Approved: March 15, 2001
Date

MINUTES OF THE SENATE NATURAL RESOURCES COMMITTEE.

The meeting was called to order by Chairperson Robert Tyson at 8:30 a.m. on March 8, 2001 in Room 423-S of the Capitol.

All members were present except: all present

Committee staff present: Raney Gilliland, Legislative Research Department
Judy Krase, Committee Secretary

Conferees appearing before the committee:

Tracy Streeter, State Conservation Commission
Leslie Kaufman, Kansas Farm Bureau
Rod Geisler, Chief of Municipal Programs, Bureau of Water, Kansas Department of Health and Environment
Mark Green, Superintendent of Water Pollution Control, City of Topeka
Dr. William Hargrove, Director, Kansas Center for Agricultural Resources and the Environment, Kansas State University

Others attending: See attached list

Senator Tyson opened the meeting with the hearing on **HB 2048** and asked staff of Legislative Research to explain the bill. Raney Gilliland said the bill basically extends the distances with respect to the riparian buffer that would be qualified under the Kansas Water Quality Buffer Initiative from 150 feet to 180 feet.

The first conferee and proponent was Tracy Streeter, State Conservation Commission, and he said that during some of the discussions on this bill in the House it was pointed out that the definition of riparian buffer could stand some improvement and he is submitting a proposed amendment to the bill (Attachment 1). Questions and discussion followed.

The second conferee and proponent of **HB 2048** was Leslie Kaufman, representing Kansas Farm Bureau (Attachment 2).

Senator Tyson declared the hearing closed.

Senator Tyson then opened the hearing on **HB 2198** which concerns the Kansas water pollution control revolving fund and called on staff of Legislative Research to explain the bill. Raney Gilliland said the bill would allow expenditures from the fund to be used to make grants to qualifying projects as authorized by the Federal Appropriation Act of 1996 in accordance with the Rural Communities Hardship Grants Program guidelines, and also to make grants to qualifying projects as authorized by the Consolidated Appropriations Act of 2001 in accordance with the Wet Weather Water Quality Act of 2000.

The third conferee was Rod Geisler, Chief of Municipal Programs, Bureau of Water, KDHE who was a proponent of **HB 2198** (Attachment 3). Questions and discussion followed his testimony.

The fourth conferee was Mark Green from the City of Topeka, a proponent of the bill (Attachment 4). Questions and discussion followed.

Written testimony was submitted by Kim Gulley, Director of Policy Development and Communications, League of Kansas Municipalities (Attachment 5). She was a proponent of **HB 2198.**

Senator Tyson declared the hearing on **HB 2198** closed.

Conferee Dr. William Hargrove, Director, Kansas Center for Agricultural Resources and the Environment,

Kansas State University, gave a report on the Final Animal Waste Lagoon Research Project (Attachment 6). Questions and discussion followed his presentation.

Senator Huelskamp moved that the minutes of February 15, 16, and 19 be approved, seconded by Senator Lee. Motion carried.

The meeting adjourned at 9:30.

The next meeting is scheduled for March 9 at 8:30 a.m.

SENATE NATURAL RESOURCES COMMITTEE
GUEST LIST
DATE: 3-8-01

NAME	REPRESENTING
Rod Bremer	KDHE
Bill Hargrove	KCARE/K-State
Jim Alley	Seaboard
Don Rezac	Kansas Cattlemens Assn
Joe Fund	KDHE
Mark Green	City of Topeka
GREG A FOLEY	KDA
John Hasch	KDHE
David Miller	DOB
Shelley King	Ks. Soc. of Prof. Eng.
Ron Appletoft	WATER DIST No 1 of Jo Co
Leslie Kaufman	Ks Farm Bureau
Tracy Streeter	State Cons Comm.
Kevin Barron	Hein/Lwr Chrtr.

SCC KANSAS

State Conservation Commission

109 SW 9th Street
Suite 500, Mills Building
Topeka, KS 66612-1299
Telephone: (785) 296-3600 • Fax (785) 296-6172

Senate Natural Resources Committee
March 8, 2001

Testimony on House Bill 2048
Tracy Streeter, Executive Director

Mr. Chairman and Members of the Committee, thank you for the opportunity to testify in support of House Bill 2048. This bill will allow Kansas landowners an additional incentive to plant buffer strips on lands adjacent to streams. In addition, an amendment to HB 2048 is attached proposing to clarify the type of vegetation eligible for the incentive.

K.S.A 2-1915 currently allows riparian buffer strips up to 150 feet in width that are enrolled in the Conservation Reserve Program (CRP) to be taxed as grassland or wasteland. As you are aware, K.S.A 79-1476 requires all other lands enrolled in CRP to be classified as cultivated dry land for valuation purposes. Last year, USDA modified the CRP rules to increase the maximum width for riparian forest buffer strips to 180 feet. As a result, the state tax incentives offered under the Governor's Buffer Initiative are not in direct alignment with CRP rules.

This width change proposed in HB 2048 only applies to buffer strips planted to trees or a mix of grass and trees. It is not anticipated that HB 2048 will have a significant fiscal impact on agricultural property tax collections. Currently, only 200 of the approximately 3,000 acres enrolled in the Initiative have been planted to trees. The annual tax reduction on predominant soil types in four counties participating in the Buffer Initiative ranges from $2.77 to $9.49 per acre.

The proposed language contained in the attachment will clarify that trees may be considered as a type of, or included in a mix of vegetation planted in the specified riparian zone. The current language may be interpreted to exclude trees unless tame or native grass exists as part of the planting.

I encourage your support of HB 2048 with the proposed amendment. Even though the proposed legislation is unlikely to affect a large number of acres, it is important to recognize the value of trees in a healthy riparian zone and to ensure that all incentives are available to landowners choosing to establish riparian buffers. Again, I appreciate the opportunity to appear before you today and will stand f time.

Senate Natural Resources Committee
Date 3-8-01

Attachment # 1

Session of 2001

HOUSE BILL No. 2048

By Committee on Environment

1-17

AN ACT concerning riparian buffers; amending K.S.A. 2000 Supp. 2-1915 and repealing the existing section.

Be it enacted by the Legislature of the State of Kansas:

Section 1. K.S.A. 2000 Supp. 2-1915 is hereby amended to read as follows: 2-1915. (a) Appropriations may be made for grants out of funds in the treasury of this state for terraces, terrace outlets, check dams, dikes, ponds, ditches, critical area planting, grassed waterways, tailwater recovery irrigation systems, precision land forming, range seeding, detention and grade stabilization structures and other enduring water conservation practices installed on public lands and on privately owned lands. Except as provided by the multipurpose small lakes program act, any such grant shall not exceed 80% of the total cost of any such practice.

(b) A program for protection of riparian and wetland areas shall be developed by the state conservation commission and implemented by the conservation districts. The conservation districts shall prepare district programs to address resource management concerns of water quality, erosion and sediment control and wildlife habitat as part of the conservation district long-range and annual work plans. Preparation and implementation of conservation district programs shall be accomplished with assistance from appropriate state and federal agencies involved in resource management.

(c) Subject to the provisions of K.S.A. 2-1919, and amendments thereto, any holder of a water right, as defined by subsection (g) of K.S.A. 82a-701, and amendments thereto, who is willing to voluntarily return all or a part of the water right to the state shall be eligible for a grant not to exceed 80% of the total cost of the purchase price for such water right. The state conservation commission shall administer this cost-share program with funds appropriated by the legislature for such purpose. The chief engineer shall certify to the state conservation commission that any water right for which application for cost-share is received under this section is eligible in accordance with the criteria established in K.S.A. 2-1919, and amendments thereto.

(d) (1) Subject to appropriation acts therefor, the state conservation commission shall develop the Kansas water quality buffer initiative for

the purpose of restoring riparian areas using best management practices. The executive director of the state conservation commission shall ensure that the initiative is complementary to the federal conservation reserve program.

(2) There is hereby created in the state treasury the Kansas water quality buffer initiative fund. All expenditures from such fund shall be made in accordance with appropriation acts upon warrants of the director of accounts and reports issued pursuant to vouchers approved by the executive director of the state conservation commission or the executive director's designee. Money credited to the fund shall be used for the purpose of making grants to install water quality best management practices pursuant to the initiative.

(3) The county or district appraiser shall identify and map riparian buffers consisting of at least one contiguous acre per parcel of real property located in the appraiser's county. Notwithstanding any other provisions of law, riparian buffers shall be valued by the county or district appraiser as tame grass land, native grass land or waste land, as appropriate. As used in this subsection (3), "riparian buffer" means an area of stream-side vegetation that: (A) Consists ~~of tame or native grass and may include forbs and woody plants;~~ trees, tame or native grass, forbs and other woody plants, or a combination thereof; (B) is located along a perennial or intermittent stream, including the stream bank and adjoining floodplain; and (C) is a minimum of 66 feet wide and a maximum of ~~150~~ *180* feet wide.

(e) The state conservation commission shall adopt rules and regulations to administer such grant and protection programs.

(f) Any district is authorized to make use of any assistance whatsoever given by the United States, or any agency thereof, or derived from any other source, for the planning and installation of such practices. The state conservation commission may enter into agreements with other state and federal agencies to implement the Kansas water quality buffer initiative.

Sec. 2. K.S.A. 2000 Supp. 2-1915 is hereby repealed.

Sec. 3. This act shall take effect and be in force from and after its publication in the statute book.

Kansas Farm Bureau

PUBLIC POLICY STATEMENT

SENATE COMMITTEE ON NATURAL RESOURCES

RE: HB 2048 – Authorizes an Increase in Size of Riparian Buffers.

March 8, 2001
Topeka, Kansas

Presented by:
Leslie Kaufman, Associate Director
Public Policy Division
Kansas Farm Bureau

Chairman Tyson and members of the Senate Committee on Natural Resources, my name is Leslie Kaufman. I am the Associate Director of the Public Policy Division for Kansas Farm Bureau.

During the 1998 Legislative Session, Farm Bureau testified in support of SB 523 that created the Kansas Water Quality Buffer Initiative. This new program was an expansion to the Water Quality Initiative launched by Governor Bill Graves in 1995. The purpose of this voluntary, incentive-based program is to filter sediments, pesticides, nutrients and other contaminants from runoff before they wash into the rivers and streams during rainfall events. The buffer program has been quite effective and popular with landowners.

The 1998 legislation that launched the state buffer program contained a provision that requires the Executive Director of the State Conservation Commission to ensure that the state initiative is complementary to the federal Conservation Reserve Program (CRP). Today, Kansas Farm Bureau supports HB 2048 that updates the riparian buffer program. Last summer, the federal program authorized an increase in the maximum width for riparian buffers to 180 feet from the original150 feet, allowing for greater water quality protection.

Senate Natural Resources Committee
Date 3-8-01

Attachment # 2

Additionally, this expanded maximum width can modestly increase the economic benefit to landowners by allowing more cropland that is converted to trees, shrubs and grass to be valued at a lower rate for property tax purposes. The bill before you today, HB 2048, makes the state buffer initiative compatible with the current federal program.

We support Governor Bill Graves' recommendation in his 2001 State of the State message proposing to expand the buffer program to three additional river basins where TMDL's are now being implemented. We encourage each member of this committee to promote and support this important water quality program.

Policy adopted by the farm and ranch members of Farm Bureau contains statements that clearly support the protection of water quality. We encourage:

- Additional efforts to prevent contamination of ground water and surface water;
- Adequate funding to assist landowners with projects including the installation of stream buffers; and
- Support of the Governor's Water Quality Initiative.

We certainly appreciate this opportunity to express our support for HB 2048 that enhances the Kansas Water Quality Buffer Initiative. Thank You!

KANSAS
DEPARTMENT OF HEALTH & ENVIRONMENT
BILL GRAVES, GOVERNOR
Clyde D. Graeber, Secretary

Testimony on House Bill 2198
to
Senate Natural Resources Committee
Prepared by Rodney Geisler, Chief-Municipal Programs Section, Bureau of Water
Presented by Karl Mueldener, Director-Bureau of Water

March 8, 2001

I am appearing before you today to support and discuss HB2198, which revises the legislation establishing the Kansas Water Pollution Control Revolving Fund (fund).

The fund was established in 1989 to allow Kansas to receive Federal grants from EPA, and then provide low interest loans for wastewater treatment and water pollution control projects. The program is working well, having provided 165 loans to local governments for over $397 million (as of September 28, 2000).

Congress has now created two new federal grant programs, required to be administered by the same state agencies that administer the State Water Pollution Control Revolving Fund. These are the Rural Hardship Assistance Grants (RHAG) program, which received a one-time appropriation of $651,400 for Kansas, and the Wet Weather Water Quality program which can provide about $7 million per year.

The hardship grants can be used for small, rural, unsewered communities with an average income at poverty level and unemployment rates at least 1% above the national average. Several projects in Kansas qualify for this funding and indicate they want to proceed with a sewer project.

The Wet Weather Water Quality Act authorized a new grant program to provide grants for at least 55% of project costs to communities to resolve Combined Sewer Overflows and Sanitary Sewer Overflows. In Kansas, there are only 3 cities with combined sewers - Atchison, Topeka, and Kansas City. The expense to comply with federal law and regulations is large, and nationally this is a big issue. There is a Needs Survey conducted by EPA for wastewater and water quality issues which Kansas participates. The 1996 Needs Survey reports the combined sewer overflow needs are estimated to be $531 million for Kansas, in these 3 communities only, and $45 billion nationally. For sanitary sewer overflows, the estimates are $126 million in Kansas and $3.33 billion nationally. KDHE has identified approximately 50 communities with chronic sanitary sewer overflow problems.

The HB 2198 will amend existing state legislation to allow Kansas to utilize the new grant programs and allow KDHE to administer these in conjunction with the ongoing Kansas Water Pollution Control Revolving Fund.

I thank you for the opportunity to appear before the House Environment Committee and will stand for questions the committee may have on this topic.

Capitol Tower Building
400 SW 8TH Street, Suite 200
(785) 296-0461

Senate Natural Resources Committee
Date 3-8-01
Attachment # 3

CITY OF TOPEKA

Water Pollution Control Division
1115 NE Poplar
Topeka, Kansas 66616
Phone 785-368-3851

Testimony on House Bill 2198
To
House Environment Committee
Presented by Mark Green, Water Pollution Control Superintendent, City of Topeka
February 28, 2001

I am appearing before you in support of H.B. 2198 which authorizes new uses for the Kansas Water Pollution Control Revolving Fund (the Fund). Topeka has used the Fund for both past and present sanitary sewer projects and believes its expansion will benefit all Kansans.

Topeka had the opportunity to receive assistance from the Fund for the construction of the North Topeka Wastewater Treatment Plant (NTP) that came "on-line" in 1996. Construction of the state-of-the-art NTP has allowed Topeka to meet, and exceed, regulatory requirements of the NPDES Permit for point source discharges under the Clean Water Act.

Currently, Topeka is using the Fund to finance two large construction projects. Improvements at the Oakland Wastewater Treatment Plant will allow Topeka to exceed surface water quality requirements both now and into the future. A key process added to the plant is the use of ultra violet radiation to disinfect the plant's effluent before it enters the Kansas River. Topeka is also using the Fund to pay for the construction of the Deer Creek sanitary sewer interceptor. Located on the eastern edge of Topeka, this interceptor will allow Shawnee County to take several failing lagoon systems off-line. In addition, future development in the eastern part of Topeka will benefit from the availability of sanitary sewer service in a developing area.

Through the use of the Kansas Water Pollution Control Revolving Fund the City of Topeka has been able to fund needed improvements in our sanitary sewer system while minimizing the impact of increased wastewater treatment rates to our citizens. The expansion of the Kansas Water Pollution Control Revolving Fund program to include both the Rural Communities Hardship Grants Program and financial help for those who must address the requirements of the Wet Weather Quality Act of 2000 will greatly enhance the water environment of the State of Kansas.

LKM
League of Kansas Municipalities

300 SW 8th
Topeka, Kansas 66603-3912
Phone: (785) 354-9565
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To: Senate Natural Resources Committee
From: Kim Gulley, Director of Policy Development & Communications
Date: March 1, 2001
Re: Support for HB 2198

Providing wastewater treatment is a fundamental service that most cities in Kansas provide for their citizens. Over the past few years, providing this service has become increasingly more difficult as a result of numerous mandates imposed on wastewater treatment operations. As you know, the vast majority of cities in Kansas are made up of small communities with limited budgets and resources. Unfunded mandates pose the greatest burden in these small cities.

HB 2198 authorizes the Kansas Department of Health & Environment to offer some assistance to those communities that are struggling to meet the challenges of operating a wastewater treatment facility. We support this and all other efforts to assist the cities of Kansas in providing the highest quality wastewater treatment services possible. For this reason, we encourage your favorably recommendation of HB 2198.

Thank you for your consideration of this important issue. Please do not hesitate to contact me if I can provide any further information to the Committee.

Senate Natural Resources Committee
Date 3-8-01

Attachment # 5

HIGHLIGHTS FROM THE K-STATE STUDY OF ANIMAL WASTE LAGOONS

Dr. Jay Ham, PI

Summarized and Presented by:
W.L. Hargrove, Director, KCARE

- Seepage rates have been measured for a total of 18 lagoons in Kansas, including beef cattle, dairy, and swine
- Seepage rates in KS ranged from 0.01 in/day to 0.10 in/day and averaged 0.05 in/day (Results from Iowa for 27 lagoons were in the same range and had the same average.)
- In the past year, the focus has been on the Equus Beds Region; measured 2 swine and 2 cattle lagoons; all of these had seepage rates less than or equal to 0.03 in/day
- Lagoon chemistry has been determined from 58 samples taken from 38 lagoons; the predominant form of N is ammonium and ranges in concentration from 10 to 3500 ppm; on average, swine lagoons are about 5 times higher in ammonium than cattle
- Coring has been done on 8 lagoons ranging in age from 12 to 25 years; results show that ammonium is held in clay beneath the lagoon; significant quantities of ammonium were not found at distances greater than about 10 ft from the bottom of the lagoon and in many cases not greater than about 3 ft below the bottom of the lagoon; quantities of ammonium were greater underneath swine lagoons compared to cattle lagoons
- There is no evidence that fecal coliform bacteria seep through the bottom of lagoons; there is evidence that large amounts of chloride seep through lagoons and moves to greater depths than ammonium; it is difficult to assess the environmental impact of chloride leaching
- Very large quantities of ammonium (tens to hundreds of tons) are stored in soil beneath lagoons; this presents a concern at lagoon closure
- The risk of groundwater contamination is determined by the soil properties underneath the lagoon, the concentration of the waste, and the depth to groundwater; because these factors vary from location to location, site specific guidelines are needed for lagoon design, permitting, and closure; we have developed such guidelines and delivered them to KDHE

News & Features

K-STATE Kansas State University

From Kansas State University's Agricultural Experiment Station and Cooperative Extension Service

K-State Research and Extension,
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News, 113 Umberger Hall,
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Released: March 8, 2001

Study: Location Of Waste Lagoons Is Key To Their Safety

MANHATTAN, Kan. – Kansas State University scientists have completed a four-year study that provides the state's best information on the environmental impact of earthen waste lagoons, which are commonly used to collect livestock or municipal waste.

Among their key findings is that the location, design and maintenance of the lagoon are critical factors in protecting groundwater from such nutrients as nitrogen and chloride.

"Compared to four years ago, we know a lot more about lagoons – how they work, how much they seep, and more," said Jay Ham, the project leader and an agronomist with K-State Research and Extension. "Until four years ago, seepage rates from lagoons had never been measured in Kansas. We now have a lot more science-based information that can help people make decisions."

Ham presented the research team's report to members of the Kansas House of Representatives Environmental Committee March 8. The first and fourth years of the study were funded by the Kansas Department of Health and Environment (KDHE); the middle two years were funded by the Kansas Water Office.

State officials initially sought more information on seepage rates of animal waste lagoons as a result of some people's concern that the nutrients contained in those lagoons were threatening public water supplies. Agencies like KDHE hope to use the research results to develop guidelines for granting permits to landowners who are building waste lagoons.

Lagoons are commonly found in confined animal feeding operations (CAFO) in Kansas. In 2000, KDHE reported 3,000 active permits for CAFOs in Kansas.

Ham said that K-State's study shows clearly that lagoons seep at rates much lower than the previous state standard of one-fourth inch per day. On average, the 20 lagoons tested seeped less than 1/20 inch per day. He added that most of the nitrogen that does seep through the bottom of the lagoon stays close to the lagoon while it's being used.

But there is a risk that the "reservoir" of nitrogen that accumulates under lagoons could convert to nitrate and migrate toward groundwater after the lagoon is closed. "This is our biggest concern," Ham said.

"There is a lot of variation in Kansas soils, especially in the central and eastern parts of the state, and that makes a difference," Ham said. For example, the best lagoons in Kansas are built in clay soils, because they hold waste and adsorb (gather) nitrogen much better than lagoons built in sandy soils.

In addition to soil type, important factors in deciding where to build a lagoon include the land's depth to the water table; the chemistry of the waste the lagoon will handle; and how long it will be open, according to the K-State researchers.

-more-

Location of Lagoons Key To Their Safety/Page 2

To illustrate the point, Ham cited his team's work this year on the area in central Kansas known as the Equus Beds. The region contains the wells that supply drinking water to numerous towns, including the cities of Wichita, Hutchinson and McPherson.

Last year, the K-State researchers measured seepage rates of four lagoons in the Equus Beds region; the average seepage from those lagoons was 1/28 inch per day. Ham said the findings indicate that, like other areas of Kansas, there are good and bad places to build lagoons in that region.

"We found that the Equus Beds region was just like anywhere else in Kansas; there were places in the Equus Beds that had clay soils and a water table 30 to 40 feet from the surface. That's a pretty safe place to build a lagoon," Ham said. "But then we found places in the Equus Beds that had shallow groundwater and very sandy soils.

"So, the science says that even in the Equus Beds region, you should still take a site-specific approach to building a waste lagoon. Even on an individual farm, there are areas where there may be some danger [to groundwater], and there are areas where there isn't."

K-State's research also suggests that, prior to building a lagoon, landowners must take into account the chemistry of waste that it will handle. For example, swine waste contains up to seven times more ammonium (the main form of nitrogen in lagoons) compared to cattle waste. Cattle lagoons, though, contain higher concentrations of chloride.

K-State's four-year study introduced the concept of a "Lagoon Design Tool", which Ham said is a "logical framework" for site-specific lagoon design.

"So, for example, using a short list of inputs about a site (for example, soil type, depth to groundwater, and type of operation), the tool customizes the lagoon design so that the lagoon can be used safely," Ham said. "This could mean using plastic-lined lagoons at locations with vulnerable groundwater."

In December, 2000, K-State's work on the proposed "logical framework" was published in the Journal of Environmental Quality, a peer-reviewed publication.

Other states also are interested in K-State's methods of measuring lagoon seepage, Ham said. The U.S. Environmental Protection Agency recently awarded a $110,000 grant to K-State to develop a standardized method for measuring seepage.

Even though the university's study on seepage rates has ended, Ham said K-State researchers still are involved in other waste management projects, including studies on lagoon closures; applying waste to land; nutrient management; and air quality for feedlots and production sites.

-30-

Story by:
Pat Melgares, News Coordinator
pmelgare@oznet.ksu.edu
K-State Research and Extension

For more information:
Jay Ham is at 785-532-6119

Animal Waste Lagoon Water Quality Study

Principal Investigators

J.M. Ham,Professor, Agronomy Department
L.N. Reddi,Professor, Civil Engineering Department
C.W. Rice; Professor, Agronomy Department

Funding: Kansas Department of Health and Environment, $70,000
Duration: July 1, 2000 to June 30, 2001

Introduction

Anaerobic lagoons are used to collect, treat, and store animal waste at many confined animal feeding operations (CAFOs) in Kansas. Lagoons contain nutrients, salts, pathogens, and other chemicals that potentially could impact drinking water supplies. The purpose of this project is to study seepage losses from lagoons and determine under what circumstances these losses could affect groundwater quality. Specific objectives include: (1) measure the whole-lagoon seepage rates at existing CAFOs in Kansas; (2) survey the chemistry of lagoon effluent; (3) measure soil chemical properties and microbial populations beneath old animal waste lagoons; and (4) study the movement of lagoon effluent and microbes through different types of compacted clay or synthetic liners. Results from the research will provide information that can be used to optimize site selection for new lagoons, improve lagoon design criteria and construction methods, and develop best management practices for lagoon closure. This is the fourth and final year of the project.

Summary

Whole-lagoon seepage rates have been measured from 18 lagoons in Kansas. Study sites included cattle feedlots, swine facilities, and one dairy. Seepage rates ranged from 0.2 mm/day (<1/100 inch./day) to 2.4 mm/day (1/10 inch./day) with an overall average 1.23 mm per day (or 1/21 inch per day). Fifteen of the 18 lagoons tested had seepage rates less than $1/16^{th}$ inch per day. Seepage rates from three lagoons in the Equus Beds region were 0.6, 0.7, and 0.8 mm/day (all less than 1/32 inch per day). Analysis of lagoon effluent (58 samples from 38 sites) indicated large differences in lagoon chemistry between locations. Ammonium nitrogen, which accounted for over 99% of the soluble nitrogen, ranged from 10 ppm to 3500 ppm. On average, nitrogen concentrations in swine lagoons were about five times higher than those at cattle feedlots. Soil cores were collected beneath eight lagoons that had been operated from 12 to 25 years. Results showed that ammonium nitrogen was strongly adsorbed by the soil clay particles and that nitrogen concentrations often decreased to background levels at 3 m (10 ft) beneath the lagoon. In most cases, about 75% of the ammonium nitrogen that had seeped from the lagoon was still within 1 m (3 ft) of the liner. Soil nitrogen under lagoons at cattle feedlots was lower than that observed at swine facilities. Other ions, such as chloride, penetrated to much lower depths at all locations. The reservoir of ammonium nitrogen that exists beneath older lagoons could convert to nitrate (a mobile form of nitrogen) and migrate to lower depths after lagoon closure. Data suggest that the properties in the soil beneath lagoons, the concentration of the waste, and the depth to groundwater are the crucial factors that affect the risk of groundwater contamination. Because all of these factors vary with location and the type of CAFO, decisions regarding lagoon design, permitting, and closure should be site specific. A logical framework and software tool were developed that allows for site-specific lagoon design. Results have been published in peer-reviewed scientific journals.

Recommendations for Further Study

Research topics that need further study include: (1) fate and transport of ammonium nitrogen trapped beneath lagoons, (2) best management practices for lagoon closure, and (3) development of improved software tools for lagoon siting and design.

Fecal Coliform in Kansas Surface Waters

Principal Investigators:
Charles W. Rice, Professor, Department of Agronomy

Funding:
$133,044 State Conservation Commission Jan. 1998 - June 2001
$100,000 Kansas Department of Agriculture Jan. 1999 - June 2001
$10,000 Kansas Water Office (year one only - 1998)

Introduction

Bacterial contamination is one of the primary or secondary contaminants in the majority of the twelve major river basins in Kansas. Microbial contamination of water resources results in impaired use due to the increased risks to humans and the degradation of recreational and drinking water quality. Fecal Coliform (FC) limits in surface water vary depending on the intended use. For recreational primary contact, e.g. swimming, the maximal allowable standard for FCs is 200 colony forming units (CFU)/100 mL water. For secondary contact, e.g. fishing, the standard is 2000 CFU/100 mL water. For finished drinking water the standard for fecal coliforms (FC) is <1CFU/100 mL. Sources of coliform bacteria include runoff from animal feedlots, livestock grazing lands, and urban areas; wildlife, and waste handling systems including septic and treatment plants.

Summary

In 1998, Kansas State University developed a study in collaboration with state agencies to 1) assess water quality at several locations to determine: a) level and pattern of bacterial contamination in Kansas waters; and b) bacteria from on-site waste systems; and 2) determine effectiveness of best management practices, particularly vegetative filter strips for reducing bacteria in runoff.

Key results were:

- Areas with minimal human impact, i.e., wildlife areas had low levels of fecal coliforms. Wetland areas decreased bacteria concentrations in the inflow.
- Ponds in grazing lands were consistently less than 200 CFU/100 mL
- Stream segments without significant livestock near streams and without community development did not have high levels of fecal bacteria.
- For on-site wastes systems
  - Failing systems that had surface discharge: fecal bacteria in the soil surface traveled less than 300 ft. away from the discharge point
  - Downward movement under leach fields in the Equus Bed area was minimal unless the system was overloaded in which bacteria and nitrate moved to at least 8 ft.
- Vegetative filter strips effectively reduce bacterial loading from feedlots. In only one runoff event out of 16 was fecal bacteria reduction less than 80%. Maintenance of the filter strip is extremely important.

We are currently collecting and storing bacteria from different fecal sources to build a database of techniques to determine source. We do not have sufficient information at this time to recommend which technique is best or identify sources. We also are conducting research on fecal bacteria survival in soil and sediments.

Soil Chemistry Under Swine Lagoons

Principal Investigator

Kang Xia, Graduate student, Agronomy Department

Funding

GRA support for one Ph.D student for 3 years

Scope of Activity

A batch study was conducted to investigate the sorption and desorption behaviors of NH_4^+ (ammonium cation) on soils under the lagoon liner. Most of the studies on ammonium adsorption and desorption by soils have been conducted using simple ammonium salt solutions. No research has been found in evaluating the ammonium adsorption and desorption kinetics using liquid animal waste. The chemical and biological components in the liquid animal waste may have a significant impact on the kinetics of ammonium adsorption and desorption by soil.

Summary

Two representative Kansas soils were collected for the sorption and desorption batch study. The two soils were Kennebec silt loam (fine-silty, mixed, mesic, Cumulic Hapludolls) and Harney very fine sandy loam (coarse-silty, mixed, calcareous, messic, mollic Udufluents). Certain amounts of soil samples were mixed with swine lagoon effluent and $(NH_4)_2SO_4$ (ammonium sulfate) solution, respectively, at different concentration ratios, and these mixtures were allowed to equilibrate for a range of times. The amount of ammonium cation adsorbed by the soil was calculated from the reduction of ammonium cation in the solution. Once the adsorption of ammonium by the soil reached maximum, ammonium desorption kinetics were evaluated by extracting the adsorbed ammonium with 0.01 M Kcl (potassium chloride) solution for various length of time. The ammonium desorption from soil was calculated from the increase of ammonium cation in the solution.

Figure 1 illustrates that ammonium adsorption is enhanced while desorption is retarded by swine waste compared with the ammonium salt solution matrix. Results from this research suggest that the multiple nutrients and organic matter in swine waste have a significant impact on NH_4^+ adsorption and desorption processes.

Recommendation for Future Investigation

The effects of competitive cations and organic matter in animal wastes on the adsorption/desorption behaviors of NH_4^+ on soil will be studied.

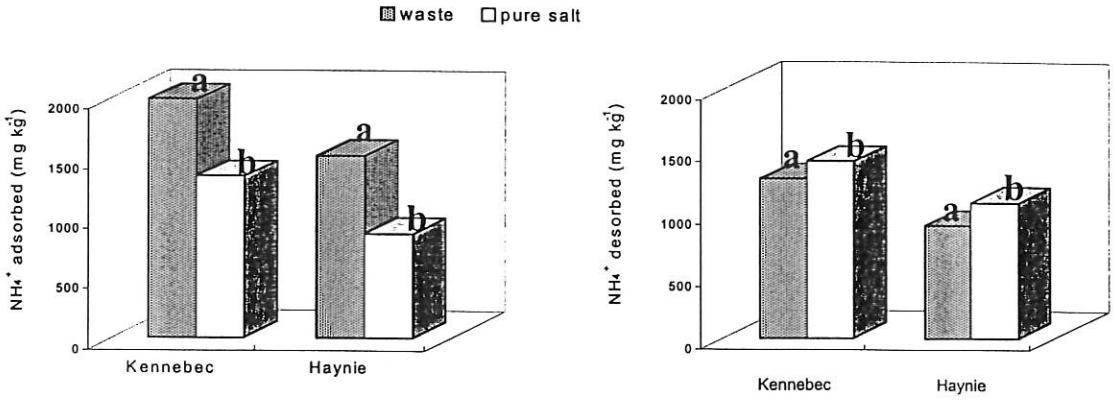

Figure 1. Adsorption and desorption of NH_4^+ on two Kansas soils (Kennebec and Haynie) mixed with liquid swine waste or $(NH_4)_2SO_4$ solution (Fernando and Xia 2000).

Utilization of Livestock Wastewater with Subsurface Drip Irrigation

Principal Investigators

Freddie R. Lamm, Northwest Research-Extension Center
Todd P. Trooien, South Dakota State University
Loyd R. Stone, Professor, Agronomy Department
Mahbub Alam, Southwest Area Extension Office
Danny H. Rogers, Professor, Biological and Agricultural Engineering Department
Gary A. Clark, Professor, Biological and Agricultural Engineering Department
Alan J. Schlegel, Southwest Research Extension Center

Funding

$15,000 in early spring 2000 to fund development of swine wastewater SDI site.
$25,000 for FY 2001 to conduct swine wastewater study and to continue beef wastewater study.

Introduction

In response to increasing nationwide concern about problems associated with livestock wastewater generated by confined animal feeding operations, K-State Research and Extension initiated a project to address odor, seepage into groundwater and runoff into surface water supplies. Subsurface drip irrigation (SDI) is a potential tool that can alleviate all three problems, while still utilizing livestock wastewater as a valuable resource for crop production. A study was begun in 1998 on a commercial beef feedlot to answer the engineering question *"Can SDI be successfully used to apply livestock wastewater?"* Based on the continuing positive results of this study, a new study was initiated in 2000 with swine wastewater to answer the question *"What are appropriate amounts of swine wastewater to apply for corn production using SDI or LEPA center pivot sprinkler irrigation?"*

Summary

Beef wastewater study: Five driplines with different emitter flow rates were tested with beef feedlot lagoon wastewater for three growing seasons. The flow rates of the two smallest emitter sizes, 0.15 gal/hr/emitter and 0.24 gal/hr/emitter have decreased approximately 30% during the three seasons, indicating some emitter clogging. The three largest driplines (0.40, 0.60, and 0.92 gal/hr/emitters) have had less than 5% reduction in flow rate. These results show that SDI has potential for use with lagoon wastewater. However, the smaller emitter sizes normally used with groundwater sources in western Kansas may be risky for use with lagoon wastewater.

Swine wastewater study: This study was initiated in 2000. Analysis of extensive soil nutrient and redistribution data is still pending. However, corn yield data did indicate an advantage of SDI (256 bu/acre) over LEPA center pivot sprinkler irrigation (248 bu/acre) when using swine wastewater as the nutrient source.

More details can be found in the K-State Reports section of the K-State SDI web site: http://www.oznet.ksu.edu/sdi

Recommendations for further investigation

The beef wastewater study will be continued in 2001 because questions still remain about the long-term, multiseason performance of SDI systems using livestock wastewater. The swine wastewater study will be continued in 2001 to further examine corn production, nutrient use and redistribution in the soil.

Crop Growth in Soil Beneath Animal Waste Lagoons

Principal Investigators

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Liansheng Zhu, Graduate student, Agronomy Department
Loyd R. Stone, Professor, Agronomy Department
Jay M. Ham, Professor, Agronomy Department

Funding

The Graduate Research Assistantship of master's degree student Liansheng Zhu, which for the Department of Agronomy is set at $14,363 in 2000-2001. August 21, 2000 - August 20, 2001.

Introduction

When animal waste lagoons are closed, the effluent and sludge are removed, leaving the soil at the bottom of the lagoon. The soil consists of a clay liner that contains salts and high levels of ammonium-nitrogen. We want to see if we can grow plants in the soil, which can be used in a phytoremediation process to clean up the polluted soil.

Summary

Nine crop species were germinated under greenhouse conditions in soil taken at different locations beneath a closed animal waste lagoon in Manhattan, KS, to determine if plants would grow in the soil high in NH4-N (ammonium-nitrogen) and salts. Concentrations of NH4-N and salts were highest in the middle of the lagoon (921 mg/L NH4-N; electrical conductivity = 2.49 dS/m). All species (barley, Hordeum vulgare; sunflower, Helianthus annuus; corn, Zea mays; winter wheat, Triticum aestivum '2137' and 'Turkey'; soybean, Glycine max; forage sorghum, Sorghum vulgare; grain sorghum, S. bicolor; and rapeseed, Brassica sp.) germinated and grew well in the sieved (2 mm) soil, except grain sorghum because an old seed lot was used. The wheat cultivar '2137' grew taller than 'Turkey.' Plants grew better in the lagoon soil than in a control agricultural soil, and this difference was attributed to the high levels of nitrogen in the lagoon soil. Soybean took up the most nitrogen, suggesting that it might be a good crop to grow in the lagoon soil to mine the nitrogen.

Recommendation for further investigation:

We currently are using organic amendments (oat straw; corn cobs) to tie up the excess nitrogen in the lagoon soil under greenhouse conditions. The goal is to prevent the nitrogen from leaching out of the soil. Under field conditions, leached nitrogen would end up in ground water and pollute it.

Publication:

Zhu, L., M.B. Kirkham, J.M. Ham, and L.R. Stone. 2000. Crop growth in soil beneath an animal waste lagoon. Agronomy Abstracts, p. 387. American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, Madison, WI.

Relationship Between Soil Test Phosphorus Levels and Phosphorus in Surface Runoff in Manure Amended Soils: A Rainfall Simulator Study

Principal Investigators:

Gary M. Pierzynski, Professor, Agronomy Department
Gary Clark, Professor, Biological and Agricultural Engineering Department

Funding

$133,213, March 1999 to February 2001

Introduction

Phosphorus represents a significant threat to surface water quality. Several notable examples include sensitive water bodies in the Atlantic Coastal Plain, western Oregon, the Great Lakes region, Florida, and Chesapeake Bay. Recent water quality data for Kansas and the Great Plains indicates that nearly all surface water bodies are severely impacted by phosphorus as determined by total phosphorus concentrations. The phosphorus comes primarily from surface runoff with a large proportion attributable to agricultural lands. Site characteristics related to potential offsite movement of phosphorus include soil erosion, soil runoff class, soil test phosphorus levels, and the rate and placement of phosphorus applied to soils. Several studies have shown significant relationships between soil test phosphorus levels and soluble phosphorus concentrations in surface runoff for soil receiving phosphorus as either inorganic commercial fertilizer or from poultry litter.

Summary

The objectives of this study were to construct a small-plot rainfall simulator and then to determine the relationship between soil test phosphorus levels and total, dissolved, and bioavailable phosphorus concentrations in surface runoff from two cattle manure-amended soils. Little information is in the literature on the relationship between soil phosphorus levels and phosphorus in surface runoff from soils amended with animal wastes. Such data is essential for Kansas and other states that are using or will be using soil test phosphorus levels to regulate phosphorus applications to soils. In this study, the influence of the addition of varying amounts of cattle manure on phosphorus levels in soils and in runoff was investigated by collecting 30 minutes of runoff and comparing the form and concentration of phosphorus in runoff to extractable phosphorus from soil samples (0 to 5 cm) taken immediately prior to rainfall simulation. Manure was applied at 0, 50, 100, 150, or 200 Mg/ha with three replications.

As the amount of manure added increased, soluble phosphorus concentrations in runoff increased; sediment concentrations increased; runoff volume decreased; and total phosphorus concentrations did not change. A significant linear relationship between Bray-1 extractable phosphorus in the soil and soluble phosphorus in the runoff was found. Manure additions apparently increased the infiltration capacity of the soil, which in turn decreased runoff volume and sediment concentrations in runoff. Total phosphorus concentrations in runoff were inversely related to sediment concentrations, producing the net effect of no significant increases in runoff total phosphorus concentrations as manure additions increased. The influence of time and surface runoff characteristics bears further investigation and the results from this work can be used to validate the phosphorus risk assessment tool under development by the National Resource Conservation Service for Kansas.

Impact of Land Application of Swine and Beef Cattle Wastes on Soil Properties and Crop Growth

Principal Investigators

Alan Schlegel, Professor, Southwest Research-Extension Center
Loyd Stone, Professor, Agronomy Department
Chuck Rice, Professor, Agronomy Department
Mahbub Alam, Assistant Professor, Southwest Area Extension

Funding

$17,500 on 28 Sept. 2000 for CY2000.

Introduction

Animal wastes can be a valuable resource for crop production and can enhance soil chemical and biological properties. However, improper management of animal wastes can cause environmental concerns and have deleterious impact on soil physical properties. Recent legislation in Kansas requires monitoring of soil chemical properties on soils receiving application of wastes from larger swine facilities. Based on soil test phosphorus (P) levels, application of swine wastes may be restricted or even eliminated on particular fields. Best management practices (BMP's) have been established to minimize excessive buildup of soil test P. However, the impact of these BMP's has not been validated in field settings. Although only swine wastes are regulated by the Kansas legislation (HB2950), there are proposed national standards that would regulate land application of wastes from other animal types (including beef cattle). Since beef cattle produce the most waste in confined feeding operations in Kansas, this project includes application of both swine and beef cattle wastes. The objectives of this research are to determine the impact of application of swine and beef cattle wastes on soil properties (chemical, biological, and physical) and crop growth; and to evaluate and validate the effectiveness of current BMP's.

Summary

Effluent water from a swine lagoon and solid manure from a beef cattle feedlot were applied at rates based on the 1. crop P requirement, 2. crop N requirement, and 3. twice (2x) the crop N requirement. Other treatments were three rates of commercial fertilizer and an untreated control. The available $N:P_2O_5$ ratio for cattle manure was 0.7 compared to 4.4 for swine effluent. Grain yields of irrigated corn were increased by all animal waste and fertilizer treatments. However, the type of animal waste or rate of application had little effect on corn yield. No yield measurements were obtained in 1999 in this study because of severe hail damage, which may have increased corn yields in the control treatment in 2000. Residual soil nitrate levels (spring of 2000) tended to be higher following application of swine than beef wastes (or the control) to a depth of 5 ft. Deeper than 5 ft, there was no differences in soil nitrate from manure applications compared to the control. Soil test P levels in the surface soil (0-6 inch depth) were higher following applications of cattle manure than swine effluent.

Recommendation

The intent of the investigators is to continue annual applications of swine and beef wastes for a total of 5 years (2000 was year 2), if funding is available. This 5-yr time frame will allow for evaluation of existing BMP's for land application of swine and beef wastes and determinations of the impact of animal waste applications on soil physical properties.

Determination of Nitrate Leaching following Land Application of Swine Lagoon Effluent and Beef Feedlot Manure

Principal Investigators

Alan Schlegel, Professor, Southwest Research-Extension Center
Loyd Stone, Professor, Agronomy Department

Funding

$19,300 on 11 April 2000 for CY2000.

Introduction

A potential problem with land application of animal wastes is movement of nitrate-N through the soil profile (leaching) and into the groundwater. Two conditions are needed to have nitrate leaching, the presence of nitrates in the soil and downward movement of soil water. With spring applications of animal wastes for use by summer crops (e.g. corn), the time period prior to rapid plant uptake of N (May and June) generally coincides with high rainfall amounts and relatively high soil nitrate levels. After the corn plants have reached their maximum rooting depth (about tasseling), the increased transpiration rate and N uptake decreases water movement through the root zone and increased uptake decreases soil nitrate levels. Consequently, the potential for nitrate leaching is diminished. The objective of this research was to determine the amount of nitrate leaching from land application of various rates of animal wastes and commercial N fertilizer. An existing study with several rates of cattle and swine wastes for irrigated corn was used as the research site (see summary of Impact of Land Application of Swine and Beef Cattle Wastes on Soil Properties and Crop Growth for description of the study).

Summary of investigation and results.

Effluent from a swine lagoon and solid manure from a beef cattle feedlot were applied at three rates based on the 1. crop P requirement, 2. crop N requirement, and 3. twice (2x) the crop N requirement. Other treatments include three levels of commercial inorganic fertilizer (60, 120, and 180 lb N/acre) and a control treatment that receives no waste or fertilizer. Suction-cup lysimeters were used to collect soil water samples at 3 and 5 ft depths at four times (June 12 and 20, July 10 and 25) during the growing season of irrigated corn. The water samples were analyzed for nitrate-N and inorganic P content. To determine drainage rate at the 5-ft soil depth, water content and matric potential were measured at each sampling date by using tensiometers and neutron attenuation. The 5-ft depth is at the bottom of the effective rooting depth of corn, so any nutrient movement past this depth is assumed non-recoverable by the corn plant. The drainage rate (at the 5-ft depth) was much greater early in the season and decreased rapidly with crop growth. During the two June sampling times, drainage averaged 0.57 inches/day compared to about 0.05 inches/day during the two July sampling times. Application of animal wastes had no effect on drainage rate. Soil solution nitrate-N content (5 ft depth) was greatest following application of swine effluent at the 2xN rate with an average of about 125 ppm nitrate-N for all sampling periods compared to about 50 ppm or less for all other treatments. Soil nitrate concentrations generally did not decrease across the sampling periods. Consequently, nitrate leaching was greater during the two June sampling dates (more drainage) than the July sampling dates. Since swine effluent applied at twice the recommended rate (based on N requirements) produced the greatest soil nitrate concentrations, it also had the greatest amount of nitrate leaching (average of about 14 lb/acre/day for the four sampling dates compared to 5 lb/acre/day or less for all other treatments). Solution P content (5 ft depth) was greatest following application of cattle manure at the 2xN rate at 0.44 ppm P compared to less than 0.15 ppm for all other treatments (soil solution P content of 0.05 ppm is sufficient for maximum corn yield). Phosphorus movement at the 5 ft depth for all treatments was less than 0.2 lb/acre during the four sampling dates.

Recommendation for further investigation

The intent of the investigators is to continue monitoring nitrate movement for at least one more year if funding is available. Multiple-year determinations of nitrate movement will greatly enhance evaluation of existing BMP's for land application of swine and beef wastes.

Manure Analyses from Kansas Swine Operations

Principal Investigators

DeRouchey, J. M, Ph.D student, Animal Sciences and Industry Department
R. D. Goodband, Professor, Animal Sciences and Industry Department
J. L. Nelssen, Professor, Animal Sciences and Industry Department
M. D. Tokach, Northeast Extension Area Office
S. S. Dritz, Assistant Professor, Food, Animal, Health and Management Center

Funding

FY 99 & 00 $17,400

Scope of Research and Objectives

Little information is available to swine producers to compare their swine manure nutrient concentrations with other operations from other states, as well as within Kansas. Currently, there is a need for a database from samples of manure to determine the concentration of nutrients and minerals.

The objectives for this project are broken into retrospective and prospective areas. First, our retrospective approach focused on data currently available to the Kansas Department of Agriculture. Secondly, the prospective segment will pertain to the sampling of swine manure from various sites in Kansas. This will allow the determination of differences in manure composition between different phases of production and seasons of the year.

Retrospective Project

We summarized nutrient and mineral concentrations of manure storage facilities sampled from Kansas swine producers during 1999 that met the 1,000 AU level required by law. This information was published in the 1999 Kansas State University Swine Day report, and we concluded that high standard deviations between lagoons existed. Although means from some lagoons were lower, most producers had manure that analyzed higher than previously published values from other sources. This data reveals the importance for individual analysis of lagoons for proper application to cropland to maximize yield and environmental stewardship. Additional research needs to be completed to provide a more detailed understanding of nutrient concentrations from manure samples in Kansas. This recommendation for further research is addressed in the prospective research project.

Prospective Project

Manure samples from six different production systems within Kansas have been taken six times over the course of one year to help determine changes in nutrient and mineral concentrations in relation to the time of season. We will analyze each sample for 22 different minerals and properties. The months that will be sampled are February, April, June, August, October, and December. The different operations will include: 1) nursery 2) wean to finish 3) finisher 4) sow 5) farrow to finish and 6) hoop structures. For each segment of production, 6 to 10 different sites will be tested (Appendix 1).

The submission of the final report for the prospective experiment is projected for completion by April 1, 2001.

Appendix 1. Number of manure samples analyzed per phase of production in 2000.

Item	Month Sampled					
	Feb	Apr	Jun	Aug	Oct	Dec
Hoop barn	6	6	6	6	6	N/A
Lagoons						
Sow	9	9	9	9	9	N/A
Nursery	8	8	8	8	7	N/A
Wean to finish	7	7	7	7	7	N/A
Finish	10	10	10	10	9	N/A
Farrow to Finish	8	8	8	8	8	N/A

N/A, Data not available at this time.

Fiscal Year 2001 Expenditures - Animal Waste Salaries

Department	Total
Agronomy Assistant Scientists (2)	$71,084
Graduate Students (4)	$67,616
Animal Science Graduate Student (1)	$8,700
Biological and Agricultural Engineering Research Assistant (1)	$38,100
Extension Assistant (1)	$47,248
Civil Engineering Graduate Student (1)	$15,000
Northwest Research - Extension Center Undergraduate Student (1)	$5,000
Total	**$252,748**