

LEM NEWS



Livestock Environmental Management Newsletter

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Pixabay

The season of joy is upon us again and while the hustle and bustle of the Holidays, year-end reporting and taxes may have my thoughts pre-occupied, I would like to take a second to express my gratitude and say thank you for allowing me to do this job.

With year-end reporting, I get to rehash some of the interactions I had with you, my agents and producers, and I'm reminded how grateful I am that you ask me questions, support me in my travel, and help me continue to make the livestock environmental management program strong and relevant.

In this quarter's LEM News, you will find research reports that support the relevance and strength of this program as well as a few reminders and things to think about as we head into winter.

I hope you enjoy your holiday celebrations. Talk to you next year!

Merry Christmas, —MB

Central Dakota AG DAY

Dec. 16, 2016

Carrington Research Extension Center
Carrington, N.D.



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Research in Production: Bale Grazing Project at the Half-way Mark

Background

Bale grazing is a winter feeding practice that allows cattle access to a limited number of bales for a specific period of time in a field such as improved pasture or hayland. Timing, spacing and methods depend on the producer's goals. Bale grazing is not recommended on native range because cool season invasive species or weeds may be introduced.

A two-year project focusing on hay bale grazing began in the fall of 2015 on four North Dakota beef operations in Burleigh, Kidder, Logan and Morton counties. NDSU Extension initiated the project in response to producer interest in this feeding method in ND (it is a more common practice in Canada). The North Dakota Grazing Lands Coalition financially supported the first year of sampling.

Potential benefits of bale grazing include cost savings in terms of time and labor and nutrients added to the field or pasture as manure and urine, resulting in improved forage quality and increased biomass.

The goals of the bale grazing project were to validate the effects of bale grazing on soil health, forage production and cattle performance. The project team will share information related to management of bale grazing with producers.

Methods

It is a common practice for ranchers to use poor production areas for bale grazing in an effort to add nutrients as soil amendments. Most of the soils at our treatment (feeding) sites was very poor with gravelly components. At each of the sites, four bales were randomly selected as treatment sites. Controls were adjacent (non-grazed) areas on the same ranch with the same soil type and plants diversity.

Soil samples were collected in the fall of 2015 (pre-grazing) as well as in the summer of 2016 (post-grazing). Core soil samples were collected from the edge of the bale site, as well as 5 and 10 feet from

(Continued on page 3)



A two-year Extension project focusing on hay bale grazing began in the fall of 2015 on four North Dakota beef operations in Burleigh, Kidder, Logan and Morton counties. Data collection will continue through 2017.



Bale grazing is a winter feeding practice that allows cattle access to a limited number of bales for a specific period of time in a field such as improved pasture or hayland. *Photo by Penny Nester.*

(Continued from page 2)

the center of the bale. Samples were collected at 0-6 inches and 6-24 inches for traditional soil analysis as well as 0-6 inches for the Haney soil test.

Core samples were taken from the four treatment bales and analyzed for nutrient content. Any supplemental feed sources were also collected and analyzed.

Body condition scoring occurred on 30% of the grazing herd at each location both before and after bale grazing.

Forage and residue samples were collected during the summer of 2016. Forage was clipped to bare ground from the center of the treatment bale area as well as 5, 10 and 15 feet from the center using $\frac{1}{4}$ meter frames. Any remaining bale residue from the treatment bales that fell within the $\frac{1}{4}$ meter frame was also collected.

Current Results and Discussion

Among the four ranches involved, there were various management differences. Bale spacing ranged from 15 feet to 40 feet. Grazing periods ranged from 14 days to 96 days. Acres that were grazed ranged from $\frac{3}{4}$ to 40. Producers were not expected to standardize their practices, in order to gather a variety of measures from actual working beef operations. Despite management differences, the producer objectives were similar in the following areas: all producers wanted to feed out of a confinement situation; all producers wanted to improve soil quality; all producers wanted to operate equipment fewer days during the winter feeding period; all producers fed a low quality hay with a better quality hay or supplement. Body condition scores did not change during the grazing period for any of the sites.

Residue collected six months after grazing was heaviest in areas where animal numbers were low and bale numbers were high. Residue amount depends on animal numbers, hay quality and bale spacing, with each producer expressing a different ideal amount of residue. At all of the sites, the 5-foot perimeter from the center of the bale consistently had the highest percentage of residue.

Three of the four sites had an increase in forage biomass the year following bale grazing (summer 2016). We will be measuring forage response in 2017 as well and expect to see a difference at all four sites at that time.

Soil samples are still being analyzed.

More information will be available after final sample collection during summer/fall of 2017. Interim and complete project data and recommendations will be presented at winter programs. --*Mary Berg with Chris Augustin, Fara Brummer, Jackie Buckley, Sheldon Gerhardt, Penny Nester, Ashley Stegeman, Kevin Sedivec, and Dennis Whitted, all members of the Project Team.*

Kids, Compost, Crops and Consumption...

Teaching Our Future the Full Cycle

While the “Kids and Compost...From the Feedlot to the Garden” program was successful in introducing 3rd and 4th grade youth to manure, compost and the uses as fertilizer, each session was approximately 6 minutes long and we really wanted to share the whole food cycle with these students. We created a new, extended program called **Kids, Compost, Crops and Consumption** where youth participating learned about nutrition, agricultural production and where their food comes from. This program was piloted to 80 third- and fourth-graders at a low-income school in the Fargo School District.

The program consisted of six, one hour lessons taught once a month throughout the school year. Each lesson focused on a different part of the food cycle:

- ◆ Livestock production
- ◆ How compost recycles plant and livestock manure into a valuable resource for crop production
- ◆ How soil supports livestock and crop production
- ◆ Root development, required nutrients for plant growth and photosynthesis
- ◆ Health benefits of vegetables and how to incorporate vegetables into their diet

The final lesson was a review of the previous lessons.

Each student was provided with a square foot garden and all of the necessary supplies and information to grow spinach during the summer. Students also received two recipes for using spinach and tasted those recipes before the lesson ended. Every lesson also promoted daily physical activity. Success of the at-home gardening project is currently being measured.

Students improved their knowledge of nutrition, composting and agriculture.

97 % know livestock use plants as food.

78 % know paper can be composted, compared with 41% before the program.

68 % correctly defined photosynthesis as the life cycle that uses sunlight energy and carbon dioxide to make sugar and oxygen.

75 % correctly answered that sand is the largest soil particle, compared with 20% before the program.

91 % know fruits and vegetables contain vitamins and minerals that help our brain, eyes, heart, skin and teeth.



The Kids, Compost, Crops and Consumption team with all 80 students at the final lesson. Thundar was our special guest who reminded students to stay active during summer break.

Educating students about the nutritional requirements of a healthy diet and about agriculture production teaches them where their food comes from and may begin to provide food security.

Feedback from teachers consisted of:

“We appreciate all of your work and patience with our students. You made it hands-on, interesting and something they will remember. Thank you for all of your work and effort!”

“The most valuable part of the program was exposing the students to agriculture in ways they have not experienced. Very hands-on and having something to take home to try was excellent. As one student said, ‘Showing us real life.’”

The **Kids, Compost, Crops and Consumption** program is being piloted again in three different counties in 2017 and will be available to every county in 2018. —*Mary Berg with Alicia Harstad, Kelcey Hoffmann, Nikki Johnson, Linda Schuster, Stacy Wang, and Todd Weinmann, all members of the KCCC Project Team.*

Land Use of Riparian Ecosystems in the Northern Great Plains: Empowering our Educators

The Situation

Escherichia coli, fecal coliforms, excess nutrients and eutrophication have been identified as the leading causes of impairment to surface water throughout the Great Plains Region. The leading source of this impairment has been identified as non-point source pollution from livestock grazing and livestock feeding and handling operations. Best management practices have been identified for 1) land use practices within riparian ecosystems and 2) nutrient and manure management that enhance water quality. However, Extension professionals and educators lack the knowledge, technical skills and curriculum to confidently provide programs in these areas.

Extension Response

A program was developed providing technical in-service training and program curriculum on 1) land use of riparian ecosystems and 2) manure and nutrient management for Extension Personnel, educators and technical service providers within the Great Plains Region. The program team developed 12 presentations, a classroom activity, 5 field demonstrations and supplemental aids which were provided to the 48 training participants from 4 states. Two in-service trainings held in Sioux Falls, SD and Bismarck, ND, were organized providing technical in-service training and program curriculum. Results of the

training were shared with 18 Extension Educators in the North Central Region during a webinar.

Impacts

Riparian Management:

- Participants (34) increased their knowledge of riparian ecosystems, management and assessment by more than 45%.
- Participants (34) reported a 46% increase in confidence in communicating about riparian ecosystem and management.
- 61% of follow-up survey respondents (18) have incorporated the riparian ecosystems curriculum and technical skills into their outreach and programming efforts.

Nutrient Management:

- Participants (37) increased their knowledge of nutrient and manure management, marketing, regulations, composting, and application by more than 40%.
- Participants (37) reported a 48% increase in their confidence in communicating about nutrient and manure management.
- 63% of follow-up survey respondents (19) have incorporated nutrient and manure management curriculum and technical skills into their outreach and programming efforts.

Workshop follow-up survey respondents have estimated reaching an estimated 1,200 clients in the 2-month period since the trainings.

Feedback

- *“Utilizing the knowledge and skills obtained at the land use/water quality training, I am able*

to provide landowners/producers with better technical and financial assistance through the implementation of best management practices.” - Environmental Program Manager, Red River Regional Council, NDSU Workshop

- *“Water quality & riparian has been shared with over 400 elementary and 8th graders during Conservation Days.” - Extension Educator, UNL, SDSU/UNL Workshop*
- *“I have added content to my college class relative to spreader calibration and regulations.” - Professor, UNL, SDSU/UNL Workshop*

Public Value Statement

Providing proper training to our Extension educators and professionals empowers them to offer programs and technical assistance to land managers in the short-term and may help lead to improvements in water quality in the future.

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Non-Extension Collaborators

Bowman-Slope Soil Conservation District
Burleigh County Soil Conservation District
East Dakota Water Development District
North Central Region Water Network
North Dakota Game & Fish Department
Nutrient Advisors
USDA, Agriculture Research Service
USDA, Natural Resource Conservation Service
Wild Rice Soil Conservation District

Resource Links

- <http://northcentralwater.org/professional-development-for-extension-professionals-and-educators-on-land-use-and-management-practice-to-enhance-water-quality-2/>
- <https://www.youtube.com/watch?v=67RqYt04CBw>

Extension teams honored for Program Excellence include KCCC



Photo caption: KCCC Team members (from left in photo): Alicia Harstad, Extension agent, agriculture and natural resources, Stutsman County; Mary Berg, area Extension specialist, livestock environmental management, Carrington Research Extension Center; Jim Murphy, representing program sponsor Farm and Ranch Guide; Todd Weinmann, Extension agent, agriculture and natural resources/horticulture, Cass County; Stacy Wang, Extension associate; Nikki Johnson, area Extension specialist, community health and nutrition; Kelsey Hoffmann, Extension agent, agriculture and natural resources, Cass County. Not pictured: Linda Schuster, administrative secretary, Carrington Research Extension Center.

Four NDSU Extension Service teams were honored for their work with a Program Excellence Award at NDSU Extension and Research Extension Center conference in Fargo in October.

The Program Excellence Team Award recognizes teams for outstanding Extension educational program achievement relative to responsibilities. These team awards are based on the involvement of county, area, and/or state staff and partners in the design, delivery and evaluation of educational programs that are responsive to the needs facing North Dakota citizens and stakeholders with an innovative approach to program development and delivery.

A multidisciplinary Extension team built the Kids, Compost, Crops and Consumption program to teach youth about nutrition, agricultural production and the origin of their food, with six age-appropriate monthly lessons focusing on the food cycle and a square-foot garden box for each child.

Other projects recognized during the Fall Conference were:

Ditch Hay Program. Focus on the quality and suitability of ditch forages as livestock feed, with emphasis on the importance of accurate forage testing and interpreting and using test results.

Field to Fork: Enhancing the Safe Use of North Dakota Specialty Crops. Focus on safe food handling of specialty fruit and vegetable crops from field to table, using webinars, YouTube videos, a comprehensive website, ten Field to Fork handouts for use in farmers' markets, and an online mini-course.

Watch Me Grow. Container gardening and nutrition, with an emphasis on family and community engagement.

The honors included cash awards sponsored by Farm and Ranch Guide. – Linda Schuster, Carrington REC.



The Kids, Compost, Crops and Consumption team preparing bags of soil for the final lesson and take-home project for participating students.



Waste to Worth International Conference on Livestock and Poultry Environmental Quality

April 18-21, 2017 in Raleigh, NC

Join a national network of agri-professionals addressing issues related to air, water, soil, and climate. The focus of the Waste to Worth Conference is science-based environmental management on livestock and poultry operations and utilization of manure as a resource.

Manure as a source of N for wheat and the effect of supplemental N on wheat protein content

Low soil nitrogen (N) availability is the main limiting factor for yield and kernel quality in hard red spring wheat (HRSW) production and consequently nitrogen fertilization is one of the largest single expenses to grow HRSW. The N fertilizer cost is causing some producers to look for alternative and more affordable sources of N for wheat production. Manure is an alternative fertilizer which can supply all the required nutrients at recommended levels for HRSW production. However, research done in North Dakota has shown that spring applied solid manure results in slow mineralization and consequently delayed N release, which can lead to lower yields and/or lower protein content in the kernel.

In the spring of 2016, we started a field trial at the CREC to test the response of HRSW to fresh beef feedlot manure and commercial fertilizer. The following treatments were applied to the main plots (60ft wide by 45ft long):

- 1.0 X N- Recommendation as manure (1xN-MAN)
- 1.5 X N-Recommendation as manure (1.5xN-MAN)
- 1.0 X N-Recommendation as commercial fertilizer (1xN-FERT)
- CHECK (see picture)

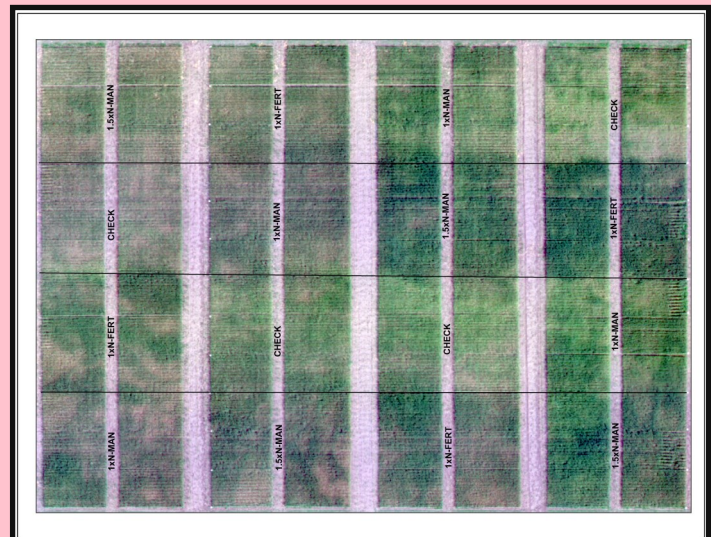
The main plots were then split into two subplots (30ft wide by 45ft long). One of the subplots received supplemental N at planting and the other one at boot stage. The subplots were then split into three sub-subplots (30ft wide by 15ft long), where we applied rates of N (0, 20, and 40 lbs/ac) at either planting or boot stage.

Wheat (cultivar Faller) was planted on May 3, 2016, at the rate of 1.4 million PLS/ac. On the same day, we applied the supplemental N due at that time. The remaining supplemental N was applied on June 23. The plots were harvested on August 17, 2016.

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Paulo Flores, Nutrient Management Specialist, CREC.



Plot layout showing subplot design.

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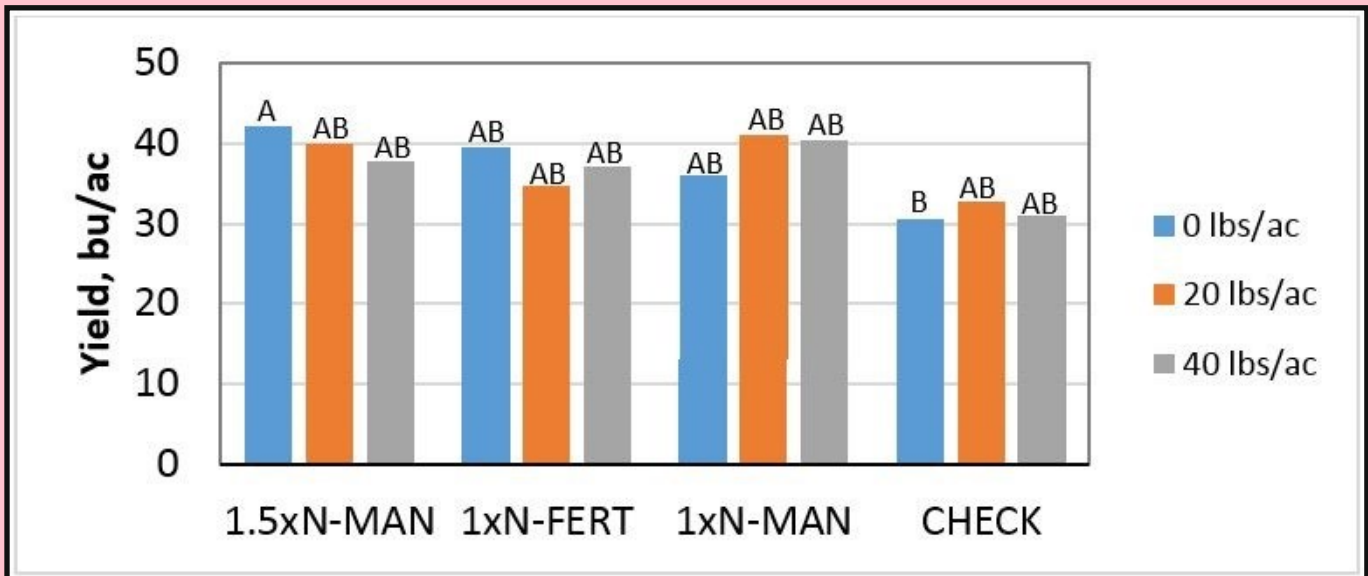


Figure 1. Wheat yield response to manure and urea used as sources of N plus supplemental N-rates. Bars with the same letter are not significantly different (Tukey Test, $\alpha=0.05$).

In summary, wheat fertilized with fresh beef feedlot manure showed similar yields (2-3 bu/ac more; (Figure 1) than wheat fertilized with urea.

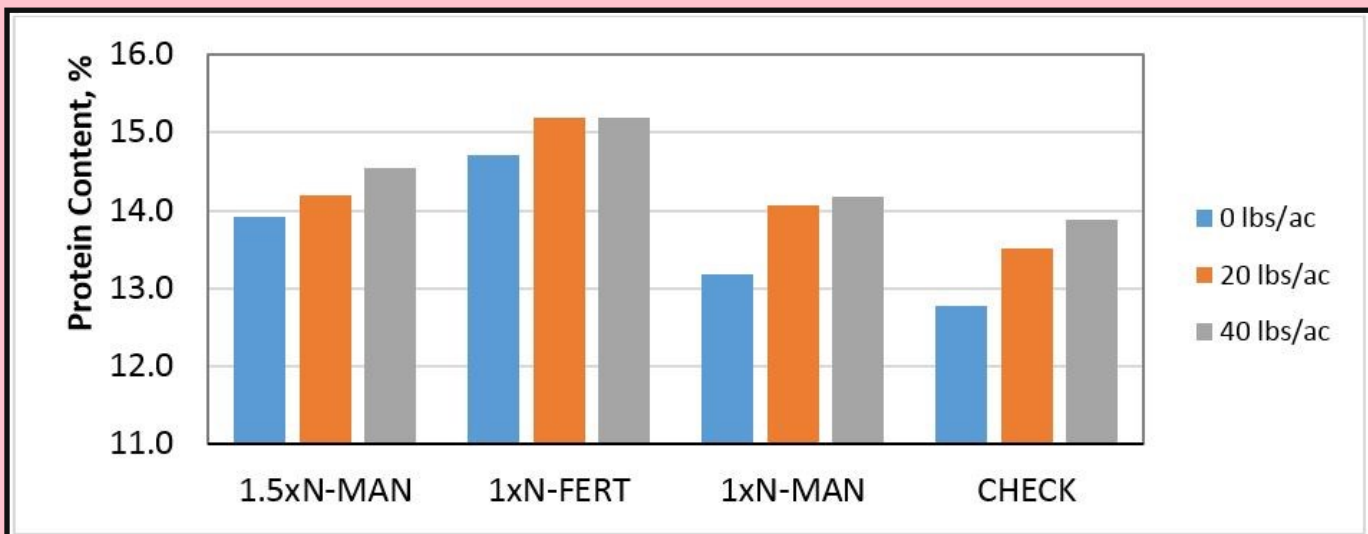


Figure 2. Wheat protein content in response to manure and urea used as sources of N plus supplemental N-rates.

Although there was no interaction between the fertility treatments and supplemental N-rates, the results suggest that when using manure as fertilizer a supplemental 20 lbs of N/ac would be advisable to increase/maintain protein content above 14% (Figure 2), avoiding that way protein discounts. More years of data are necessary to verify the findings of this study.

Regarding recommendations about using either manure or commercial fertilizer for wheat production, there are many factors (fertilizer cost, manure application cost, manure nutrient value to subsequent crops, wheat price, protein discounts and premiums) that play a role on that decision. Therefore, I suggest that such recommendations should be done on a year by year basis, taking into consideration the most current information for those factors. — Paulo Flores, Ph. D., Nutrient Management Specialist

The Phosphorous Index: What is it and how does it relate to a feedlot facility?

The Phosphorus Index (PI) was proposed by Lemunyon and Gilbert (1993) and is used by the ND Department of Health, NDSU Extension Service and the Natural Resource Conservation Service (NRCS). The PI assesses the potential for phosphorus (P) to move from agricultural fields to surface water, with a rating of low, medium, high, or very high. (PI rating ranges are different than the ranges used in the NDSU fertilizer recommendation tables.)

To calculate the PI rating, a spreadsheet uses six inputs to create a score linked to the soil type for each individual field. The six inputs are:

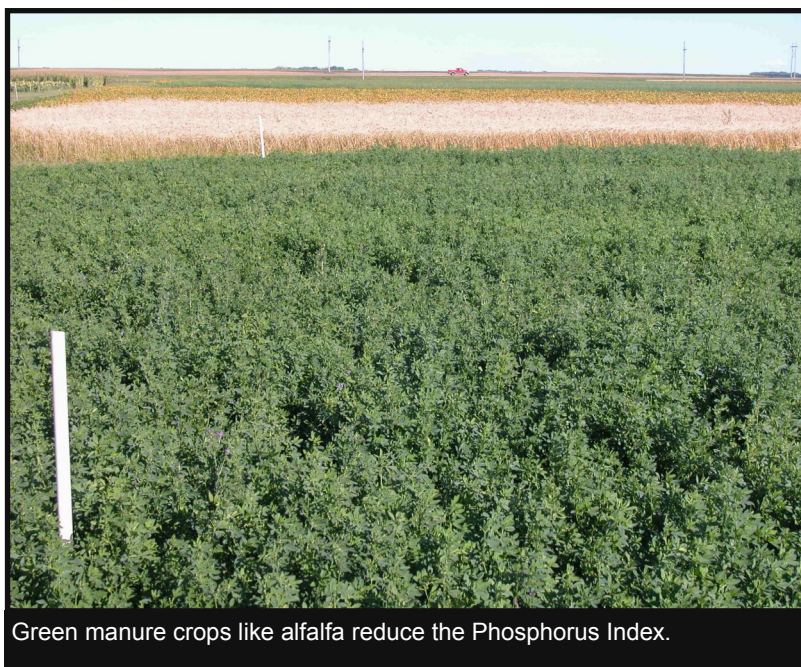
- soil erosion by wind and water in (tons/acre/year)
- surface water risk
- soil test phosphorus
- phosphorus fertilizer application rate (pounds P₂O₅/acre) from all sources
- phosphorus fertilizer/manure application method
- distance to permanent surface water or water course

Soil erosion by wind and water; soil test phosphorus; and phosphorus fertilizer application rate are scored as expected, with a higher range increasing the score.

The distance to a permanent surface water or water course is also scored with nearby water features increasing higher the score.

Surface water risk relates to soil type and is evaluated so the score increases with the runoff risk.

The phosphorus fertilizer/manure application method score is based on the method of fertilizer spreading; if the fertilizer is injected or is incorporated in a timely manner a lower score results.



Green manure crops like alfalfa reduce the Phosphorus Index.

Commentary from the CAFO Corral



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The spread sheet also includes best management practices (BMPs) for:

- cover or green manure crop
- filter strips
- contour buffer strips
- established no-till system

If BMPs are implemented the score is reduced.

The PI rating is an important part of the nutrient management plan (NMP). The PI allows manure and other sources of nutrients to be applied at rates that meet the nitrogen needs of a crop if the PI rating is low or medium.

If the PI is high, it allows manure and other sources of nutrients to be applied

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at rates to meet the **phosphorus removal** in the crop biomass.

If the PI is very high, it requires that **no manure be applied to that field**. Manure shall not be applied to fields where the soil test phosphorus exceeds 125 parts per million (ppm) (250 lbs. per acre). This is a requirement of the NMP as stated in Section 7.5 (1) & (2) of the “North Dakota Livestock Program Design Manual”.

The key input that changes frequently is the soil test value for phosphorus. In the NDSU



Calibrated spreaders are used to apply tested manure on CREC fields.

“North Dakota Fertilizer Recommendation Tables and Equations” for crops, an Olsen test value of > 16 ppm indicates that “the probability of getting a response to applied nutrient is less than 10 percent.” The P input for the Phosphorus Index has an Olsen range: <20 ppm (low); 20-40 ppm (medium); 41-80 ppm (high); and >80 ppm (very high). If the recent Olsen test for the field is > 16 ppm and also > 20 ppm the soil test phosphorus may need to be updated (from low to medium) in the PI spreadsheet, and this updated range may cause a field to move into a different PI rating, which, in turn, could change the manure application rate according to the P needs of the crop. A determination may also be that no manure may be applied to that field until levels of P drop to allowable levels for application of manure.

EXAMPLE						
North Dakota Phosphorus Index Risk Assessment (Version 1.0)						
Factor	None (0)	Low (1)	Medium (2)	High (3)	Very High (5)	Score
1. Soil Erosion	<2 tons/ac	2 - <5 tons/ac	5 - <10 tons/ac	10-15 tons/ac	> 15 tons/ac	2
2. Runoff Limitations		Not Rated		Moderate	High	1
3. Soil Test P (See Table 3)	Not applicable	Low	Medium	High	Very High	3
4. P Application Rate (Annually applied or rotational average lbs. P ₂ O ₅ per acre per year, all sources)	None applied	<30	30-90	91-150	>150	2
5. P Application Method (Use highest applicable risk category for multiple P applications)	None applied	Injected or subsurface application	Spring applied and incorporated within 2 weeks	Fall/winter applied and incorporated within 2 weeks	Surface applied with no incorporation, or fall/winter applied with spring incorporation	3
6. Distance to Surface Water	>1000 feet	200-1000 feet	100 -<200 feet	20 -<100 feet	<20 feet	5
Gross Score (sum of Factors 1 through 6)						16
7. BMP Implementation Credits	Subtract 1 point for each of the BMPs implemented (circled) on this site. Cover or Green Manure Crops Filter Strips Contour Buffer Strips Maximum score is 2					2
Net Score (sum of Factors 1 through 6 less Factor 7, BMP Implementation Credits)						14
Score	Phosphorus Index Risk Interpretations					
< 8	This field has a LOW potential for off-site P movement if management is maintained at the current level. Organic nutrient application rates may be calculated according to crop nitrogen requirements.					
8 to 11	This field has a MEDIUM potential for off-site P movement and some management changes may need to be made to support continued long term organic nutrient applications. Organic nutrient application rates may be calculated according to crop nitrogen requirements.					
12 to 15	This field has a HIGH potential for off-site P movement and management changes should be implemented to decrease risk. Organic nutrient application rates should be calculated according to crop phosphorus requirements.					
16	This field has a VERY HIGH potential for off-site P movement and management changes are needed to decrease risk. Organic nutrients should not be applied to this field.					

It is important to note that the PI rating ranges are vastly different than ranges listed in the NDSU “North Dakota Fertilizer Recommendation Tables and Equations.” This Phosphorus Index ranges up to 80ppm (and greater) where NDSU Extension Publication 882 only addresses P levels of 0-16 (and greater).

To review the Phosphorus Index for North Dakota, see [https://efotg.sc.egov.usda.gov/references/](https://efotg.sc.egov.usda.gov/references/public/nd/north_dakota_phosphorus_risk_assessment.pdf)

[public/nd/north_dakota_phosphorus_risk_assessment.pdf](https://efotg.sc.egov.usda.gov/references/public/nd/north_dakota_phosphorus_risk_assessment.pdf)

To review the NDSU Extension Publication, see <https://www.ag.ndsu.edu/publications/crops/north-dakota-fertilizer-recommendation-tables-and-equations/sf882.pdf>

— Brady Espe, ND Dept of Health Livestock Program

Coming Events

December 16. Central Dakota Ag Day sponsored by Foster Co. Extension at Carrington REC.

January 3-4. Lake Region Roundup, Memorial Building, Devils Lake.

January 10-11. Winter Ag Expo, Jamestown Civic Center.

January 18-19. NDSU Feedlot School sponsored by Foster Co. Extension at Carrington REC.

January 25-27. KMOT Ag Expo, ND State Fair Center, Minot. **Stop by our booth!**

February 7. Stutsman County Beef Producers Meeting, Medina.

February 14-15. KFYR Agri-International, Bismarck Event Center. **Stop by our booth!**

February 22. Custom Manure Haulers Workshop, Mandan.

March 4-11. ND Winter Show, Valley City.

April 18-21, 2017. [Waste to Worth Conference](#) on Livestock and Poultry Environmental Quality, Raleigh, NC.



<https://www.ag.ndsu.edu/succession>

NDSU Extension offering *Design Your Succession Plan* workshops to assist farm and ranch families to get started on their succession plan and shape the future ownership of their business. *Design Your Succession Plan* is a multi-session workshop to help you:

- Get started** on a succession plan using a workbook during and after the workshop
- Open lines of communication** with family to create a shared vision for the family business
- Work with professionals** to construct a plan and documents to put the family's vision into action

Center Points: Easy as 1-2-3...

The Carrington REC has a weekly blog with updates on what's happening now and information on coming events. Read online at www.ag.ndsu.edu/CarringtonREC or subscribe to receive a weekly reminder and quick link.

Subscribing is as easy as 1-2-3:

1. **Send an e-mail to Listserv@listserv.nodak.edu**
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3. **In the body (not the subject line) of the e-mail enter the following:
SUB NDSU-CARRINGTONREC-CENTERPOINTS yourfirstname yourlastname**

OR: Simply send a regular email to Mary.Berg@ndsu.edu.



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