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agronomy news

Feedlot Manure Focus Of SARE Project

Impacts on crop yields, nitrate levels, weed and insect populations, and microbial biomass, as well as management decisions were examined.

INSIDE:

In 1996, CSU received a grant from the USDA Sustainable Agriculture Research and Education Program (SARE) to work on feedlot manure utilization in the South Platte River Basin. This newsletter summarizes the results of this project over the last few years.

On-Farm Tests Show Manure Impacts On Corn Yields

Over-application of manure did not improve yield and can harm soil and water quality.

Field studies were established in Weld County in 1997 to evaluate beef feedlot manure impacts in irrigated cropping systems. One field had a clay soil (Nunn series) with no manure applications in the last eight years (except for one application in the fall of 1995). The other field had a sandy loam soil (Vona series) with a long history (>50 years) of beef manure applications. In 1998, the sandy site was relocated to another sandy field (Valent loamy sand) with a long history of turkey and beef manure applications. All three fields were irrigated through center-pivot systems. Each field was laid out with four replications, four manure treatments (0, 10, 20, and 30 tons manure per acre), and two sidedress nitrogen treatments (0 and 50 lbs/acre) in split-plot designs, with manure treatments as the main treatments and sidedress nitrogen as the split plots.

Analyses of Beef Feedlot Manure Used on Field Plots

Field	D.M.	pH	Soluble Salts	Total N	P_2O_5	K_2O
	%		mmhos/cm	----- lbs per ton -----		
Nunn clay (1997)	78.9	7.9	37.1	16	27	36
Vona sandy loam (1997)	45.0	8.6	43.7	20	11	23
Nunn clay (1998)	62.2	8.6	33.5	24	36	26
Valent loamy sand (1998)	50.8	8.6	41.0	15	14	25

Pre-season soil sampling showed that no additional nitrogen fertilizer was required for the Nunn clay and about 90 lbs of nitrogen per acre were required for the Vona soil. The Valent soil required nearly 180 lbs nitrogen per acre based on soil testing. In the second year, the Nunn clay soil showed trends of increasing soil NO_3-N, P, K, and salts with increasing manure application rates. Therefore, the plots receiving the higher manure

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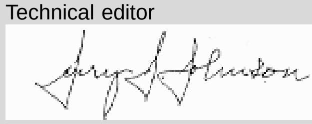
Technical editor



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Corn Yields

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rates required less nitrogen fertilizer.

Manure came from on-farm or nearby beef cattle feedlots. The manure used in the experiments was sampled during application and analyzed by the CSU Soil, Water, and Plant Testing Lab. The manures differed in dry matter content (D.M.) and nutrient content due to their different ages and management practices.

Corn Yields (Bushels/acre) as Influenced by Manure Application Rate.

Manure Rate (tons/acre)	Sandy Site: 1997	Sandy Site: 1998	Clayey Site: 1997	Clayey Site: 1998
0	177 A*	156 A	116 B	149 A
10	168 A	152 A	124 AB	149 A
20	164 A	142 A	129 A	148 A
30	169 A	146 A	136 A	146 A

*Manure rates with a common letter are not significantly different according to Tukey's test for mean separation at $p<0.05$.

The manure treatments were applied in the early spring, one month before planting. Manure for each plot was weighed, carried to the plot by hand or with a dumptruck, and spread with rakes. The manure was incorporated immediately after application, either by disking or by rototiller.

Harvest

In 1997, both fields were damaged by hail, and yields were higher at the sandy site with a long-term manure history than on the clayey site with limited manure history. There were no effects from sidedress nitrogen applications at either field, nor any effect from manure treatments on yield at the sandy site. There was a significant impact of manure rates on corn yield at the clayey site, however. The higher manure application rates improved stand in the clayey soil, and, subsequently, increased yield. In 1998, neither field was hailed, and yields at the two fields were similar. There were no effects from sidedress nitrogen applications at either field, nor any effect from manure treatments on either soil.

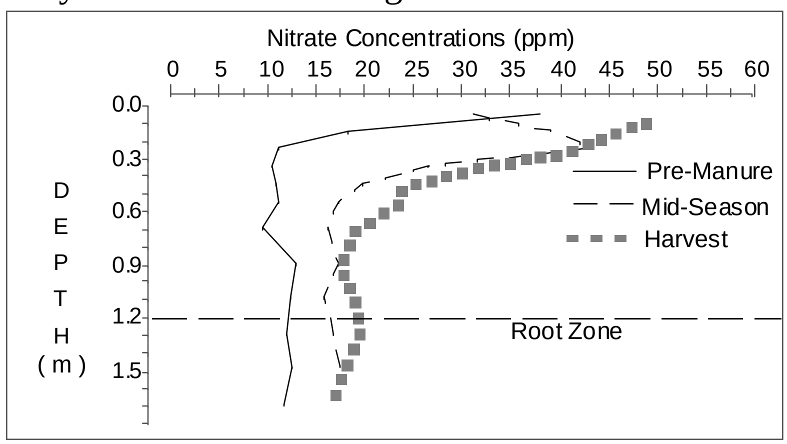
Three of the four sites evaluated had no significant yield differences due to manure application rates. This is probably due to the long-term manure application histories on the sandy sites and the long-term fertilization of the clayey site. Over-application of manure (30 ton/acre rate) did not improve yield at any location and can harm soil and water quality. Many other measurements were made on these on-farm tests. Those results are reported in subsequent articles.

Kirk Iversen and Jessica Davis, Former Research Associate and Extension Soil Specialist, Soil and Crop Sciences

Manure Application Rates Impact Nitrate Accumulation In The Soil Profile

Manure application increased soil nitrate within and below the rootzone in early summer.

Clay Loam Soil Receiving 30 Tons Manure/Acre



One objective of the project was to compare soil nitrate levels as affected by manure application rate under two different soil conditions: 1) a sandy loam with a long history of manure application and 2) a clay loam with little previous manure application. Nitrate movement was assessed by collecting soil samples from each of the fields at three times: pre-season (before manure application), mid-season, and crop harvest. Six cores were taken down to a depth of six feet in each plot at each sampling time.

The initial nitrate levels prior to manure application were about 60% higher in the clay loam soil than in the sandy loam soil, in spite of the lack of manuring history. The 10 and 30 ton/acre manure application rates both showed a trend of elevated nitrate levels both within (0-4 ft) and below the rootzone (4-6 ft) in both fields. In the pre-season to mid-season period, all manured plots had increased soil nitrate levels, and the 30 ton/acre rate had greater increases (39%) as compared to the 10 ton/acre manure application rate (22%). Soil nitrate increased below the rootzone in all treatments from pre-season to mid-season, even those without current manure application. This was particularly true in the sandy loam soil, probably due to the previous long-term manure application. By mid-season (especially in the sandy loam soil), decreases in soil nitrate in the upper profile were accompanied by elevated soil nitrate in the subsoil due to the combined effects of plant uptake and leaching.

From mid-season to harvest time, soil nitrate level decreased below the rootzone in all plots, but the decline was much greater in the sandy soil (18%) than in the clayey soil (3%). Within the rootzone during the late summer, soil nitrate levels increased in the clay soil (9%) and decreased in the sandy soil (30%). The combined effects of crop uptake and leaching result in these reductions in soil nitrate. It is difficult to separate these two effects. However, within the rootzone of the clay soil, soil nitrate increased even in late summer. A portion of the nitrate buildup in the clay loam soil can be attributed to high nitrate concentrations (10 mg NO_3-N/L) in the irrigation water (alluvial groundwater).

In summary, soil nitrate concentration below the rootzone increased in early summer and decreased in late summer. The spring manure application resulted in excess soil

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Feedlot Manure Application Impacts Weed Populations

Manure application suppressed proso millet germination.

Weed seedlings compete with crops for light, nutrients, and water and can contribute to yield reduction. The effects of manure application on weed seedling population dynamics are two-fold. First of all, manure applications may increase the density and diversity of the weed seeds in the weed seedbank through the addition of seeds contained in the manure. Secondly, nutrients in manure may affect the weed population by stimulating weed seedling growth. While manure application has many recognized benefits, additional weed pressure can reduce producer profit. The primary objective of this component of the SARE project was to investigate the influence of manure application rates on weed seedling populations.

The effects of manure rates on weed seedling population dynamics were evaluated by counting weed seedling densities. Weed seedling sampling was conducted prior to a post-emergence herbicide application, in early June of each year. On average, corn seedling height ranged from 14 to 16 in., while weed seedling height ranged from 2 to 16 in. at the time of sampling. Eight weed seedling density samples were taken in each plot. Within each sampling quadrant of 1.74 ft^2, the number of weed seedlings by species was counted.

The density and type of weed seedling species between experimental sites varied. The sandy site tested in 1997 was the most severely weed-infested field of those studied. The clayey site was moderately infested, and we observed no weed seedlings in the sandy site used in 1998. In the severely-infested field, there were 13 weed seedling species that were observed (pigweed, lambsquarters, spurred anoda, barnyard grass, common mallow, velvetleaf, Canada thistle, kochia, dandelion, tooth spurge, smart weed, bindweed, and nightshade).

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Nitrate

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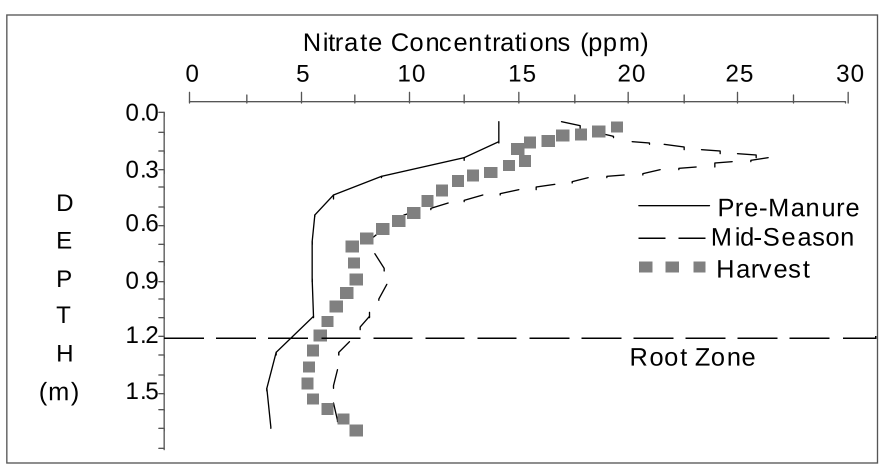
nitrate when the corn was still small, its need for nitrogen was not great, and the root system was not fully developed. In addition, early season nitrate accumulation may be a result of manure and fertilizer buildup from previous years. Soil ammonium was also measured and remained nearly constant among treatments and depth, showing little fluctuation with time as well. These observations are based only on the first year of this two-year study; the second year's samples are still being analyzed.

Sandy Loan Soil Receiving 30 Tons Manure/Acre



Bret Ahnstedt, Greg Butters, and Jessica Davis, Graduate Student, Associate Professor, and Extension Soil Specialist, Soil and Crop Sciences

Weeds

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Eight weed species were detected in 1997 and 1998 in the moderately-infested field (pigweed, velvetleaf, common sunflower, cocklebur, buffalobur in 1997 only, kochia in 1998 only, common mallow, bindweed, and proso millet). Proso millet seedling density was greater than the other seven broadleaf seedling populations. The predominant broadleaf species was cocklebur. Across both sites, broadleaf species occurred in higher densities in the severely-infested field; however, the grass population (specifically, proso millet) was greater in the moderately-infested field.

Impact of Manure Application Rate on Weed Seedling Densities (number of weeds per square foot) for the Severely Infested Field in 1997

Manure Rate (tons/acre)	Pigweed	Velvetleaf	Spurred-anoda	Lambs-quarter	Kochia	Barnyard-grass
0	0.58	0.03	0.84	1.71	0.01	1.49
10	0.82	0.08	0.60	1.28	0.02	2.00
20	1.17	0.36	0.52	1.09	0	1.96
30	1.55	0.09	1.50	1.75	0	3.18

Impact of Manure Application Rate on Weed Seedling Densities (number of weeds per square foot) for the Moderately Infested Field in 1997

Manure Rate (tons/acre)	Pigweed	Cocklebur	Buffalo-Bur	Common Mallow	Bindweed	Proso millet*
0	0.03	0.36	0.02	0.01	0.07	42 a
10	0.03	0.31	0.01	0.01	0.08	41 a
20	0.06	1.31	0	0	0	35 b
30	0.05	0.03	0.01	0	0	32 b

* Manure rates with a common letter are not significantly different based on Least Significant Differences at $p<0.05$.

The highest density of proso millet occurred in the treatment where no manure was applied. No significant difference was detected at a p-value of 0.05 within or among treatments for any weed seedling species in 1997 or 1998, except for proso millet in the moderately-infested field. Across both years the mean density of proso millet was greater when no manure treatment was applied and decreased as rates of manure increased. In 1997, proso millet mean density from plots treated with 0 or 10 T/A of manure were significantly greater than densities from plots treated with 20 or 30 T/A of manure. When the experiment was conducted again in 1998, proso millet mean densities from plots treated with 0 T/A of manure were significantly greater than mean densities from plots treated with either 20 or 30 T/A of manure. It is speculated that some factor related to the manure may have inhibited proso millet seed germination.

Impact of Manure Application Rate on Weed Seedling Densities (number of weeds per square foot) for the Moderately Infested Field in 1998

Manure Rate (tons/acre)	Pigweed	Cocklebur	Kochia	Common Mallow	Bindweed	Proso millet*
0	0.03	0.06	0.02	0.01	0.01	37 a
10	0.03	0.39	0.07	0	0.01	30 ab
20	0.03	0.45	0.12	0.04	0	29 b
30	0.06	0.01	0.13	0.04	0	27 b

* Manure rates with a common letter are not significantly different based on Least Significant Differences at $p<0.05$.

Dawn Wyse-Pester and Philip Westra, Graduate Research Assistant and Professor, Bioagricultural Sciences and Pest Management

Feedlot Manure Application Modifies Environment For Soil Insects

Manure application rates had no effect on corn rootworm.

The manure test plots were evaluated for insect damage, as well as weed populations. Previous studies in more humid environments indicated that manuring increased corn rootworm populations and caused subsequent reductions in yield. We evaluated the relationship between manure application rates and rootworm damage to see if it held true in our semi-arid environment.

Insect damage to corn plants was evaluated at harvest on both fields in 1997. Corn rootworm damage was assessed by digging up plants and inspecting roots. Corn rootworm ratings were based on the Iowa 1-6 system, where 1 = no damage to roots and 6 = complete removal of root system. One plant per plot was evaluated for rootworm damage. Rootworm damage was very even across all treatments on both fields. Average damage at the clayey site was 2.2, and at the sandy site the damage rating averaged 2.4. Both ratings indicate very little effect on yield due to damage by rootworms. There was no significant impact on rootworm damage due to manure application rates. In 1997, both fields were treated with insecticide either at planting or at cultivation to control rootworms.

Rootworm and grasshopper damage by site and manure application rate in 1997.

Site	Manure Rate	Rootworm Damage*	Grasshopper Damage**
	T/A		
Clay	0	2.2	8.2
	10	2.2	8.4
	20	2.2	8.4
	30	2.4	7.7
Sand	0	2.4	n/a
	10	2.5	n/a
	20	2.6	n/a
	30	2.3	n/a

* - 1 = no root damage; 6 = complete root removal.
** - % leaf defoliation.

The clayey site had a grasshopper infestation in 1997. Grasshopper damage averaged 8.2% leaf defoliation, which suggests an extremely small effect on plant yield. There were no significant differences among treatments, indicating no effect of manure rate on grasshopper damage.

In 1998, all plots were sampled at harvest for corn rootworm damage. Damage ratings varied only slightly from 2.0 to 2.7, which means that only slight damage was noted, and thus, corn rootworm feeding had no effect on yield. In 1998, the clayey site received an application of rootworm insecticide, but the sandy site did not. Standing plants were rated by damage observation for second generation European cornborer. Less than 3% damaged plants were observed. The majority of the damage was found just below the tassel, thus, final yields were not affected by the damage from this insect. No significant impacts of manure application rate on insect damage were found in either year.

Jerry Alldredge, Extension Agent, Weld County

When Manure Meets The Microbes

Manure application increased microbial biomass nitrogen in two out of three fields.

Manure applications to soil may have substantial effects on soil organisms and their activities. These effects may be beneficial or detrimental to the sustainability of crop production. The objectives of the soil biology studies were to analyze the impact of manure application rate on biological activity, microbial biomass, and earthworms in the SARE plots.

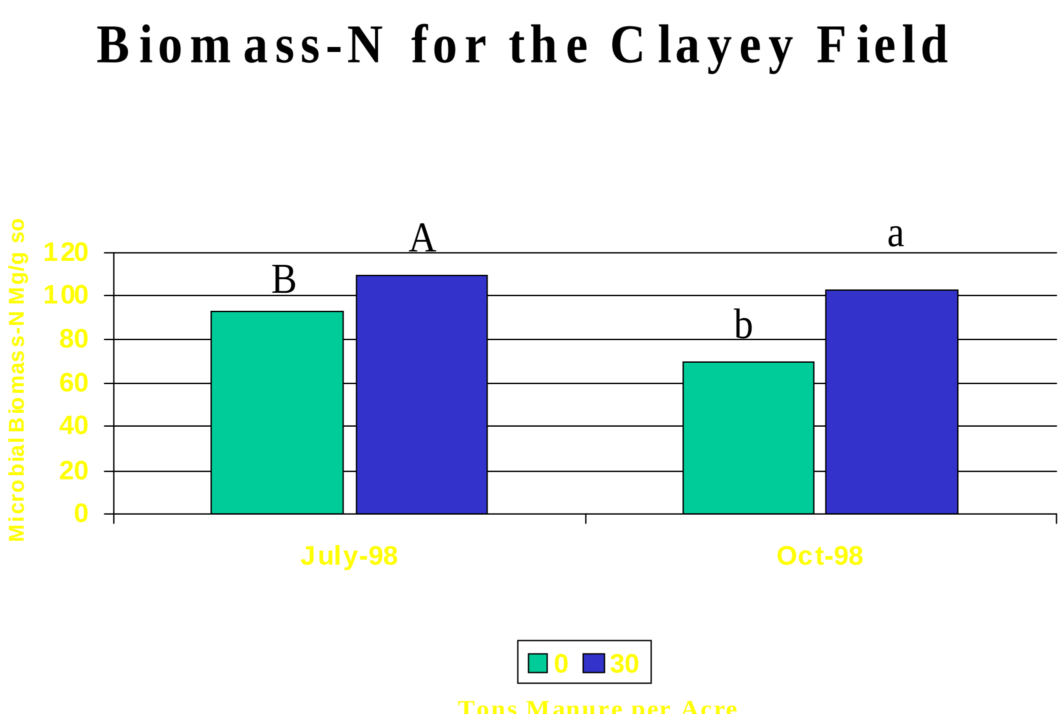
Microbial Biomass

The substrate-induced respiration method was used to estimate active biomass carbon, the fumigation-incubation method was used to measure total biomass carbon, and the fumigation-extraction method was used to measure microbial biomass nitrogen. Both sites (two replicates) were sampled in the fall of 1997. In 1998, both sites were sampled twice (in June and September). Each sample consisted of ten soil composites taken to a depth of 15 cm.

Both active and total biomass carbon tended to be greater in the clayey sites than in the sandy sites. However, manure application increased microbial biomass nitrogen in both the sandy and clayey soils in 1998. Manure also increased total biomass carbon in the sandy soil in 1997. Sidedressed nitrogen fertilizer also influenced microbial activity. Sidedressing significantly increased the biomass nitrogen in all three fields. Therefore, both manure and nitrogen fertilizer stimulated microbes and increased microbial biomass nitrogen. The nitrogen contained in microbial biomass is not available for plant use until the cells die and the organic nitrogen in the biomass is mineralized to form ammonium-nitrogen.

Earthworms

Soil samples were collected for earthworm counts from each site in fall 1997 and in both June and September of 1998. Earthworms (adults and cocoons) were counted and identified to the species level. Preliminary results indicate that earthworm counts are too low to analyze statistically. Factors such as tillage, rootworm pesticide applications, or salts may have a strong dampening effect on earthworm populations at these sites.



Greg Smith, Kenneth Doxtader, and Jessica Davis, Graduate Student, Professor, and Extension Soil Specialist, Soil and Crop Sciences

Producers Make Manure Management Decisions

Producers value manure at $3.85 per ton due to its positive impact on soil properties.

We conducted a mailed questionnaire survey of crop producers in Weld County, inquiring as to their views about and uses of manure. During November and December 1998, questionnaires were mailed to all persons (approximately 1000) identified as owners of cropland in the feedlot-intensive area of Weld County, near Greeley. About 270 persons responded to the survey, which solicited several kinds of information, including: 1) General descriptive questions about the operator's farm/ranch; 2) Two parallel series of questions about a) a typical field (if any) to which the operator had applied manure during the past season , and b) a typical field to which the operator had not applied manure; 3) Questions concerning the economic value, positive or negative, that the operator placed on manure as a soil amendment; and 4) A series of questions concerning perceptions of the benefits and problems associated with applying manure to crops.

Respondents to the survey represented producers typical of Weld County. Average total acreage of operation was about 500 acres, with most oriented in one way or another to animal production. For the majority of producers, corn (shell or silage) constituted the largest single crop, typically followed by other feed crops, such as alfalfa or hay. Forty-three percent of all operators were engaged in some kind of animal production, with cattle being the most common species.

About half (53%) of persons surveyed reported having applied manure to at least one of their fields during the past year, with nearly half of those (44%) saying that they obtained most of what they used from their own livestock. On fields to which manure was applied, average usage was 19 tons per acre. On those fields operators saw as suitable for manure application, 66% of those who had their own source of manure said they applied manure at least every other year. Among operators who relied on off-farm manure sources, 55% of those who applied manure this year indicated that their typical practice involved application of manure at least every other year.

Perceived Value

Over 80% of producers saw manure as having positive economic value. On average, these people indicated that manure was worth $4.80 per ton to them. Those who indicated that manure had negative value to them said, on average, that they would have to be paid $2.50 per ton to accept manure spread on their fields. Averaging negative and positive values across all producers, the average per ton value of manure was (+) $3.85.

Producers were asked to respond to a series of questions concerning the importance of potential benefits of manure use, such as "Inexpensive Fertilizer" and potential problems, such as "Salt Damage to Plants." Responses to these questions suggest that most producers view manure positively. On a scale of 5 (Important) to 1 (Not Important),

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Decisions

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the average score for Benefits was 3.9, as opposed to only 2.7 for the Problems. Even the least important Benefit "Prevents Wind Erosion" ranked nearly as high as the most important Problem. Benefits seen as most important included "Improves Soil Properties" and "Source of Organic Matter," while the most important Problem was "Causes More Weeds," followed by "Soil Compaction." These attitudes toward manure use did show up in producers actual behavior, with high scores on importance of Benefits and low scores on importance of Problems being associated with substantially increased chances of having used manure on at least one field last year.

While it seems natural to suspect that producer's perceptions of the economic and agronomic value of manure might affect propensity to use it, we also investigated how field-specific factors influenced whether a particular field was chosen for manure application. Neither the kind of crop grown, nor whether a field was leased or owned, nor the current status of weed problems in a field, nor the past yield history of a field affected the chances of it being manured. Distance of a field from a manure source, and size of the field had the most effect on the manure-use decision, with greater distance and larger field size showing strong negative associations with a field having been manured.

Mike Lacy, Erich Stroheim, and Dana Hoag, Associate Professor and Graduate Student, Sociology and Professor, Agriculture and Resource Economics

web sites

Glossary of Soil Science Terms
http://www.soils.org/sssagloss/index.html
The home page of the Internet Glossary of Soil Science Terms.

National Society of Consulting Soil Scientists (NSCSS) Soil Links
http://www.nscss.org/soil.html
... an immense, well-organized, and nearly 100 percent comprehensive listing of every topic even remotely of interest to soil scientists. (Websurfer's Bi-weekly Earth Science Review, February 1997).

Sciences of Soils
http://hintze-online.com/sos/soils-online.html
The Soils Online page was created to guide soil scientists through the daily expanding information in the Internet.

Soil Solutions
http://members.iquest.net/~jdwolt/
Understanding soils as an environmental component. Serving the community of soil science practitioners.

UF/IFAS AgriGator
http://WWW.IFAS.UFL.EDU/WWW/AGATOR_HOME.HTM
AgriGator is sponsored by the University of Florida's Institute of Food and Agricultural Sciences. It is one of the leading sites providing information and links to a wide variety of agricultural topics.

USDA Current Research Information System (CRIS)
http://cristel.nal.usda.gov:8080/
CRIS is the U.S. Department of Agriculture's (USDA) documentation and reporting system for ongoing and recently completed research projects in agriculture, food and nutrition, and forestry.

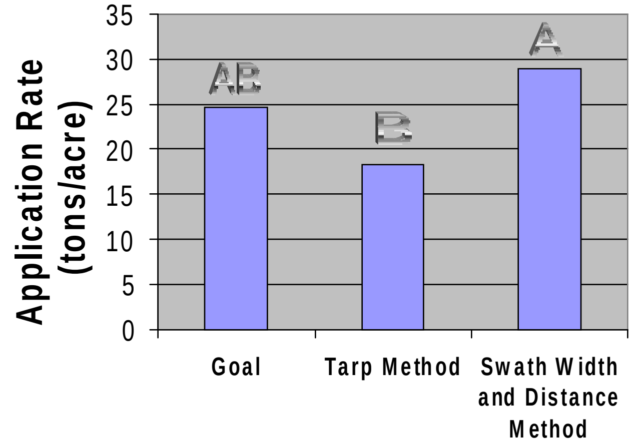
Yahoo's Soil Science Sites
http://dir.yahoo.com/Science/Agriculture/Agronomy/soil_Science/
A search engine for specific information on soil science, soil sampling and analysis, and others.

Manure Haulers Achieve Application Rate Goals

But 70% of manure haulers had poor spreader uniformity.

CSU's nutrient management calculations result in a very precise recommended manure application rate. However, due to the variable nature of manure and the variability of application by solid manure spreaders, farmers usually can not apply manure as precisely as we can calculate a rate. The variability in manure spreading is due in part to equipment problems such as failure of beater bars to break up clods, variable rates of feed aprons, and sluffing of manure from the spreader sides during application. Very few manure haulers calibrate their manure spreaders; most feel that they can estimate the application rate based on experience and can adjust the spreader according to the wetness of the manure.

We worked with ten manure haulers to test spreader uniformity and calibration techniques. Two calibration methods were evaluated. The Tarp Method in which the spreader operator drives over three tarps, the manure on the tarps is weighed, and an application rate is calculated by dividing by the area of the tarps. The Swath Width and Distance Method requires truck scales so that the manure spreader can be weighed full and empty. The manure is spread, and the swath width and distance traveled is measured; then the rate can be calculated by dividing the weight by the area.



The Swath Width and Distance Method resulted in significantly higher measured application rates than the Tarp Method. The variability across tarps averaged 30%; this amount of variability is innate to manure spreading. However, the application rate goals, stated by the manure haulers before spreading, were not significantly different from either spreader calibration method. Manure haulers applying manure for other producers are paid to apply a defined application rate, and most are achieving their application rate goals. We did not evaluate manure application rates spread by farmers on their own land.

Seven out of ten manure spreaders had spread patterns which were off-center. Some of the trucks did not seem to be loaded evenly, but trucks were loaded according to common procedure; therefore, the unevenness of the spreading could be partially attributed to asymmetrical loading and partially attributed to the need for adjustment and improvement of manure spreaders. Swath widths ranged from 7 ½ ft to 16 ft. Therefore, the haulers must adjust their overlap patterns depending on the swath width, in order to achieve a more uniform spread.

Both the Tarp Method and the Swath Width and Distance Method depend on the use of small tarps with 30% variability. A third method does not depend on small tarps, and can be used for field-scale determinations. The Loads per Field Method requires the hauler to know the acreage of the field and then to count the number of loads applied to a field. Based on the average weight of a load, the rate can be determined. Unfortunately, this method calculates application rate after the application is complete, when it's too late to change the rate on that field.

Jessica G. Davis and Ronald B. Meyer, Extension Soil Specialist and Former Graduate Student, Soil and Crop Sciences

CSU And NRCS Host Do-it-yourself Manure Management Workshops

Fifty-three producers and 69,410 cattle served.

We held a series of seven workshops throughout Colorado during the winter of 1998-1999. The purpose of the workshops was to provide beef and dairy producers with the information and tools necessary to develop Comprehensive Nutrient Management Plans (CNMPs). The new EPA/USDA Joint Strategy outlines an expectation that all animal feeding operations (regardless of size) will have CNMPs by 2008. Large livestock producers often hire crop consultants or engineers to develop CNMPs, but the smaller producers can not afford this luxury. Therefore, we aimed these workshops at the smaller producers (<1000 head) and called them, "Do-it-Yourself Manure Management Workshops."

Size of Livestock Operations in Attendance	
Number of Head	Percent of Participating Operations
1-100	16
101-500	29
501-999	24
1000-2000	18
2001-5000	6
5001-10,000	6
>10,000	2

The "Do-it-Yourself Manure Management Workshops" were a joint effort between Colorado State University Cooperative Extension and the local Natural Resources Conservation Service. Part of our goal was to illustrate for producers what resources are available in their own counties for support in CNMP development. We provided empty notebooks with dividers in them for each essential part of a CNMP, so that producers could fill their own plans in as they worked through the day and continue the CNMP development in the months thereafter.

We developed worksheets for producers to fill out for their own operations which they could then insert into the appropriate sections. It was our goal to make this process as simple as possible. The local NRCS offices were especially helpful in providing access to soil surveys and soil map information. Our intention was that producers would work on developing CNMPs specific to their operations during the workshops and would leave knowing what else they needed to do to complete their CNMP.

Impact

There were fifty-three livestock operations feeding 69,410 head represented at the workshops. In addition, seventeen field staff for NRCS and ten extension agents

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Workshops

(Continued from page 12)

Planned Changes By Participants Based on the Workshop (What Changes Will You Make Based on This Workshop?)	
Change In Manure Management	Percent of Participating Operations
Better Record Keeping	33
Manure Utilization at Agronomic Rates	18
Awareness	12
Runoff Collection and Storage	10
Analysis of Soil and Manure Samples	10
Manure Management	4
No Change Needed	4

were also in attendance. Our goal was to help small producers (animal feeding operations with less than 1000 head), and 69% of the producers in attendance did fit this category (see table this page). Although there were substantial numbers of larger cattlefeeders and dairymen, most of them had between 1000 and 2000 head. One hog producer attended.

Seventy-two percent of the participants felt that the workshop impacted their operation and that they are now able to complete their CNMP. Two participants said they knew what to do but they didn't have time, and two participants had specific questions they needed answered before they could complete their CNMPs. When asked what changes they will make based on the workshops, only 4% said that no change was needed (see table this page). The changes mentioned most often included keeping better records, applying manure at agronomic rates, doing a better job of runoff handling, and testing manure and soil samples.

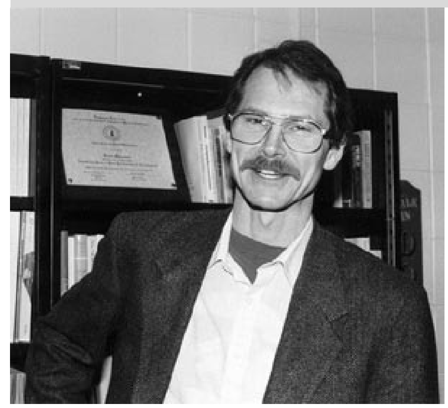
These workshops were successful in helping small beef and dairy producers develop CNMPs. We plan to continue them in winter 1999-2000.

Acknowledgments

These workshops would not have been possible without the Cooperative Extension and Natural Resources Conservation Service field staff who lined up the facilities, delivered the audience, and helped with the soil surveys. We specifically want to thank Jerry Alldredge, Robbie Baird-LeValley, Bruce Bosley, Randy Buhler, Gary Campfield, David Colburn, Wayne Cooley, Marlin Eisenach, Jan Fritch, Brad Gillmore, Cindy Gillmore, Dawn Jackson, Keith Maxey, Ron Meyer, Frank Riggle, C.W. Scott, and Charles Starkovich. These workshops were funded by the USDA Sustainable Agriculture Research and Education Program, and lunch was covered by local livestock associations.

Jessica Davis, Holly Horner, and Kirk Iversen,
Extension Soil Specialist, Soil and Crop Sciences;
Area Agronomist, Natural Resources Conservation Service (Greeley); Former Research Associate, Soil and Crop Sciences

meet. . .



Mike Lacy

is an associate professor in the sociology department, and is one of several faculty there who do research on environmental and economic issues. He is a native Kansan who reports that his first paid job as a teenager involved hoeing experimental plots for the Kansas State University agronomy department. Now thirty years later, he has come full circle to work with agronomists again as part of the SARE project, on which he is examining manure use by crop producers in Weld County. Besides that work, he also specializes in methods for analyzing quantitative social science data.

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