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South Dakota Farm and Home Research

SDSU Agricultural Experiment Station

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Abortion in sheep
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Director's comments

Thirteen citizens—your neighbors—
will set our goals. Help them out

Ray Moore
Agricultural Experiment Station

If you are a regular reader of this page, you know that I usually end my comments by asking you to write or call if you have questions, comments, or suggestions.

If you've been reluctant to do that before, now is your opportunity. There are 13 citizens of South Dakota who will be happy to take your comments. (They are listed on the inside back cover of this issue.) They are a blue-ribbon committee named by SDSU President Robert Wagner to review our research and to develop a set of goals and objectives that will start your Agricultural Experiment Station off into its second century of service to South Dakotans.

They are all leaders in our state-wide community; their names were submitted by the various organizations to which they and you belong. They represent a variety of constituent groups, including consumers. President Wagner has stated that they will look at all aspects of agricultural research "to insure that efforts underway are in keeping with the needs and desires of South Dakotans."

We welcome this probe of our activities at the Experiment Station; we have, in fact, urged that it be done.

Just over 10 years ago another group of citizens convened with our faculty to examine our priorities for the next decade. The 1975 plan consisted of 12 major goals, with the primary thrust to increase research in two areas—energy and irrigation (which included water sources and quality and the management of crops, soil, and water).

The "future" that group planned for has become the present. It is time for all of us to look ahead again. In the meantime, we will continue with our schedule of internal reviews. Annually, each of our projects is reviewed at both state and national levels. Advisory boards yearly evaluate the programs at field stations. I believe we do an excellent job of monitoring the quality of our individual projects, but what we lack is input in determining our major overall thrusts in research. Everyone of us sometimes gets too close to the trees to see the forest.

What "future" for the Experiment Station will the 1986 group propose? I suspect they may have to work backwards.

What will agriculture be like in the year 1995 or 2000? How many farms will there be in South Dakota? What will farmers be planting; what kinds of livestock will they be raising? The citizens' group will not only be describing what they think will be the state of agriculture in the future; they will be prescribing what they want in the future. Goal setting involves not only what we expect but what we desire. And since these committee members have "proven" themselves in their communities by their forward-looking work, we feel the Experiment Station and the future of agricultural research in South Dakota are in good hands.

Their report will be just in time for us to begin implementing these citizen goals in our

Director's comments

(Continued on page 23)



● Keep oats clean

No racehorse premium, dockage, even refusal at the elevator if oats carry live insects

How serious is it if you discover insects when you open your oat bins?

They cost South Dakota oat producers \$300 to \$350 thousand every year. And they may take a higher toll next year, and the next, as more producers turn to the expanding racehorse market.

About a third of South Dakota's annual oat production of 90 million bushels is marketed for a premium to buyers from the milling and racehorse feed industries. The premium is an estimated 10¢/bu.

An average discount of 3.8¢/bu specifically for insects in oats was taken by 77% of elevators surveyed in 1982 and 1983. Elevator operators docked or refused 11.7% of the oats brought to their scales because live insects were present in the grain.

Most of them said that one live insect per sample of oats was enough to cause it to be docked.

Bran bugs prefer damaged oats and moisture levels over 11%

So we looked in the oat bins of 58 randomly selected producers from the 17 major oat producing counties in eastern South Dakota. Counties were east of a line from Milbank through Mitchell to Yankton. We dug for insects and noted the construction of the bin, and we checked back the following year.

Bins filled with 1982 oats were first sampled in August of 1982 and then every 6 weeks until March 31, 1983. In the second year, 21 of the same bins, emptied of the '82 crop and refilled with new 1983 oats, were sampled every 2 weeks for the same time period.

What we found were the secondary feeders or "bran bugs." This type of insect feeds primarily on moldy or

cracked grain and on oats with a loose hull.

The primary insects, those which burrow into the seed for oviposition such as the weevils, were minor pests of stored oats.

Moisture content of the oats and insect populations went hand in hand (Table 1). If oats were between 8 and 11% moisture, the average insect population was quite low. Above 11%, the average insect population increased with each successively higher moisture level.

Different insects preferred different moisture levels. The flat and rusty grain beetles favored oats above 13% moisture, while the sawtoothed grain beetles liked their oats below 12%. Oats stored below 11 to 12% moisture did not eliminate insect infestations, but the populations were in a manageable range.

Insect populations were highest in the fall (Table 2). In October 1982, 74% of the bins contained at least one live insect in 2.2 lb of oats. In November, infested bins averaged 58 insects per 2.2-lb sample, the peak for the year.

In September of 1983, 84% of the bins were infested, and the average population of the infested bins peaked at 45.4. In both years, insect presence and numbers declined gradually from the fall until March of the following year. Cold temperatures in winter months reduce insect activity and survival.

Insect levels vary with type of bin and floor construction

Quonset type storage contained the highest insect problems. Samples from circular steel bins contained live insects



These types of bins are more likely to have live insects in the oats than wooden bins. Type of construction, kind of floor, and especially the kind of cleaning you do before filling in the fall all make a difference. The more grain left in the corners, the higher the chances of big insect populations in the oats. Broom the bin, at least; vacuuming is better; spray or fumigate if you had insects in the bin the year before.

17% more of the time than bins of wooden construction. They also had 14% more live insects in 2.2 lb of oats.

Floor construction made a difference. Bins equipped with false floors or with an aeration duct system had the highest average insect population at 104 per sample. Bins with steel floors were next (48), followed by bins with cement (28), and bins with wood floors (22 insects per 2.2-lb sample).

False and steel floors were found only under steel bins and wooden floors in wooden bins. Cement floors were found in all types of construction.

Quantities of oats above 2000 bu were typically in quonset storage and large steel bins. Two thirds of these bins were infested, with an average insect population of 39 in 2.2 lb. Below 2000 bu, wooden bins and small steel bins were used, and only 38% of them were infested, with an average insect population of 16 per sample.

Table 1. Insect presence and populations as related to moisture content of first year stored oats.

% moisture	1982-1983			1983-1984		
	No. of samples	% infested ^a	Average population ^b	No. of samples	% infested ^a	Average population ^b
8.0-8.9	6	50	7.0	8	75	26.0
9.0-9.9	50	48	9.6	110	53	34.0
10.0-10.9	83	37	9.4	130	54	34.2
11.0-11.9	97	41	21.5	39	36	46.9
12.0-12.9	39	51	18.0	23	26	28.0
13.0-13.9	20	65	60.0	1	0	—
14.0-14.9	8	88	29.1	—	—	—
15.0-15.9	4	100	188.3	—	—	—
16.0-16.9	2	50	201.0	—	—	—

^aSample contained at least one live insect per 2.2 lb.

^bAverage population of only the infested samples.

Table 2. Presence and populations of insects as influenced by date of sampling of first year stored oats.

Month	1982-1983			1983-1984		
	No. of samples	% infested ^a	Average population ^b	No. of samples	% infested ^a	Average population ^b
August	55	36	8.1	27	78	12.4
September	29	66	13.6	51	84	45.4
October	27	74	31.5	41	71	44.0
November	56	59	58.2	32	50	36.2
December	48	54	31.7	53	45	27.8
January	18	28	4.2	44	27	14.0
February	41	32	15.3	36	17	5.5
March	35	26	25.5	27	7	6.0

^aSample contained at least one live insect per 2.2 lb.

^bAverage population of only the infested samples.

Insects will lurk in the corners; you must clean bins between fills

When the 1982 peak infestation was between 0 and 9 insects in 2.2 lb of oats, the average population for new-crop oats the next year was 14.9. This increased to 33.5 in the 10-29 category and 41.5 in bins with previous peak level above 30 insects.

The message in that is if you have insects in oats one year, clean the bin before refilling it. You can use either residual sprays or fumigation.

And there's a difference between a scoop shovel and a broom.

Bins cleaned with a grain scoop had the highest average population (41 insects in 2.2 lb of oats) the following year. A broom was better (31), and a vacuum cleaner better yet (14). The more grain residue left in the bin, the better the chance of a severe infestation.

If you are growing good quality, high test weight oats for the specialty trade, you are cheating yourself out of that 10¢ to 15¢/bu extra if you don't practice good sanitation in and around your bins. It's little enough to do, considering the size of the premium. □

The writer is Jack Ingemansen, research associate in the Plant Science Department.

Research notes

Two amino acid ingredients increased in corn-sunflower diets for newly weaned pigs

Of the 10 essential amino acids required by swine, three—lysine, tryptophan, and threonine—have been identified by many researchers as being the first three limiting amino acids in cereal based diets. They are especially important when pigs are on a low-protein diet.

Using a lysine supplemented, 12% protein, corn-sunflower diet, researchers varied the levels of the other two amino acids and compared performance of six different lots of 16 crossbred weaned pigs averaging 21.3 lb in a pair of 28-day feeding trials.

Performance improved as tryptophan increased from .05% up

to .1% and as threonine increased from .07% up to .28%, say B.S. Borg, G.W. Libal, and R.C. Wahlstrom of the Animal and Range Sciences Department.

The researchers now estimate that optimum dietary levels for newly weaned pigs are about .16% of tryptophan and .63% of threonine when pigs are on a corn-sunflower diet.

Research basis: this is a hard place to grow corn

Corn research at SDSU focuses on inbred lines which will be used by seed corn companies to develop hybrid corn.

Corn breeder Zeno Wicks and pathologist Marty Carson say their

primary emphasis is on corn lines that will tolerate the high-stress environments found on the fringe of the corn belt. Moisture stress is considered first; disease stress is most important for irrigated corn.

Research has also begun on white corn varieties. Growers in southern states are having problems with aflatoxin, a fungus produced toxin that makes the kernels unfit for human consumption. Aflatoxin is not a common problem on corn grown in northern areas. (White corn is used for making "chips and grits".)

Why was there so much smut on corn this year?

Carson says it is probably the result of damage to the plants by hail. These injuries are easily infected by fungus. "Sweet corn is especially susceptible," he says.

Shared goals

Seedsmen and SDSU are partners in research and education acreage east of Brookings

An acreage that is both uniform in soil type and handy to SDSU scientists and visitors has been purchased by the South Dakota Crop Improvement Association and leased, free of charge, to SDSU for crops research and education.

The 117 acres, 4 1/2 miles east of Brookings along U.S. Highway 14, will be used by the Agricultural Experiment Station and the Plant Science Department.

The agreement keeps the land on the tax rolls, and SDSU will pay the taxes on it.

Signing the contract were, for the Crop Improvement Association, Gerald Moe of Arlington, its president, and for SDSU, Dr. Robert Wagner, president, Dr. Richard Battaglia, acting dean of agriculture, Dr. Ray Moore, director of the Experiment Station, and Dr. Maurice Horton, head of the Plant Science Department.

Moe said that the Crop Improvement Association used invested funds that were generated over the years from fees paid by certified seed growers.

Speaking in behalf of the South Dakota Crop Improvement Association board of directors, Moe said that this project was designed to help support Experiment Station research that in the long run benefits all South Dakota farmers.

"Our providing this land to SDSU for crop research and education is our way of showing appreciation to the University for past contributions and our faith in sound research to show the way in the future," Moe said.

"We thought we could put this money to good use by the purchasing of land for research and educational type projects to

be carried out, thus benefiting the seedsmen who helped build this fund."

Moe said that a portion of the land along U.S. Highway 14 will be used to show some of the crops grown in the state.

"We'll have a lineup right there along U.S. 14 for people to see." He thinks the location will encourage tourists to stop and look at South Dakota crops, as the land is just across the road from a roadside park.

The balance of the land will be used for various types of crops-related studies conducted and managed by researchers at SDSU.

The soil on the 117 acres is of one type and ought to be excellent for research, in Moe's judgment. After rights-of-way are taken out, 113 acres are tillable.

Moe said he also thinks that if the SDSU twilight crop tours are held at this location they will draw more people, create more interest, and show more consistency in crop variety due to the same soil type.

He added that water is available under the land, and eventually some irrigation research may be done there.

First uses of land will probably be plant breeding, variety development

Robert Pollmann, Brookings, secretary of the Crop Improvement Association, explained how this particular site was chosen.

"Our goal was to purchase land close by the University which was uniform and of a type that would be suitable for experimentation."



Gerald Moe of Arlington, center, president of the South Dakota Crop Improvement Association, signs the contract leasing 117 acres of farmland to South Dakota State University for research and education. Others signing the contract are, from left, Ray Moore, director of the Agricultural Experiment Station, Maurice Horton, head of the Plant Science Department, Robert Wagner, president of SDSU, and Richard Battaglia, acting Dean of Agriculture and Biological Sciences.



The only options for expansion of the SDSU campus are to the north and east. Research plots are presently located in those areas.

The Crop Improvement Association will hold title to the land. "We were concerned that it be kept on the tax rolls," Pollmann said. "The management of the land would be assumed by the Experiment Station and the Plant Science Department."

Crop research projects and studies the association has in mind are of a nature that would be valuable to farmers in South Dakota. "We agree with the stated goals of the Experiment Station in this regard," Pollmann said.

The acreage will be used for plant breeding, varietal development, testing and seed increase. Studies of tillage systems, soil fertility, and weed control may be included.

Pollmann said that the Crop Improvement Association "has a tremendous interest in SDSU and the research being done, and as the name of the association implies, we think that advances of any kind which improve crops will benefit the economy and South Dakota agriculture."

In addition to Moe and Pollmann, other members of the Board of Directors of the Crop Improvement Association include William Bielmaier, Wall; Delton Bormann, Stickney; Gordon Brockmueller, Freeman; Norman Frey, Mobridge; Donald Geise, Selby; Harlan Haugen, Wallace; Harold Hurlbert, Raymond; Steve Lien, Presho; John Niemi, Buffalo; Floyd Sawvell, Wall; Joe Schuch, Sisseton; James Suhr, Aurora; and John Schwab, Andover, who is vice president. □

The writer is Jerry Leslie, information specialist in the Ag Communications Office.



New: a chloride test

**SDSU is first land-grant lab to make the
recs; chloride may boost your wheat yields**

SDSU is the first land-grant university to offer chloride soil testing and to make fertilizer recommendations on a regular basis, says Jim Gerwing, Extension soils specialist.

Research over the last 4 years at SDSU has shown profitable wheat and barley grain yield increases with chloride fertilization, says Gerwing.

In eight of the wheat experiments where responses were noted, grain yield increased an average of 5.5 bu/A.

The average cost of the potassium chloride fertilizer (0-0-60) needed to get that response was about \$5.25/A. Assuming \$3.50 from the sale of a bushel of wheat, the return for each dollar invested in KCl fertilizer was \$4.

The grain yield increases are related to the amount of chloride in the top 2 feet of soil, Gerwing says. If soil test levels are less than 50 lb/A, there is a better than 50% chance of getting a yield increase. If soil chloride test levels are more than 50 lb, then a response to chloride fertilization is not likely, according to Gerwing.

A random sampling of soils from South Dakota sent to the SDSU Soil Testing Lab last

fall and this winter showed that 68% of the soils tested less than 50 lb/A chloride in the top 2 feet.

Because chloride moves readily in the soil with water, much like nitrate nitrogen, soils need to be sampled to a depth of 2 feet. Chloride analysis can be done on the soil samples sent in for nitrate nitrogen.

Chloride is not a routine test. It must be asked for.

Chloride fertilization responses have not been noted on corn or soybeans. Consequently, chloride recommendations are being made only for spring and winter wheat, barley, and rye.

If chloride soil test levels are less than 25 lb/A, 50 lb of chloride are recommended. If soil test levels are between 25 and 50 lb, 25 lb of chloride fertilizer should be used.

Chloride is applied as part of a common potassium fertilizer (0-0-60), which is about 50% chloride. So when 50 lb of chloride are recommended, 100 lb of 0-0-60 should be broadcast. □

The writer is Jerry Leslie, information specialist in the Ag Communications Office.



More sheep, more diseases

Scientists have become sleuths, tracking down elusive 'villain' in sheep abortions

The prices for lamb have been good this last year, and interest in sheep production has increased in South Dakota. More sheep, more chance of disease.

Diseases that affect reproduction can reduce profits severely. They also have raised some new and urgent questions at the South Dakota Animal Disease Research and Diagnostic Laboratory.

Each lambing season we examine aborted lambs from 100 to 200 outbreaks of abortion. We find that three infections—campylobacteriosis (vibriosis), chlamydiosis (enzootic abortion in ewes, EAE), and toxoplasmosis—cause most of the abortions.

That's not surprising. Each of those infections has been recognized as a major cause of ovine abortion for many years.

What **is** surprising is that we seem to be in the midst of a toxoplasmosis outbreak. Of equal interest (at least to scientists) is that we may have found a new bacterium, one that nobody ever seems to have isolated before.

The suddenness of toxoplasmosis and how common it is puzzle us

Toxoplasmosis is one of those "odd" diseases. There is no effective treatment or vaccination for it. And while humans

and many species of animals are susceptible, the organism that causes it (a protozoan, or single-celled animal) uses cats as its main host.

Cats become infected by eating infected rodents, aborted lambs or placentas, or food contaminated by the feces of other infected cats. About 10 days after infection, the cat starts shedding large numbers of the infective form of *Toxoplasma* in its feces. This form of the parasite can persist in the environment for more than a year under ordinary conditions. Shedding continues for about 2 weeks, by which time the cat develops immunity and probably will never shed the organisms again. Sheep become infected by eating feed contaminated with infected cat feces. In pregnant ewes, the organism attacks the placenta and fetus and causes abortion.

The alarming thing about toxoplasmosis is that until the lambing season of 1982-83, ovine toxoplasmosis was rarely seen at the South Dakota Diagnostic Lab.

That year, 17 (10.3%) of the 165 ovine abortions examined were caused by toxoplasmosis, and it was involved in 8.9% of the sheep abortions examined the next lambing season.

This rather sudden outbreak leads us, of course, to wonder just how common toxoplasmosis is in sheep in South Dakota

and surrounding states. "Why now" is another good question; possibly that may have to do with more new producers in the business who are unfamiliar with the sanitation aspects of sheep raising.

Dr. J.P. Dubey, USDA parasitologist at Beltsville, MD, is working with us to determine the prevalence of toxoplasmosis. Diagnosis of the disease in aborted lambs presents several problems, and Sheryl Seefeldt, graduate student in microbiology from LaBolt, SD, has been comparing various methods of examining serum of aborted lambs for antibodies to toxoplasmosis. Results to this point indicate that an agglutination test for antibodies in aborted lambs will greatly facilitate diagnosis.

Another organism that requires special methods to diagnose is the bacterium that causes enzootic abortion in ewes (EAE). It is highly contagious. It causes abortion in ewes and arthritis in lambs.

Most ewes become infected by exposure to abortion products from infected ewes. In South Dakota, the disease causes up to 7% of all abortion outbreaks, and within a flock, it may cause more than 25% of the ewes to abort. Vaccines for this infection are coming on the market, but their effectiveness in the field is yet to be proven.

EAE is caused by a very small bacterium (*Chlamydia psittaci*) that requires living cells in which to multiply. Because of this, it cannot be cultured using ordinary bacteriologic methods.

When campylobacteriosis showed up in vaccinated flocks we got curious

Campylobacteriosis (formerly called vibriosis) causes up to 15.5% of all sheep abortion outbreaks in South Dakota and, within a susceptible flock, may cause more than 50% of the ewes to abort.

It is a bacterial infection that ewes catch by being exposed directly or indirectly to products of abortion from infected ewes. A few ewes may acquire an intestinal infection that persists for months. Such animals shed the organism in their feces and serve as reservoirs of infection from one breeding season to another.

An effective vaccine against *Campylobacter fetus* has been available for years, and experienced sheep

breeders immunize their breeding flock each year.

However, in recent years, campylobacter abortions have been occurring in some vaccinated flocks. Our investigations have shown that 7 of the 10 campylobacter abortion outbreaks last year were caused by *C. jejuni*, a species closely related to *C. fetus*. The vaccine presently on the market apparently contains no *C. jejuni* and does not protect ewes from this infection.

We don't know whether a vaccine for *C. jejuni* will become available or how soon. Meanwhile, sheep breeders should take sanitary precautions to reduce exposure of ewes to abortion products. They should also quarantine all newly purchased breeding ewes, preferably through their entire first lambing season.

Some liver lesions are caused by an entirely brand-new bacterium

Ever since campylobacterial abortion was first studied near the turn of the century, veterinarians have noticed that a few of the lambs aborted during an outbreak had large necrotic liver lesions. Through the years, it was generally assumed that these lesions were always caused by campylobacter infection.

Several years ago, I discovered that often there was no *Campylobacter* in aborted lambs that had these liver lesions. Instead, microscopic examination of the fluid from the abomasum of these lambs often revealed an unfamiliar, tapered bacterium with flagella at each end. (Flagella are little whips which thrash about and propel a bacterium through a fluid).

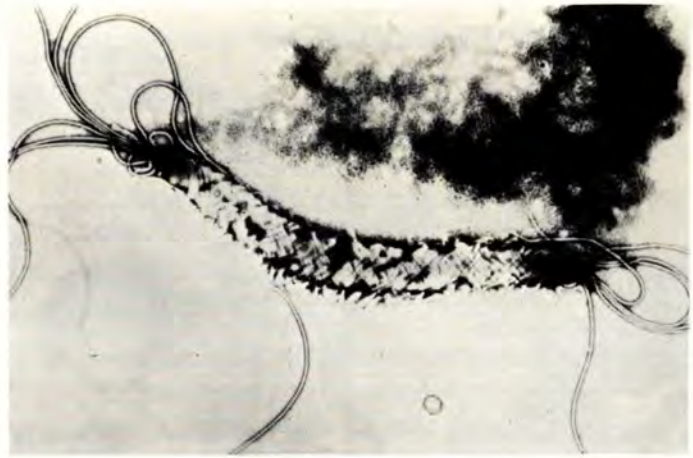
The bacterium seems shy; it resists our efforts to isolate it. In March 1984, Connie Gates, veterinary microbiologist, decided to try a special anaerobic (without air) atmosphere in which to grow the bacterium. It worked, and the organism was isolated from an aborted lamb with the distinctive liver lesions.

Since then, experimental inoculation of pregnant ewes with the bacterium has caused abortion, and some of the aborted lambs had the liver lesions previously seen in the field cases. Two more aborted lambs submitted to the Lab during the 1984-85 lambing season and another in 1986 also carried the bacterium.

To this time, nobody knows what we've



Sometimes, between abortions and healthy twins there is a wide knowledge gap. But the gap will fill in; for example, we now have a picture (taken with an electron microscope) of the new, as yet unnamed bacterium we can definitely associate with abortion. The unique "coilin" wrappings around the cell and the numerous flagella on each end are visible. (Photo taken by A. E. Ritchie, National Animal Disease Center, Ames, IA; printed with permission from J. Am. Vet. Med Assoc. 186:789, 1985.) At bottom is a liver from a lamb aborted when the ewe was injected with the new bacterium. The large circumscribed necrotic lesions are visible. (Printed with permission of Am. Assoc. Vet. Laboratory Diagnost.)



got. The bacterium remains unclassified and unnamed, even though it has a very distinctive shape and structure. Other researchers have seen similar bacteria by electron microscopic examinations of tissues, especially the lining of the stomach, in several species of adult animals.

But apparently it has never been isolated and cultured before, nor has it been associated with disease.

At present, we don't know how important this new cause of ovine abortion is. Because the bacterium is so very difficult to isolate and cultivate, it will take time to gather information concerning its prevalence, where it comes from, and how it spreads.

The organism refuses to multiply in most of the media ordinarily used for determining the characteristics of bacteria. There is a lot of work to be done before the bacterium can be classified and named. At this point, it does not seem to fit any of the recognized bacterial classifications.

We have launched a major campaign to find out; we are cooperating with microbiologists at the National Animal

Disease Center in Ames, IA, to whom we have sent the organism. Work has progressed to the point that we are considering proposing a new genus and species for the organism, *Flexispira rappini*.

Latin names don't make much sense to people who don't use them every day. But there is method in this selection:

"Flexispira" pinpoints the unusual ability of the bacterium to flex or bend as it moves. Bacteria are usually rigid.

"Rappini" is in honor of a man named Rappin who first reported seeing a similar organism in the stomach wall of dogs in 1881.

Through reports in scientific journals, we have informed other veterinarians and veterinary diagnostic personnel around the world about the character of the organism and the disease it is known to cause. In time, it will yield up its secrets. And in time, veterinarians and sheep producers will know the nature of the infection and the measures necessary to control it. □

The writer is Dr. Clyde Kirkbride, DVM, professor in the Veterinary Science Department.



35-year wrap-up

He says they weren't one-man projects, but in beef breeding one man was always there

After 35 years of writing up the results of research projects, I'm doing one last summary. No theorizing. No philosophizing. I will state some findings, and you can draw your own conclusions about the state of beef breeding research in South Dakota and the directions it's taken in 35 years.

I've been involved in beef breeding ever since I came to SDSU in 1951, but in no way has it been a one-man project. Many

fine people have contributed. In fact, you will find this report a "who's who" in South Dakota beef breeding. There will be excellent people I've had to leave out for the sake of brevity.

We found connection between fast early growth and retail cut yield

My first job back in 1951 was to redesign a beef cattle inbreeding project

developed by Leslie Johnson and utilizing cows at the Antelope Range Livestock Station, the Cottonwood Range Station, and the Reed Ranch Station north of Presho.

Bull progeny from these cows were brought to the Brookings Station for performance testing. Inbred lines were developed; later we were able to compare hybrid cattle, produced by crossing the inbred lines, to inbred and control cattle.

Results indicated heterosis (hybrid vigor) for important traits similar to that obtained by crossbreeding, except the within-breed crosses of inbred lines yielded a lower level of heterosis.

Those traits dependent upon maternal ability, such as weaning weight, were adversely affected by inbred mothers. Thus, for those traits single-cross calves did not perform at the same level as the control cattle.

Bulls from the performance test at Brookings were selected and used to continue the lines at the field stations. This phase of the project contributed to the accumulating body of information regarding correction factors and recommended procedures for conducting performance tests. It also contributed information regarding the effects of inbreeding and methods of adjusting performance traits for level of inbreeding.

In the mid 1950s, Joe Minyard joined the project, coming from the county Extension agent position in Harding County. His primary responsibilities were the development and supervision of the bull leasing program. Surplus bulls with performance records were leased to commercial producers in the state who agreed to maintain single-sire breeding pastures so that the offspring of the tested bull could be compared to offspring of the producer's own bulls.

At the start, weaning information on their calves was all that was collected. Later on, in the 60s, the work was expanded to allow postweaning feeding in Brookings and collection of individual carcass data, including yield of retail cuts. Bill Costello was leader of the carcass data collection phase.

This part of our studies led the way in establishing the relationship between fast early growth and yield of retail cuts.

With the cooperation of Darrel Busch and Lowell Wilson, various equations for

predicting retail cut yield were developed. We were able to evaluate live animal measurements, scores, and estimates of carcass traits on the live animal as predictors of carcass merit.

Early growth rate was 80% accurate in predicting retail cut yield, and the addition of all the measures, scores, and live animal estimates only added an additional 2% accuracy. In addition, estimates of heritability of growth rate and carcass composition and quality traits, along with genetic correlations among these traits, were obtained.

Industry handled dwarfism itself; we added a selenium-symptom study

During the 50s and 60s we spent a lot of time on dwarfism, an inherited defect that was troubling the beef cattle industry at that time. Primary emphasis was given to x-ray studies of defects of the spine and heart that resulted from this defective gene.

The heart appeared to offer the most opportunity for further study, but we did not have to, because the industry was able to alleviate the problem considerably by pedigree selection. We could spend our research dollars in other areas.

During this same period, Oscar Olson and Joe and I began a number of studies on selenium poisoning of cattle at the Reed Ranch Station.

Nutritional and breeding methods of prevention showed only limited success. However, we learned enough that we could make pasture management recommendations to help alleviate the severity of selenium poisoning symptoms.

Cow efficiency not determined by cow size, there was no heterosis

In the late 60s the carcass steer work was terminated at Brookings and, with the arrival of Ron Parker, we began a cow efficiency project. Carl Menzies, department head at the time, was instrumental in providing support for our work.

Early objectives were to evaluate the effect of cow size on cow efficiency, to determine if there was any heterosis for cow efficiency, and to measure lifetime cow efficiency so we could study repeatability of the trait. Mike Brown and

Mike MacNeil worked in the project in later years.

This work, which terminated in 1979, was one of the first to show that cow size had practically no effect on cow efficiency, and that there was essentially no heterosis for cow efficiency. From this work we got the first estimate of repeatability of cow efficiency.

Lower range carrying capacity if you have high producing cows

In 1972, with all of the out-state beef breeding research being concentrated at the Antelope Range Livestock Station, we started a new crossbreeding program.

Our objectives were to study different biological types, involving different cow sizes and different levels of milk production, to determine if the range area of western South Dakota could support larger and/or higher milking cows. We used straightbred Hereford, Simmental x Hereford crossbreds, and Angus x Hereford crossbred cows.

Results, in combination with the cow efficiency work at Brookings, indicated that if the larger and higher milking cows were provided energy sufficient to meet their needs for reproduction, they could produce very satisfactorily in the range area.

It is critical that the energy needs of these higher producing cows be met, and it is also critical that producers realize that meeting this need requires lowering the carrying capacity for these higher producing cows as compared to the number of smaller or lower milking cows that they could carry on the same ranch.

We can rank traits affecting cow efficiency with accuracy

We then began bringing all heifer calves produced at Antelope to Brookings each year as yearlings. Those conceiving for the first calf entered the individual feeding barn for a measure of cow efficiency during their first gestation and lactation.

This phase of the work is continuing and will lead to both a half-sib and daughter-dam estimate of heritability of cow efficiency. This phase is also providing additional needed estimates of the sources of variation in cow efficiency.

Results so far indicate the following ranking of traits affecting cow efficiency with their corresponding accuracy: weaning weight of calf (71%), milk production (27%), cow condition at weaning (16%), cow weight at weaning (10%), calf creep consumption (10%), cow condition at calving (1%), cow TDN consumption (1%), and cow height (frame size) (0%).

We had concurrent studies at various times. In the early 70s, with the cooperation of Ron Parker, we began telemetry studies of the reproductive tract of the cow.

The objective was to study the change in uterine temperature associated with the estrus cycle of the cow. Plans were to proceed to remote measurement of the pH of the uterus during the cycle.

We ran into interference—from thunderstorms and the nighttime clear channel stations. We did get some indications of the temperature changes associated with the heat period. By the time FM equipment was available, Dr. Parker had left the project and no physiologist was available.

The goal of this work had been the development of a semen capsule which could be implanted in each cow in the herd at the same time. It would dissolve at the proper temperature and pH condition when each cow came into heat. This still appears to be a reasonable goal, since gaining that ability would eliminate heat detection and conserve labor at insemination.

Computer programs can chart individual management options

Simumate, a computer program simulating crossbreeding, was developed during the early 1970s with the cooperation of Delwyn Dearborn.

This program allows a producer to evaluate different breeds and different crossbreeding systems for his own economic, feed, and management situation. It can evaluate straightbred, two-breed cross, three-breed cross, and three-breed terminal cross systems, in a cow-calf, backgrounding, feedlot, and carcass phase. Net returns for each phase and for the total system can be shown.

Simumate is still finding use in the

AGNET system and in university classrooms in this country and abroad.

A second computer simulation has been developed in the early 80s with the cooperation of James Wilson of Purdue University and Warren Hovland of the SDSU Computer Center.

The energetics of cow calf production to weaning have been simulated by using the calf birth weight and weaning weight and the cow's weight, milk production, and weight changes during the year.

The program calculates energy requirements for each day of the year for the cow and calf and graphs these along with their weight changes, milk production of the cow, and total energy required by the cow-calf pair. If energy supplies from available feed are known or can be estimated, a producer can evaluate the type of cow—as defined by cow size and milk production—best adapted to his feeding and management situation.

It's the people who make us a leader in beef production

Although it was not a formal part of the beef breeding research project one of the most enjoyable efforts over the years has been the opportunity to work with and advise the South Dakota Beef Cattle Improvement Association. This association, initiated by Henry Holzman and Leslie Johnson, was the first such group in the United States, and it has been a progressive leader in the

improvement of beef cattle in this country.

South Dakota people in general and the members of this association in particular are a special group. South Dakota has continually been a leader in performance testing, in the use of crossbreeding and artificial insemination, and, more recently, in the use of estimated breeding values and estimated progeny difference.

You needn't take just my word for it. Their achievement is evidenced by the number of breeders and cattle that are recognized each year as leaders in their respective breeds in the areas of breeding values for production traits and cow efficiency.

With these progressive people producing our beef cattle, South Dakota can look forward to continued success and leadership in the more profitable years that are sure to come.

In closing, I'd like to express appreciation not only to those already mentioned, but also to Lee Tucker, station statistician, who's been a big help over the years, and to the field station and unit superintendents, graduate students, Extension specialists, county Extension agents, and the people of South Dakota that I have had an opportunity to work with. I am very grateful for the opportunity that I have had to do research work with beef cattle in this state. □

The writer is Dr. Chris Dinkel, professor emeritus in the Department of Animal and Range Sciences.

Research notes

Preconditioning study: preliminary results

Preliminary results of a 3-year study on preconditioning feeder calves in South Dakota indicate that performance will vary with every calf crop.

This is due to variations in range conditions, weather, vaccinations, and other factors, says Rob Pritchard, Animal and Range Sciences Department.

Two hundred calves were purchased from four western South Dakota ranches, half were preconditioned, and both groups were followed through weaning,

shipping, and the feedlot. Although preconditioned calves gained less than controls initially, they gained an average 1.75 lb/day, compared to 1.35 lb for the control group, during the total period between treatment and shipping.

"However, average daily gains varied so much from ranch to ranch, one time favoring the treatment and the next time favoring the control group, that results are not considered reliable," Pritchard says.

For the feeder, there was a slight advantage during the first 28 days, but that disappeared by slaughter time. Preconditioned calves did eat

more dry matter, 13.75 lb/day compared to 12.19 for controls.

From a health standpoint, the highest sickness score was associated with preconditioned calves on a high concentrate diet, but that group still grew faster than controls. The cleanest group was preconditioned calves on a high silage diet.

Preconditioned calves used in the study were treated for parasites and vaccinated against IBR, BVD, P13, and 7-way clostridia. After weaning, steers were fed a commercial ration medicated with oxytetracycline plus hay.



New releases

The newest varieties are two big oats, unique triticale, and a high-yield flax

Two new oats, a new triticale, and a new flax have been released by the South Dakota Experiment Station.

The oats both have high test weights and are aimed at the race horse market which demands a large kernel and white hull. The triticale is awnless, a one-of-a-kind, since triticale has a reputation of being hard to feed because of its awns or barbs. The flax is high yielding, high oil, and medium-flowering. It is intended to capture the high-oil premium offered by some markets.

'Sandy' is better than Moore, will appeal to truck traffic

The new oat Sandy will probably be most compared to Moore, because its maturity is the same. However, Sandy's test weight is higher and its rust resistance better than Moore's.

"Anyone looking for a high test weight oat of premium quality for the truck

traffic will like this grain better than Moore," says Dale Reeves, who developed both new oat varieties.

Sandy is named after Elmer Sanderson of Brookings, an Extension specialist for many years who worked on small grains. Sandy was developed from a cross of Dal x Nodaway 70 and Moore. Kelly, another new variety, was also selected from the Dal x Nodaway 70 cross.

Sandy is tall and late. Its heading date has been one day later than Moore for 2 years at Brookings. Whenever lodging has occurred, Sandy has lodged less than Moore.

Yields have been good unless Sandy was grown in areas suited to earlier maturing varieties. Due to its late maturity it should be best adapted in the northern areas of South Dakota.

Test weights are "quite good," according to Reeves. Sandy test weights, when compared to Moore, were .4 and 1.1 lb/bu higher in 1984 and 1985,

respectively, in East River trials.

The grain is of good quality and has a light cream color. Milling yields have been good. Both protein and oil percents are in the medium range.

Crown rust resistance is good, similar to Dal; and stem rust resistance is equivalent to most other varieties in this region. Sandy is susceptible to barley yellow dwarf.

Since Sandy is both tall and late, it should be good as a forage. When compared with Moore and Lancer it produced 4.73 T of dry matter, compared with 4.41 for Moore and 4.57 for Lancer. Percent dry matter was 23.7 for Sandy, 25.5 for Moore, and 25.7 for Lancer. Protein percent was 8.28 for Sandy, 8.32 for Moore, and 9.84 for Lancer.

'Hytest' is just that—big and attractive. Straw strength 'fair'

Hytest, as its name implies, has an extremely high test weight with a large kernel.

Tests for kernel size at 12 locations in South Dakota showed 1,000 kernels weighing 30.3 grams, while Burnett and Benson weighed 28.2 and 28.5 grams, respectively.

Reeves says that truckers have liked Burnett because of its high test weight and big kernel. Hytest is even bigger. And it has a higher test weight and bigger kernel than Nodaway 70 and Kelly, also preferred because of their eye appeal.

Hytest has the same parents as Sandy, except that in this cross Reeves used Moore as a female parent and Dal/Nodaway 70 as a male parent.

Both Sandy and Hytest are good milling oats. Hytest is a little creamier in color than Sandy.

The biggest limitation of Hytest is its straw strength which is "fair."

Hytest is a midseason oat which heads about the same time as Lancer, Ogle, and Burnett. Plants are fairly tall, usually being between Ogle and Wright in height.

Yield tests in 1984 and 1985 showed Hytest does better with early, rather than late, planting. In 1984 late planting due to wet conditions was more detrimental to Hytest than other varieties.

Hytest ranked No. 1 for test weight in the 1984 and 1985 uniform midseason oat trials, a regional test in 11 states. Groat

percent is high. Protein percent is also high, while the oil level is medium.

For crown rust resistance Hytest would be classified as medium susceptible. It is susceptible to barley yellow dwarf. It is resistant to smut.

The two new varieties are being released in spring 1986 for planting by certified seed growers. Certified seed should be available to commercial growers in the spring of 1987.

'Marval' is one-of-a-kind, but then, all triticales are unique

Triticale is a rye-wheat cross. Varieties have always had awns or barbs that make them difficult to feed as a forage crop.

In the 1970s triticale was introduced as a miracle crop—the first man-made crop to solve all our problems, says Fred Cholick, SDSU spring wheat breeder.

The scientific community had been working with triticale about 30 years. Natural selection had been working on wheat for about 10,000 years before man began to manipulate the plant.

"Maybe man's ego made him think he could do in 20 to 30 years what it took nature 10,000 years to do," Cholick says. "A lot of claims didn't come to pass. Triticale couldn't do all it was said it could."

Triticale is now being developed to complement existing small grains.

The SDSU breeding project got involved with triticale when questions were raised during the mid 70s "push." It has been a very minor component of the program. Staff continue to look and evaluate the progress of the breeding programs. Further interest in triticale breeding will depend on future development and utilization of the crop.

Dr. Ray Moore, director of the Agricultural Experiment Station, says SDSU didn't spend a lot of money on developing this variety of triticale.

Marval is part of "our program of keeping abreast of new crops, minor crops. Sunflowers and soybeans once were minor crops. They made it," Moore says.

One of the first complaints about triticale surfaced when it was used as a forage. The barbed awns caused a problem in livestock feeding. Producers

also had some problems with palatability of triticale as a grain crop.

"There are very few awnletted varieties of anything," Cholick says. Awnletted means the plant has only a 1/4-to 1/2-inch awn at the tip. Awnletted means "almost awnless."

"To my knowledge, Marval is the only awnless triticale," Cholick says.

Ergot was a serious problem with some of the early triticales. Marval can have some ergot, but the level is relatively low compared to the initial triticales.

In the process of comparing lines developed by SDSU and lines from other breeding programs, Marval performed as well if not better in yield trials. It was compared against both triticale and spring wheat varieties. It yielded a bushel and a half less than spring wheat, assuming a 60-lb bushel.

The United States grain standards have a minimum test weight for triticale of 48 lb. SDSU uses a 60-lb bushel when comparing triticale to spring wheat. "Everybody's going to compare it to spring wheat, so why don't we start the process," Cholick says.

When compared to the varieties Karl and Kramer, Marval has a 2- to 4-bu yield advantage. It is tall and medium late with excellent straw strength. In forage trials it was compared to oats. It had comparable forage yields.

The original cross is a selection from a variety SDSU received from CIMMIT, an international breeding center in Mexico.

As with any new product, nobody is sure what the market will be. There is some contract growing for millers. Cholick sees some potential in the forage area where a producer plants an annual crop to use either as a forage or a grain, depending on the quality of the forage available, as in 1985.

Another use may be as feed grain. And Marval also has potential as specialty flour, according to Cholick.

"How big a market I don't know. I know it makes excellent pancakes, because I made some. The pancakes are sweeter, between a buckwheat and a flour pancake."

Cholick continues to be reserved about Marval and other triticales.

"We're not working with a miracle crop. It isn't oats, it isn't wheat. A producer will have to see where it fits in

his management system—for a feed grain or for production for the market."

Production practices for triticale are nearly identical to those for spring wheat. Cholick would recommend a slightly higher seeding rate for triticale.

SDSU's Foundation Seedstocks Division will allot seed to registered seed growers this spring. Commercial producers can pick up some certified seed and see where it fits in their operation in the spring of 1987.

'Rahab' is very high yielder, has high oil, planting flexibility

Rahab will be available this spring from certified seed growers.

In SDSU tests against the most common varieties of flax raised in South Dakota from 1983 through 1985, Rahab had the highest yield of the 14 varieties tested, says Charles Lay, who with Kathy Brady developed the new high yielding, high oil, medium flowering variety.

Rahab yielded 32 bu/A, compared to 29 for Linott and Culbert 79. Rahab had the second highest oil content with an average of 41.4%, compared to 41% for both Culbert 79 and Linott.

Rahab is a cross between a high-oil experimental variety from Minnesota and a rust-resistant line from North Dakota. The purpose behind its development was to increase yield and oil content, Lay says. At some markets a premium is paid for oil content over 40%.

This variety can be planted wherever flax is grown in South Dakota, but it is later than some, so it needs to be planted early to realize its full potential, Lay says.

He sees it replacing Dufferin and being a "pretty good" alternative for Flor and McGregor.

Rahab is named after a woman in the Old Testament who hid Israelite spies on her roof under flax straw when they were spying on the promised land after 40 years in the wilderness.

South Dakota has about 100,000 to 110,000 acres each year in flax. "We could increase our acreage by one third and still not be a burden on the market," Lay says. "Flax will respond to good management, early planting, good weed control, and good fertility."

The writer is Jerry Leslie, information specialist in the Ag Communications Office.

Director's comments

(Continued from page 2)

Experiment Station centennial year of 1987. With their priorities in mind, we will redirect our projects, and we will, of course, report back to you all findings.

A final note: Come to Brookings on July 9

and 10 for the "Farm and Home Fest" on the SDSU campus. Many of the units of the Agricultural Experiment Station will be holding open house and will be demonstrating the results of their research projects. And if you just happen to run into me, well, I still invite you to give me any of your questions, comments, or suggestions. ☐

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