THE CARRINGTON IRRIGATION STATION'S LIVESTOCK UNIT–A "COW HEAVEN"

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"Confinement" has a bad ring to most ears. To hear it conjurs up visions of prison bars, James Cagney and Alcatraz.

However, if you ask Vern Anderson, supervisor of the Carrington Irrigation Station's Livestock Unit, he'll tell you "confinement" beef production is nothing less than "cow heaven."

In confinement production systems, cattle are housed in pens, rather than inside barns or on pastures. The confinement allows producers to closely monitor–and control–the livestock's feed, breeding, health and weaning.

To Anderson, drylot cow-calf production–also known as confinement–can add a needed dimension of stability to a diversified farming operation in the northern Great Plains.

"(Drylot) utilizes a farmer's available labor and his otherwise nonmarketable crop residues," he says, "while at the same time it allows him to level out a lot of inputs and make more use of his machinery over a wider span of enterprises."

"I think drylot production has a place in Dakota agriculture and it has a future."

With those words, Anderson characterizes the results of work that's been going on at the Livestock Unit for the past 12 years.

In 1972, a livestock facility was added to the irrigation station at Carrington, N.D. Its basic mission was to measure beef production per irrigated acre by using methods and techniques that could be identified with Dakota farm and ranch operations.

Within a few years, Anderson says, project evaluations revealed the economic advantages of the drylot system of management.

When the Unit was built, he explains, one of the first major projects was a comparison of irrigated pasture and drylot production.

Vern Anderson, supervisor of the Carrington Livestock Unit, stops to play with Brite, one of the facility's two dogs, when beginning his rounds on an early November morning. Anderson, an associate animal scientist, has been at the Unit since 1979 and has participated in a number of research projects.

The results of the seven-year project, he says, strongly favored drylot production, both for efficiency and pounds of beef produced per acre.

"Cow-calf gains were 607 pounds per irrigated acre using year-round drylot management," he says. "The gains for irrigated pasture, with winter drylot, were 328 pounds."

Calf gains, he adds, were 457 pounds per acre in drylot and 265 pounds on irrigated pasture.

In 1982, Anderson and Ron Meyer, an assistant agriculturalist at the Station, compared the breakeven prices and returns of the Carrington cow-calf herd under drylot, irrigated pasture and range management conditions.

The results of their study?

"We were surprised at our results," Anderson says, "because the dollars and cents strongly favored drylot production."

In effect, he continues, their evaluation supported the earlier project's finding: the same land base can maintain more cows under drylot management than under either irrigated pasture or dryland range.

"The carrying capacity from one 160-acre center-pivot irrigation center–that's 130 irrigated acres–for drylot at Carrington was 200 cow-calf pairs," he says. "The irrigated pasture system could only support 135 pairs."

The disparity between the systems was also visible, he adds, when production costs were compared. The overhead for raising cattle under drylot was measurably less than that of irrigated pasture or dryland range.

"Breakeven costs for selling weaned calves under drylot were 10 cents a pound less than under the range-pasture situation," he says.

Anderson says the Unit's research projects on irrigated forage in beef production have served to highlight the many advantages drylot offers Dakota beef producers.

And, he adds, if a few misconceptions about the system can be laid to rest, producers will find drylot can both maximize their livestock dollars and streamline their operations.

A major advantage of drylot production, he explains, is the control it gives the producer–a control that extends from the herd to the land.

The control the system gives the producer over the cattle, he continues, is obvious. "You know where they all are at one time," he says. "Because you see them every day, you can quickly tell if they're sick or well."

And, while using the system does mean infectious diseases can spread quickly to the herd because of the close quarters, Anderson is quick to point out that it also allows the producer to prevent such illnesses with equal speed.

"You have better control of the animal's health under drylot conditions because you can observe them more closely," he says. "You have them all together for vaccinations when you wish to administer them. You can give all the animals what's needed at the same time, rather than chasing them back and forth to get them to a place where you can do that."

Drylot production also means the producer can closely control the herd's feed–the type, amount and quality.

It also means a better control of the birth cycle, he adds, allowing more cows to produce calves at the same time of the year.

Another feature of the system, according to Anderson, is the control it gives the producer over calf weaning. Under drylot, there's less danger of disease or fatality from weaning shock.

"Our weaning day at the Unit amounts to chasing the cow out of the pen," he says. " The calf stays."

The calf knows where the feed bunk and water are, and is completely familiar with its surroundings. "He's been eating pretty good," Anderson laughs, "so it's not a complete shock to his environment when his momma leaves."

"In four years, we've had to treat one calf for respiratory disease within a month of weaning," he points out. "I think the usual rate is about 10 percent of the calves each year."

While drylot permits an easing of some herd operations, Anderson cautions, it certainly doesn't allow the producer to run a slip-shod program. In fact, the drylot advantages may well mean the producer must improve his management efficiency.

"The cow aren't going to get anything unless you give it to them," he explains. "If you shorten them on something–if you don't give them enough calcium or phosphorous–they're not going to get it anyplace else, so you have to be a good manager and have the ration figured out."

The same goes for calves, he adds. "If they don't get enough roughage, grain or feed in general, they're not going to get it. They can't go out and pick it up by grazing like cows in the pasture."

In addition to herd control, Anderson says drylot gives the producer more control over his land.

What the system does, he explains, is take a cow off the range, where there's a large investment in land per cow, to a confinement situation, where the land base needed to support that cow is much smaller.

"Consequently, you have less money invested in land, and possibly a little more invested in equipment and facilities," he says. "But not to the point where it diminishes the total return."

Anderson uses his Unit's operation as an example of the options drylot offers the producer.

Feed for the confined livestock is harvested off cropland. Since the land is irrigated, Anderson says the Unit has a very efficient feed production, growing a lot of feed over a very limited number of acres.

"In fact," he says, "one statistic we kick around is that we can support a cow and her calf for a year on about half an acre."

Anderson like that statistic, especially when he compares it to the anywhere from 8 to 20 acres (depending on rainfall conditions) the same pair would need if they foraged for food on their own.

"I'd say an absolute minimum for this part of the country would be five acres," he amends. "If you get into the Red River Valley, you could maybe do it on three or four acres-but there you're talking about higher land prices and fertility levels than we have here on the Coteau Drift Prairie."

While Anderson is pleased with the ratio of land needed to support a cow-calf pair the Unit has achieved, he's quick to point out that part of the success is due to irrigating the land.

"The thing we have with irrigation is a consistent crop," he explains. "A yield of forage year-in and year-out."

Dry land forage is very variable, he continues. With irrigation, in addition to consistency, the crop is normally of a higher quality.

"When you raise corn, you can raise more energy under irrigation with corn for silage than you can with any other crop known at the present time," he says. "If you raise small grain under irrigation, which is marginally profitable, you have much more residue-that gives you a much more useful product for your livestock."

While drylot beef production is possible without irrigation, Anderson prefers the advantages his present system provides.

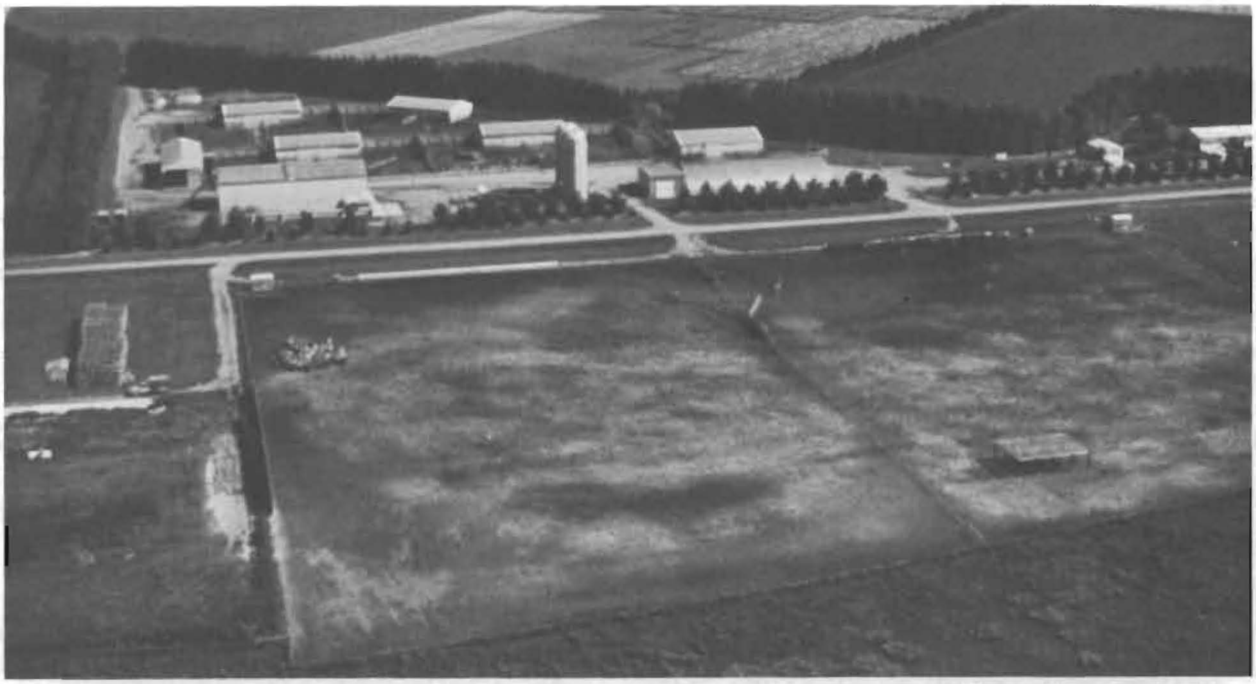
"With dry land crop production, the producer has to look at storing some extra feed from year to year to preclude a dry or short season," he explains. "Either he does that or he has to buy and sell cows back and forth. Any producer that wants to get into a drylot program doesn't want to do that. That's management by crisis."

However, while he extolls the virtues of irrigation, Anderson adds that drylot management can fit into many existing cattle programs.

One example he cites is the producer who wants to expand his operation, but has a limited land base from which to work.

"This producer can take some crop production land to raise a little extra feed," he says. "With this, gummer and older cows-the ones that would have a tough time making it on the range-could be kept in a pen for the summer."

A second situation where drylot production would fit in an existing operation is for the young farmer who wants to start a herd but lacks a lot of capital resources.



An aerial view of the Carrington Irrigation Station's Livestock Unit. Built in 1972, the facility continues its basic mission of measuring beef production per irrigated acre, using methods and techniques that can be identified with Dakota farm and ranch operations.

"This farmer could buy or rent a small farmstead," says Anderson. "He can build a pen or setup of some kind with minimal capital investment and lease a quarter or two to farm and harvest for feed. Then he could have his cow program and build from there."

Anderson says the drylot adds a dimension to any farming enterprise because it allows the producer to use a good deal of crop residue that would otherwise be virtually useless.

"We're talking about valuing straw at $20 to $25 a ton and corn stover at anywhere from $15 to $25," he says.

"Estimates on corn stover range from one to two tons per acre," he continues, "so if you value it at $50 per acre, that's an increase from your corn crop that nobody can ignore in these times."

A third situation Anderson sees where a drylot operation could fit into an existing program is for the older farmer who want to cut back his milking.

"He's usually got the equipment, the silos, the machinery and the setup," he says. "He wants to run some beef cattle to keep in the business for a few more years or to transfer to his son."

Using drylot management, he says, would allow the farmer to continue to use his capital assets in that manner.

While research at the Unit has shown the advantages of drylot management, Anderson admits there's not as much interest in the program among Dakota beef producers as he'd like to see. He feels the lack of interest stems from two major sources: a concern over the cost of irrigation and a mistaken notion of "confinement."

"Most of the state's cattlemen know what we've done here with drylot production," he says. "Unfortunately, we don't have a real close identity with many of them because when they hear 'irrigation' or 'confinement', they turn off."

Anderson understands producers' concern with irrigation costs. "People know they're looking at a substantial investment in an irrigation system," he says. "First of all, they have to have irrigatable soil and then water. Then they have to buy the system."

But, while he can see the concern over irrigation costs, Anderson says feelings about confinement are the result of too many myths and misconceptions.

"First of all, there's the popular idea that cattle belong on the range," he says. "That's the romantic notion."

Secondly, he continues, too many people equate confinement with cages, rather than pens. They think confined animals are brutalized.

This concern about confinement treatment, he adds, has resulted in a couple of inquiries from animal rights people about the Unit's projects.

"But," he continues, "they haven't bothered us because we treat our animals humanely. In fact, the cows are probably more comfortable with our program than they would be if they were out grubbing for something to eat on the range."

Because of the treatment and care the livestock receive as part of the drylot program, he jokes, some North Dakota State University specialists have dubbed the Unit "cow heaven."

"We provide for their every need," Anderson says. "They're never hungry or thirsty. They don't have to run all over God's half-acre looking for something to eat. They've got all they need right here."

He sums up the popular misunderstanding he feels exists about beef confinement when he recalls a scene from a recent television mini-series.

"One of the last scenes in 'Centennial' was about the future of the beef cattle industry," he says. "The way it was portrayed, all our cowboys are going to be running around in little white lab coats and all our cows are going to be in little pens."

Anderson doesn't see the same future.

"Well, we don't wear white lab coats around here very often, but all of our cows are in little pens year-round," he says. "I think that's been the trend to combine humane treatment and efficiency. Essentially, I see it as a new frontier in cow-calf production."

Because people misunderstand drylot production, Anderson feels too many of them miss the chance to see its advantages when they visit the Livestock Unit.

Too often, he says, many of them get caught up in looking over the advantages of other research being done at the facility, and overlook the drylot studies.

"It's interesting," he says, giving an example of what he means, "We're now in our third winter of evaluating livestock waterers and how much energy they use."

The project amounts to hooking up an electric meter to five different waterers and measuring the electric consumption of each every month, then summarizing the findings at the end of the winter. The experiment has resulted in more publicity than ever expected. People interested in the findings call the Unit from all over North dakota, neighboring states and Canada.

"People come on the place," he says, "and they want to know how they can go to town and buy a wire that's going to save them $10 a year in electricity."



(Left to Right) The Pride of the Farm, the Johnson Artificial Spring and the Mirafount are three of the five stock waterers being evaluated at the Carrington Livestock Unit for energy efficiency. After two years of testing, researchers at the facility have received numerous queries from across North Dakota, neighboring states and Canada about the comparisons they've drawn.

While he characterizes the study of irrigated forage in beef production as the Unit's "bread and butter," Anderson also stresses that any number of different research projects-like the waterer evaluation-are always under way at the facility.

For example, one new project has addresses what may be what he terms "the greatest single problem area for cattlemen": rebreeding cows after they've calved.

The Unit's project, he adds, is just one of a number of related experiments around the country to find a way to shorten the time it takes to bring a cow into heat after she's calved.

Recent studies in Nebraska yielded interesting results, Anderson says, when mature fertile bulls were housed with cow-calf pairs shortly after calving.

Apparently, contact with the bulls stimulated the cows to come into heat sooner. Those housed with the bulls started cycling 41 days post-calving; those in the control group needed 62 days.

As part of a similar project, the Livestock Unit's researchers used gomer cows (androgenized cows with actions and behavior similar to bulls) to evaluate their effect on inducing estrus in post-partum animals.

During the 1983 calving period, Anderson says, 58 mature Hereford cows and their calves were divided into two groups.

Those with an average calving date of April 2 were housed with a gomer cow; those with an average date of April 3 were housed in a control pen.

To create the gomer, a mature Hereford that lost her calf was injected with 2,000 milligrams of Testosterone Enanthate. Booster shots were administered every three weeks.

On June 6, a 21-day artificial insemination period was started.

During the period, 26 of 29 cows in the gomer pen were detected in heat and bred, while 19 of 29 animals in the control pen were bred.

Anderson says another gomer was used in the control pen only during the artificial insemination period, while clean-up bulls were turned in for the remainder of the 45-day breeding season.

While stressing that the results of a one-year study are far from what's needed to scientifically verify any of the processes involved, Anderson does term the present findings "very encouraging."

During the study, one cow in each pen was open at October pregnancy testing. Four from the gomer pen and three from the control were removed for unsoundness.

Twenty-five cows in the gomer group calved in 1984, he says, with an average March 31 calving date. Twenty-six calved in the control group, with and average date of April 8.

The data, he continues, reveal the average calving date moved ahead two days for cows in the gomer group and moved back five days for those in the control group-a net gain of seven days.

Anderson typifies the arrangements made for this experiment as "easy to set up."

"Androgenizing a cow is a simple and relatively inexpensive procedure," he says. "Using a cow that's open precludes the need for maintaining sterile bulls or using steers."

Other studies at the facility look at means of improving the drylot management system. One such, the comparison of different cow rations, creep feeding techniques and drylot herd management, has been under way for the past three years. As far as Anderson knows, it's the only study comparing various drylot management techniques in the northern Great Plains.

"We've seen a lot of work comparing drylot to pasture or range, where drylot is one treatment and a more traditional production method the other," he says. "But here we're comparing three different management regimes of drylot."

In 1982 and '83, he explains, 207 Hereford cows were randomly assigned to the three different treatments.

The first, control, consists of the normal management techniques the Unit has practiced for the past 12 years.

"In control, we feed the cows corn silage and chopped alfalfa grass hay daily," Anderson says. "That's the way we've managed our drylot cows ever since we started in '72."

The calves in the control group, he adds, are fed a high-roughage creep ration, usually 50 percent chopped hay and 50 percent whole oats or barley.

The second treatment, super management, provides its cows and calves a number of "extras."

"The cows get five pounds more corn silage a day to give them a little extra energy," Anderson explains. "We also forcefeed them mineral-particularly phosphorous-and Vitamin A."

The cows are also given a shade during the early summer days in the drylot, he continues, while the calves are allowed to creep graze a little pasture adjacent to the pen and given Aureomycin.

In the third treatment, residue, cows are offered a choice of cereal grain straw (wheat, barley and oats) in addition to a base ration of corn silage and protein supplement.

"With the free choice we give the cows under this regime, where they can consume whatever they want, we've found they'll eat around six or seven pounds a day," he says.

For the protein supplement portion of the base ration, he adds, the Unit has used a couple of different products.

"We've used sunflower meal when it was inexpensive," he says, "and we've used barley when it was inexpensive."

While data from the project's third year are still being evaluated, Anderson says some tentative conclusions are possible from the first two years' results.

"First of all, we're finding out that summer drylot management allows liberal variation in rations," he says, "provided the cows' nutritional requirements are met."

Some of the findings after two years reveal that the calves allowed in the creep pasture eat less creep feed because they're out on the grass meadow.

"They gained a little bit more," Anderson says, "but that was offset by the higher input cost for the cow's feed."

In the residue segment, he continues, researchers found performance to be pretty close to control. While a few dollars were saved, it wasn't enough to make a substantial difference.

"Basically, our control is our bread-and-butter," he says. "We get the cows to breed back pretty well. The ones on the straw ration didn't breed back quite as quickly."

While the early finding of the project seem to show crop residues can be useful in complementing high-quality corn silage for crop rations, Anderson says more testing is needed before any real conclusions can be drawn.

"In the coming years, we're going to look at a design where we can alter the straw ration somewhat," he says. "Maybe by including a little bit of straw in a ration similar to what we use in control."

While the drylot management comparisons have been going on for the past three years at the Unit, a 10-year project at the facility compares the straight breeding of Herefords with a three-way breeding system of Herefords, Red Angus and Tarentaise.

The objective of this project, now in its third year, is not to evaluate breeds, Anderson maintains, but the entire system and how it compares with strainghtbred Herefords.

Herefords have been used as the base group, he says, because they exhibit many of the desirable traits important to cattlemen.

"They're fertile, easy keepers, hardy, good mothers and available," he says. "In addition, the breed has an excellent sire evaluation program to aid producers in identifying superior sires for several traits from a very large germ plasm pool."

Red Angus have been selected for their carcass quality, calving ease, fertility, mothering instincts, red color and polled trait, he continues.

Tarentaise have been included for their superior milk production, mothering instincts, fertility, lean growth and red color.

As part of the crossbreeding project, Anderson says, calves have been crossbred from straightbred Hereford cows, comparisons have been made between the crossbred and straightbred cows, the effects of wintering on crossbred and straightbred young cows has been studied, backgrounding variations between crossbred and straightbred replacement heifers have been noted and feedlot, carcass and economic data for straightbred, two-way and three-way cross steers has been collected.

A Red Angus-Hereford cross peers at visitors from one of the drylot pens at the Carrington Livestock Unit. The animal, with a Red Angus sire and a Hereford dam, is one of about 130 cows part of the first 3 years of a 10-year crossbreeding experiment at the facility.

"Our original work here at the Unit was all done with straightbred Herefords," Anderson summarizes. "While it's an awfully good animal, I'm not sure if it has the genetic potential we can make use of with our high-quality feed and irrigated forage."

There are two trains of thought on what to do with the Hereford herd at the facility, he says.

"One is that we should keep the Hereford cow, feed her as low an energy ration as we can, have her produce a calf every year and forget about her milking capacity, wean her calf at 100 days and put it back in the feedlot, then put her back out on very cheap rations."

The other approach, he says, "Amounts to breeding up the cow with a little more mild production–something that takes a higher quality feed–so she'll wean a heavier calf in the fall, breed back substantially well and go the route of higher genetic potential."

The 10-year crossbreeding program now under way, he says, is intended to look at these different viewpoints.

While much of the research at the Livestock Unit deals with the beef herd, Anderson notes that a number of project deal with the site's facilities.

In addition to the evaluation of different livestock waterers' energy use, programs are under way with the Unit's solar hay drying shed and fenceline feed bunks.

The research project involving the facility's solar hay drying building is an evaluation of three different loading systems, Anderson says.

With 7 percent of the state's annual 3.25 million-acre hay crop lost in storage, he backgrounds, there's a definite need for research in large-volume, mechanical, economical, quality preserving hay drying and storage facilities.

In preliminary studies, he points out, the Unit's solar hay drying shed accomplishes these goals.

Built in 1982, the structure is a pole-frame shed, 42 feet wide and 100 feet long. It's conveniently located next to the Unit's bunker silo, providing researchers with easy access to the two main ingredients in most drylot beef rations: corn silage and chopped alfalfa hay.

The shed's entire roof is a solar collector, with an air inlet in the center.

The Solar hay drying shed on the Livestock Unit. Built in 1982, the 42-foot by 100-foot building's capacity is about 225 tons of hay, and its entire roof is a solar collector. Presently, it's the site of a series of evaluations of different hay loading systems.

According to Anderson, the single plate collector includes the entire scissors rafter area (with a black finish on all surfaces), including the top of plywood ceiling panels fixed to the underside of the rafters.

A plenum and fan on each end of the shed allow independent fan action. A 15-horsepower electric fan pulls warmed air out of the collector and down the plenum.

The warmed air is then pushed into a central A-frame drying duct and out through the hay pack.

Anderson says the shed is filled in two stages. The first cutting is field-chopped at 30 to 35 percent moisture and loaded over the building's entire length.

Vent doors on the bottom of the drying duct are then used to dry this first partial fill.

Second cutting hay is loaded on top of the dried first cutting, he continues. Top and bottom doors are opened to dry the second cutting.

In the newest project, he says, Unit researchers have primarily been interested in the performances of three loading systems.

In the first system used, initially chopped hay from self-unloading forage wagons was off-loaded into a flight elevator. The chopped hay was then dumped onto a belt conveyor hung from the center of the shed's roof. A movable plow pushed the hay off the conveyor onto a spinning silage distributor.

While the resulting hay pack dried quite well, Anderson reports, distribution remained largely a mound of chopped hay in the center of the shed.

The second system tested used a silage blower, long-radius curved pipe and sectional plastic pipe to move the hay.

According to Anderson, this partial pneumatic system was limited in capacity, as well as the horizontal distance it could move the hay.

The third system, a pneumatic conveyor designed and built in West Germany, was installed prior to the 1984 haying season, he says.

The only one of its kind in the United States, the system has an increased off-loading capacity and automatic distribution.

The system's blower, Anderson says, operates at 1,350 RPM, rather than the conventional model's 540. It produces an air stream capable of moving chopped hay the entire length of the drying shed through a telescoping pipe.

In the third facility project under way at the Unit, Anderson says researchers are evaluating three different fenceline bunk designs.

Fenceline bunks are being looked at, he says, because of the many advantages they offer the beef producer. By using fenceline bunks, he explains, the producer doesn't need to pass through gates, with hungry animals jostling for position around the feed wagon.

Also, he contrasts the all-weather roadbed in front of the fenceline bunk to the mud, manure and frozen lumps inside a cattle pen.

And, he notes, a producer using a fenceline bunk will find it both quicker and easier to observe individual animals when the herd is lined up to eat.

Finally, he says, feedline bunk maintenance is less troublesome and its life expectency greater than that of other designs.

Anderson says the three bunks evaluated were an all-wood post-and-frame constructed of 2-inch lumber and 5-inch treated posts; a wood post-and-plank model with a slightly raised concrete bottom; and a pre-cast commercially built all-concrete design.

Unit staff members studied dimension, feed waste, maintenance and repair, cleaning ease, animal entry, durability and the cost of materials per lineal foot of bunk.

The researchers found the total wood design has the least capacity, Anderson says, but the bunk is very useful for smaller calves. Larger animals, he explains, tend to nuzzle out more material onto the bunk apron.

The wood-and-concrete bunk has proven adequate for high-forage rations, he says, but more young calves tend to crawl through it.

The "cow-size" pre-cast concrete bunk has proven durable, he says, with adequate volume for a high-forage ration.

The researchers, he notes, strongly favor pre-cast concrete bunks. While its initial cost is higher than for the other two designs, its life expectancy is considerably longer.

Although the projects under way at the Livestock facility are varied, Anderson feels a common thread binds them together–both today and in the future.

The thread, he says, is the benefits the different experiments will give the public.

"Our aim is to increase the producer's product potential," he says. "Whether it's by saving him a dollar through improved livestock breeding, or saving him an hour through a better management system."

In the future, Anderson hopes to hear more from those producers who've adopted some of the Unit's programs. "We need to know what kind of problems they're having," he says, " in order to improve our own techniques and studies."

Down the road, Anderson sees all kinds of useful knowledge coming from the Livestock facility. Knowledge he thinks the public needs to improve its day-to-day operations.

"We look forward to seeing a definite increase in production with our cross-breeding and terminal rotation programs, and we've barely seen the beginning-barely scratched the surface-of the efficiency and production benefits of drylot management."

But, no matter what directions research takes at the Unit, Anderson is still certain the same goal-benefiting the public-will remain constant.

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not the time to back off on our efforts to produce more efficiently and to market our products more effectively.

The NCI represents a positive step in that direction. Last summer's symposium was another. We have tended to focus on production in the past. We have taken some criticism on that. But I will make no apology for that emphasis. We simply need to broaden our research efforts in the area of post-production processing and the marketing of those products.

The name of our Department of Cereal Chemistry and Technology is soon to be changed to Cereal Science and Food Technology, and that is more than a cosmetic change. It represents a change of direction, with real emphasis on what can be done with our agricultural products to enhance their marketability. Professor Orville Banasik, who will be reitiring in July of 1985, has been a visionary pioneer in moving NDSU in this direction, his efforts culminating in the creation of the NCI.

I suppose the crux of my message is very predictable: this is not the time to back off on our research efforts. They have served us well in the past. They continue to serve us well. The knowledge research generates is our best hope for the future.

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tal pollution while reducing processing, storage and distribution costs. Increased emphasis is needed on developing products that upgrade diets, fit consumer needs and compete in export markets. Basic knowledge regarding the properties of foods and maintaining wholesomeness and safety of food supplies also needs to be upgraded.

Broadened emphasis in these areas could have major implications for NDSU in terms of academic offerings, research and service to producers, processors and marketers of North Dakota products. Increased levels of food processing in North Dakota, rather than exporting raw materials for processing elsewhere, could make such academic training and research even more important in the future. Or, to look at the other side of the coin, having expertise and training in food processing available might even play a role in expanding North Dakota's industrial base.

With a long history of excellence in agricultural research to build on, NDSU needs to propare to meet the changing needs of North Dakota Agriculture. The new plateau of service and research Orville Banasik envisions for cereal chemistry is a vital part of new plateaus of service and research provided by the total university.