas prone to late spring and early fall frost damage.

Many varieties are very susceptible to 2,4-D-related herbicides, so avoid planting in close proximity to areas where these herbicides are used (road right-of-ways, lawns, crop fields).

- **Cultivar selection:** Determine how the grapes will be used. Different varieties are recommended for juice, jam and jelly, or wine.

Length of growing season, growing degree days, and low winter temperatures limit the varieties that can be grown in South Dakota. The southern half of the state, with a longer growing season and less damaging winter temperatures, is more suited to production grapes.

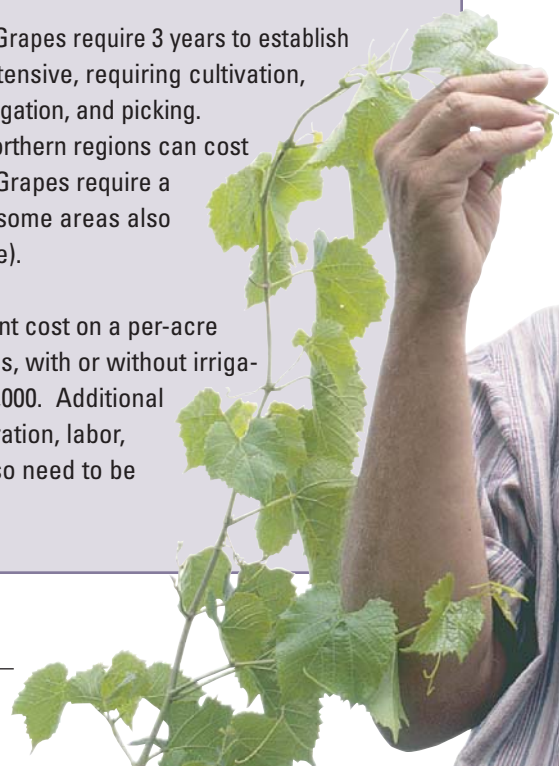
Select early-maturing grape varieties that have good cold hardiness. Start small and learn the characteristics of the cultivars you have selected before planting on a large scale.

- **Number of vines to plant:** A well-established vineyard will come into production 3 years after planting. A mature grapevine will produce 5 to 20 pounds of fruit, which will yield about one-half gallon to 1 gallon of juice or wine.

Yield potential is roughly 2 to 6 tons per acre. However, weather hazards, herbicides, birds, or other animals can significantly reduce production potential.

- **Economic factors:** Grapes require 3 years to establish and are very labor intensive, requiring cultivation, pruning, spraying, irrigation, and picking. Varieties suited for northern regions can cost \$1.50 to \$6 per vine. Grapes require a trellis system and in some areas also irrigation (\$1,000/acre).

Anticipated investment cost on a per-acre basis (600 vines, trellis, with or without irrigation) are \$1,000 to \$3,000. Additional costs for land preparation, labor, and weed control also need to be considered.



is good. In an extremely cold climate I think it has a place in the home garden or home vineyard.”

Grape grower Tom Plocher of Hugo, Minn., made a systematic effort to grow all of N.E. Hansen’s grape varieties that he could find, eventually obtaining about 18 of the 32 varieties. The rest, Plocher speculates, were lost decades ago when people stopped growing them. Plocher—a grape breeder himself—says none are of outstanding value. Even the Chontay in his view is mainly of historical value, having been surpassed by other varieties that are hardier or have better qualities. The only Hansen variety that Plocher still cultivates is Sipsoska, a cross between a variety called Lady and a North Dakota wild grape.

“Sipsoska has a lot of things going for it for our region,” Plocher said. “For a northern variety it ripens early, it has high sugar content, it has good disease resistance. It just has this flaw that we haven’t been able to deal with. It has a pronounced, clay-like, earthy taste.”

If scientists were able to neutralize whatever causes the earthy flavor, Plocher said, Sipsoska would have strong

potential for the region’s wine industry. But biologist Roland Riesen at Youngstown State University in Ohio, who has looked at the Sipsoska problem briefly, said there are more than 1,000 chemical compounds in wine. That makes dealing with the earthy taste of Sipsoska—which may be the result of a combination of factors—a problem scientists are unlikely to tackle.

Hansen may have been flat-out wrong about the “new era in grape culture for the prairie Northwest,” or he could have been simply decades ahead of his time.

Fennell has put modern science to work in studying how grapevines prepare for winter dormancy, focusing on the early stages when plants such as *Vitis riparia*, the only species of grape native to South Dakota, begin responding to the lower temperatures and shorter length days of autumn.

“I’m mainly looking for the genes that control that early acclimation response,” Fennell said. “This has applications to other woody plants besides grapes.”

In addition, Fennell grows new grape varieties released by the University of

Minnesota, the region’s leading source of hardy grape varieties. That saves South Dakota growers the trouble of evaluating the varieties for themselves.

Fennell also is in the early stages of assembling a web site to serve as a clearinghouse of information for South Dakota grape growers.

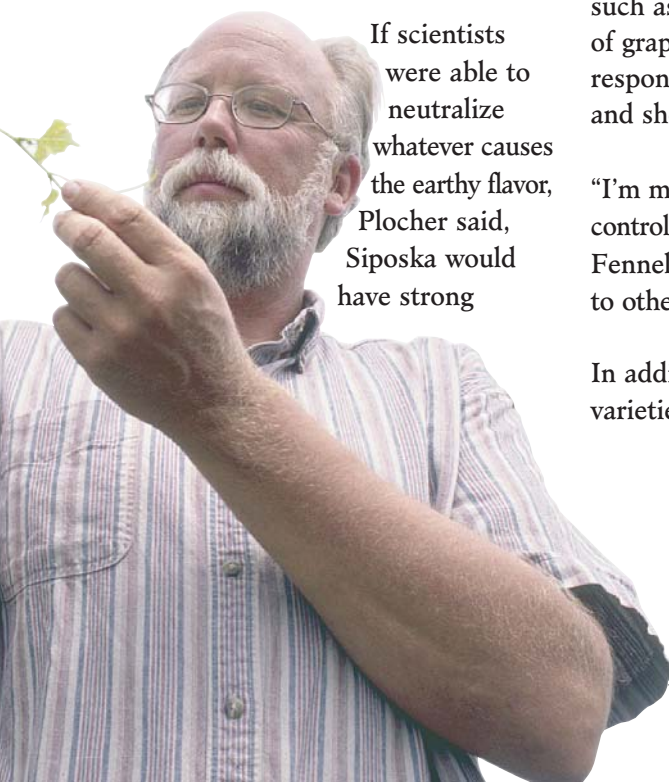
Nygaard likes that idea as a way for grape growers to connect and perhaps form an association. Nygaard said factors such as winter hardiness, early and late frosts, and herbicide drift remain crucial to the success of South Dakota grape growers. Their chances are better if there’s a mechanism for putting the latest scientific information in their hands, he said.

“We have a lot of people interested in viticulture. I think we could have a non-profit organization where we can get together monthly and have events and symposiums and reach out and help others. After we get to about our fifth winery, then we can have a South Dakota Winemakers Association, too.”

Fennell, who fields most of the questions about grape growing at SDSU, said there is no grape breeding position at SDSU, in part because Minnesota’s well-established program is right next door.

“Breeding of woody fruit crops requires about 20 years of inputs before a cultivar is released. It is much more efficient to cooperate with the University of Minnesota,” she said. ♦

Jim Schade of Volga uses only South Dakota fruits in his commercial wines. He says of Valiant, “It’s bulletproof in the Upper Midwest. If you’re concerned about survival, you plant Valiant.”





FEED GRAIN

A specialized
for pork and poultry producers

C

orn growers and hog farmers alike have an economic stake in Hans Stein's research at SDSU.

Stein, an animal scientist, is overseeing a project feeding low-phytate corn to hogs to monitor how well the animals digest the feed.

Low-phytate corn, which is likely to become commercially available to farmers in the next 2 to 3 years, allows non-ruminant animals such as swine to use more of the phosphorus from the corn. That saves farmers the cost and trouble of adding supplemental phosphorus, an essential nutrient, to the diet. But perhaps more importantly, it reduces the amount of phosphorus excreted in manure.

BY LANCE NIXON

Each year, according to the USDA Agricultural Research Service, hogs and poultry in the United States excrete about 30 million tons of manure containing 460,000 tons of phosphorus.

Stein said low-phytate corn may find a niche as a feed grain because of the advantage it offers pork and poultry producers.

“Especially farmers who have too much phosphorus in the soil would have an interest in it,” Stein said.

Phosphorus and nitrogen are important issues in concentrated animal feeding, Stein said. So far, most attention and most research has been on nitrogen, but phosphorus is a growing concern.

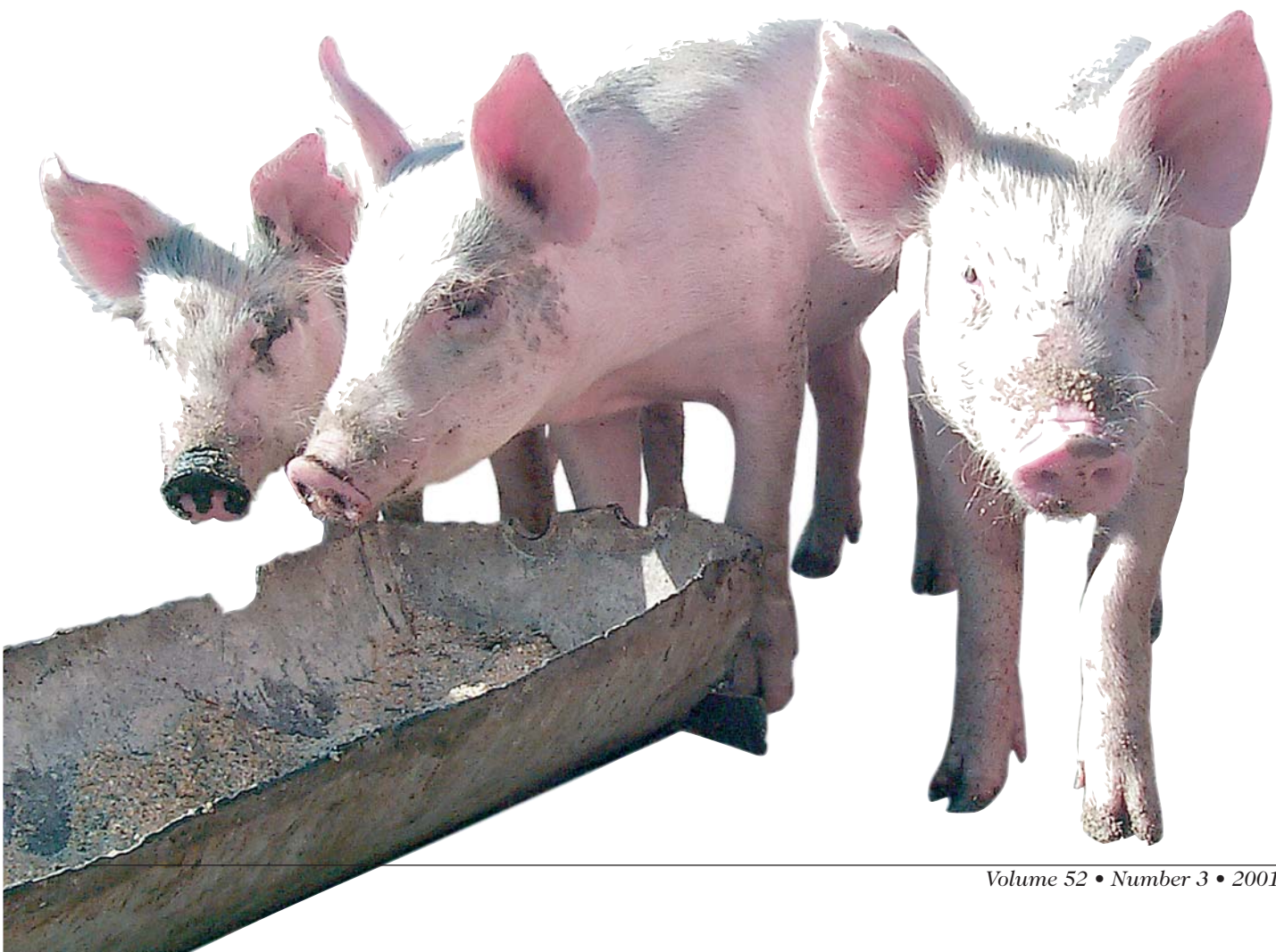
SDSU Extension Soils Specialist Jim Gerwing explains that South Dakota and many other states have written their manure management regulations based on nitrogen. But a farmer who applies manure to his fields based on what that nitrogen standard allows can easily apply two to five times as much phosphorus as his crops remove.

Phosphorus doesn't pose health concerns to humans as serious as does nitrogen, which can cause potentially fatal “blue baby syndrome” in infants if they are given water high in nitrate. But phosphorus can cause environmental problems: Excess phosphorus in runoff can wash into waterways, where it can spur abnormally high growth of algae and other aquatic plants. Decaying

algae and plants, in turn, can deplete the dissolved oxygen in water so that fishes and other organisms die.

The South Dakota Agricultural Experiment Station, the SDSU Water Resources Institute, and the South Dakota Cooperative Extension Service sponsored a recent conference that dealt with a variety of issues relating to phosphorus, including regulations, applying manure to cropland, and the effects of phosphorus on lakes and streams.

Stein spoke on a topic that could translate directly into less expense and less regulatory red tape for hog producers: options for reducing phosphorus in animal waste.



“There are basically two things you can do to decrease the amount of phosphorus in manure. One would be to decrease the amount of phosphorus in feces, the undigested dietary phosphorus. The other is to decrease the amount of phosphorus in urine. What comes out in the urine is basically what you feed the animals in excess of what they need.”

Stein and a graduate student, Robert Bohlke, are looking at the first of those options: improving the digestibility of corn so that there is less phosphorus in hog manure.

Stein said there are two ways of doing that: either adding an enzyme called phytase to the diet—first approved for sale in the U.S. in 1995—or

feeding a low-phytate corn. Low-phytate corn is not yet commercially available but will be soon.

“Either of those options would decrease the phosphorus that is excreted in feces by approximately 40%.”

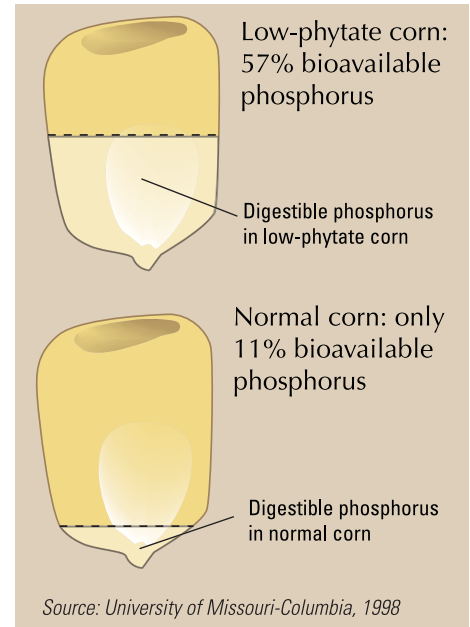
The advantage of the low-phytate corn compared to ordinary corn is that it contains far more free phosphorus, a form more usable to monogastric animals such as swine.

“In regular corn most of the phosphorus is present in a form called phytate-bound phosphorus. That’s indigestible for non-ruminant animals,” Stein said.

Scientists at the University of Missouri-Columbia reported in 1998 that in laboratory tests, low-phytate corn had 57% of its phosphorus in a bioavailable form, compared to 11% from normal corn.

Stein’s research uses corn from DuPont Specialty Grain, one of the companies producing low-phytate corn.

Low-phytate corn was developed in the early 1990s after Victor Raboy, a geneticist for the USDA Agricultural Research Service, isolated a corn mutant that stored most of its phosphorus as inorganic phosphate rather than phytate.



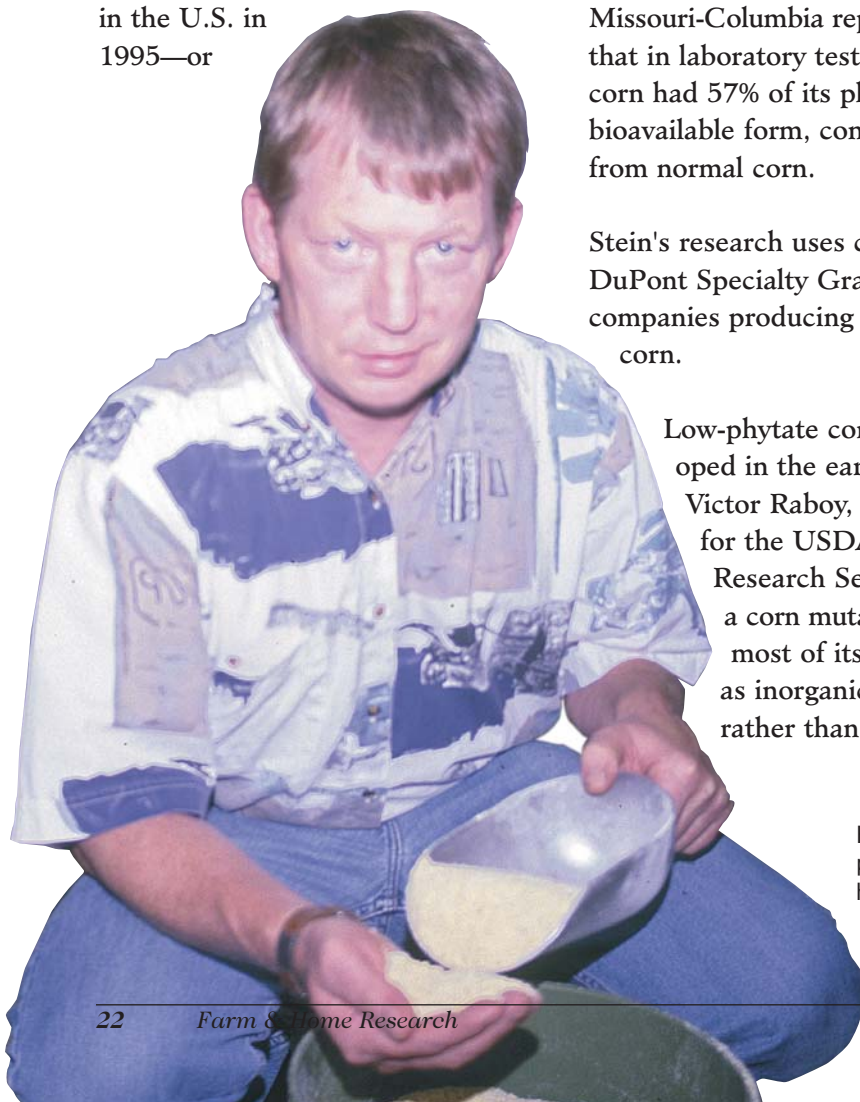
Raboy didn't use genetic modification to get his results but simply isolated and bred into corn a version of an already existing corn gene.

Typically about 80% of the phosphorus in ordinary corn and other feed grains is stored as phytic acid, or phytate. Although ruminants can digest it, this form of phosphorus is unavailable to monogastric animals such as swine and poultry. Those animals lack the enzyme phytase needed to digest the phosphorus stored as phytic acid.

Because of their hogs' inability to extract phytate-bound phosphorus from corn, producers frequently add inorganic phosphorus to the hog diet.

Raboy said hogs typically can use only 15% to 20% of the phosphorus in ordinary corn, but they can use

Hans Stein, SDSU animal scientist, says the key to reducing phosphorus in the environment is reducing phosphorus in hog diets to levels the animals actually need.



65% to 75% of the phosphorus in low-phytate corn. Low-phytate corn enables pigs and poultry to absorb more phosphorus than they could from ordinary corn, thus reducing the amount of phosphorus in manure.

Phosphorus is a crucial nutrient for animals, which use most of what they absorb to build bones and the rest to build tissues and aid in digestion.

Stein said one crucial advantage—both in savings for the producer and for the environment—is that low-phytate corn makes it possible to decrease the supplemental phosphorus added to feed. If a producer didn't decrease the supplemental phosphorus, Stein said, there might actually be an increase in the phosphorus in the urine, offsetting the lower phosphorus content in the manure.

“By using low-phytate corn, you can decrease the phosphorus added to the diet because the pig can absorb more of the phosphorus in the corn. Therefore, phosphorus can be reduced in the feces without increasing phosphorus in the urine, so total phosphorus excretion is reduced,” Stein said.

Bob Larson, a rural Sioux Falls hog producer who raises about 17,000 to 18,000 slaughter pigs each year, said Stein's research into low-phytate corn carries tremendous implications for pork producers.

“As an industry we're very interested in it,” Larson said. “From what I understand about it, we have a

phosphorus problem with our manure. This could help us tremendously.”

But Larson—who buys all his feed—points out that if low-phytate corn yields less than regular corn, it may be hard for him to obtain it because farmers may not want to grow it. Some trials so far show low-phytate corn yielding 5% to 9% less than regular corn. In addition, the farmer would have to take additional measures to store the corn separately, meaning there will be extra handling costs.

“By using low-phytate corn, you can decrease the phosphorus added to the diet because the pig can absorb more of the phosphorus in the corn.”

—Hans Stein
SDSU animal scientist

“I know I'm going to pay premium for it,” Larson said. “If there's going to be a 9 or 10% loss in yield, someone has to pay for that.”

Raboy said it's true that some trials show yield reductions for low-phytate corn compared to ordinary corn. But he adds that the low-phytate trait has been available to breeders for less than a decade.

“There haven't even been 10 years of breeding with the trait to produce the high-yielding, competitive varieties,” Raboy said.

Raboy added that the conventional corn that is outyielding low-phytate corn isn't as effective as a feed source for animals such as poultry and hogs. He goes so far as to predict that, barring some disadvantage with low-phytate—if research showed it didn't store as well as regular corn, for example—low-phytate corn may become the corn of choice for many growers.

“Twenty years from now, planting low-phytate corn might be widespread,” Raboy said. “It is a trait that is very desirable from the standpoint of the end use of corn.”

Low-phytate corn will become commercially available in 2 to 3 years.

The SDSU scientist is looking at additional nutrients besides phosphorus.

“We are also studying other nutrients such as amino acids. We are studying calcium. We are studying energy.”

Meanwhile, although the research at SDSU so far concentrates on phosphorus in manure, Stein said some experiments to address the problem of phosphorus in urine are in the planning stages. Because it is the excess phosphorus that is present in urine, Stein said the key to reducing it will be to learn more precisely what nutrients livestock need and then not feeding them more than they need.

“In the future we'll have to feed a lot more precisely,” Stein said. ♦



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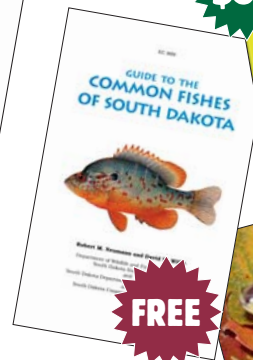
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