

CCA ADVANTAGE

*The Voice of the Certified Crop Adviser Program
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Putting Technical Service Providers to Work

Remarks by Bruce I. Knight, Chief, NRCS, at the Certified Crop Advisers Summit, Ottawa, Ontario

I know that the Certified Crop Advisers (CCAs) have concerns about the Technical Service Provider (TSP) process, and I want to address those concerns this afternoon and answer any questions. But first, I want to assure you all that USDA, NRCS and I are all committed to making TSPs work to the benefit of producers and providers alike.

Service Providers and the Farm Bill

The TSP system is one of the key provisions of the Conservation Title of the 2002 Farm Bill. I have said many times that the farm bill is simply too big for NRCS and its traditional partners to implement without help.

As you know, the farm bill provided an additional \$17.1 billion for conservation over a 10-year period. There is no way the NRCS workforce and the conservation district employees could put that investment to work on the ground without the help of service providers like the CCAs.

The administration is investing more in conservation every year – a proposed \$3.8 billion this fiscal year! And with this growing investment, we have a growing need for the help of TSPs.

The CCAs have been involved in creating the TSP process from the begin-

ning. You have provided valuable input at every stage of the process, and we have listened closely to your advice and incorporated it into the TSP process wherever possible.

Implementation

As with any complex new system, the TSP process is the result of many suggestions from different points of view. We started by asking producers what kind of provider system they wanted. We continued, asking provider groups what they needed out of the system, and we worked closely with the groups who have, over the years, been providing technical assistance through Cooperative Agreements and Memorandums of Understanding.

With the help of all these stakeholders, we were able to get the interim final rule for the TSP assistance out before Thanksgiving of last year.

In March we issued an amendment to the rule to set up the process for determining rates. With that amendment in place, we began a survey of potential providers to find out what they would charge to provide the services needed for each conservation practice. As you know, that process, and our subsequent work to come up with the not-to-exceed rates, took us well into the summer.

We have signed Memorandums of Understanding with eight major certifi-



Bruce I. Knight
Chief, NRCS

ing organizations, recognizing their certification programs. We also got the TechReg site up and running on the Internet and used it to register 1,324 providers, of which half are CCA-certified. Right now, there are more than an additional 1,000 registrations pending. Illinois is an example to all the states, with almost 200 certified TSPs — 90 percent of them local!

Some provisions of the interim final rule for TSPs had inadvertently hindered our past working relationships. So, in July, we issued an amendment to make it easier for us to work with state, local or tribal governments who provide technical services under Cooperative Agreements and Memorandums of

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Understanding. Surprisingly, since then, there has been quite a bit of interest in the private sector for entering into these same kinds of agreements.

Arriving at the not-to-exceed rates was not an easy task, but by August we had the initial rates in place. I know there are still concerns about the rates, and that is one of the issues I want to address today.

Where We Are Today

Let me summarize where we are today: We are working on the final rule for TSP assistance. We have a system in place to certify providers and for landowners and operators to select providers. We have more than 1,300 certified providers ready to go. We have not-to-exceed rates in place for the services. And we obligated more than \$23 million for technical services in fiscal year 2003. That means we exceeded the \$20 million earmark. The number of certified providers and the number of dollars obligated are going up every day.

These are pretty amazing accomplishments. But we did not do the one thing that matters most to you as providers and to producers: We did not get the system in place soon enough to allow very many landowners with conservation program contracts to start selecting and employing contractors during the 2003 fiscal year.

I want to be clear that there actually were a number of landowners around the country whose contracts included line items for TSPs. And more contracts can be modified to include work by TSPs.

Many NRCS offices also used local contracting authority to procure the services of service providers from the private sector. So there was money that went directly to private sector providers.

We are still reviewing the data from the states, to make sure we are consistent and accurate in attributing obligations to the private sector, governments, universities and other service providers.

Preliminary data indicate that about \$8.7 million was obligated to private vendors, \$7 million to state agencies, \$5.9 million to conservation districts, \$777,000 to private organizations, \$268,000 to county governments, and \$478,000 to others.

Most of the 2003 expenditure for TSPs went out through state, local and tribal governmental entities under Cooperative Agreements and Memorandums of Understanding. In fact, figures from early September show a majority of obligations for technical services went to conservation districts and 17 percent went to state agencies — far more than we anticipated. Most of the money going to states is for wildlife habitat projects.

I know service providers, including CCAs, feel like they missed many opportunities because it took so long to set the not-to-exceed rates. All I can say is that setting these rates was a complex process and took time. The private sector price survey indicated that the NRCS cost would be the rate in most cases. Then we had to look at how our state offices determined their rates and make sure all of the costs were reflected in the rates of each state.

Putting TSPs to Work

We now have many certified providers in place, and we have started to put them to work.

Our Wyoming office awarded two contracts for engineering services, for more than \$400,000. New York entered into more than \$200,000 in contracts with private-sector firms. Nebraska awarded \$700,000 to engineering firms for livestock waste system design and \$300,000 for watershed rehabilitation design. Kansas has contracted out its entire WHIP portfolio. And these are just examples.

Allocating 2004 Funds

The most important thing we have to do is get some 2004 money out there to pay for the work. But as you know, the federal government is operating under a continuing resolution. Under that resolution, we will not be signing any new

contracts. We will be servicing existing contracts and getting ready for the '04 season.

Even after Congress appropriates the money, it will take some time to allocate it to the states.

Adjusting NTE Rates

Another important task this fall will be to look at the not-to-exceed (NTE) rates and see how they need to be changed. I know many providers, including some CCAs, object to several aspects of the rate structure.

We will be looking at these concerns and others over the next few weeks, and we will adjust the rates as appropriate.

I am sure we will make a number of adjustments. But these changes may not answer every complaint. The rates should not be set so low as to discourage all participation by viable TSPs, nor should they be set so high as to result in wasteful federal expenditures. After all, the true test of the rates is not that TSPs are happy with them, but whether providers will bid on and perform the work. And keep in mind that state conservationists already can make exceptions to the rates if practices or plans are more complex than usual, to account for unique environmental conditions or when there are not enough data to establish a rate.

Conclusion

We will continue working with service providers and provider organizations to improve the rate determination process. And we have contracted with economists from Clemson University to conduct a review of the rate methodology. In addition, we need to finish the certification process for the 1,000 providers who have applications pending. And we need to recruit more applicants to be sure all geographic areas, and all practices, are covered.

I am confident that by working together we can come up with a rate structure that results in reasonable prices for the landowner and the taxpayer and a reasonable return for the service provider.



Certified Crop Advisers Add Value to Canadian Agriculture

By Dr. Tom Bruulsema, from his opening speech at the CCA Summit, Ottawa, Ontario

I have the privilege this year of serving as chair of the International Board for the CCA program, a certification program of the American Society of Agronomy. I also serve as director in Eastern Canada and the Northeast United States for the Potash & Phosphate Institute of Canada (PPIC).

Canadian agriculture is moving to a higher level of accountability. It's what consumers are demanding, particularly in food safety, but also in documenting responsible production in terms of environmental conservation and protection. Regulation of nutrient management demands that new skills be applied. The standard of knowledge, the code of ethics and the commitment to continuing education are the key professional elements that the CCA brings forward to enhance accountability.

Of the five elements of the Agricultural Policy Framework (APF), environment is usually the first thought when it comes to involving CCAs. The CCAs are already delivering assistance to farmers in completing environmental farm plans and nutrient management plans. They have skills that lend themselves to being involved in the Stewardship Incentives and Greencover programs.

The other four elements of the APF — Food Safety and Quality, Business Risk Management, Renewal and Science & Innovation — have goals that would benefit from professional involvement as well.

A traceable, branded approach to Food Safety and Food Quality will require the involvement of many specialized professionals: to improve safety and quality of food, the process begins with the crop in the field. CCAs provide farm-

ers with advice on application of pesticides to avoid residues on food. They also advise on effective control of insects and diseases that reduce food quality.

In Business Risk Management, there's an obvious need for accountable professionals in areas like crop insurance. The advice they provide reduces the risk of crop failure due to weather, pests and improper application of crop inputs. Maximizing return for every dollar of input cost also increases economic stability on farms.

In the Renewal element, the "Capturing Opportunities" component aims to improve the profitability of producers "by making them aware of advances in science and technology and helping them understand how they can apply these innovations to their farm" — precisely what the CCA does for the crop production enterprise.

In Science and Innovation, we don't expect CCAs to *be* scientists, but they *apply* science. Their knowledge should be tapped when it comes to setting goals and priorities for science and innovation.

We see multiple roles for certified professionals in the APF, and we invite dialog on how they can contribute.

The CCA program is governed at two levels: local and international. Local boards cover a state, province or region. In Canada there are three local boards: the Prairie Provinces, Ontario and Atlantic Canada.

As an example, the Ontario Board was formed in 1995. It included members from agribusiness, educational institutions and government:

- The Fertilizer Institute of Ontario (now Ontario Agri Business Association)
- Canadian Fertilizer Institute

- Retail Dealer (Kent County Fertilizers)
- AgCARE
- CropLife
- Agriculture & Agri-Food Canada
- University of Guelph
- Ontario Ministry of Agriculture and Food
- Ontario Ministry of Environment
- PPIC
- Ducks Unlimited
- Ontario Institute of Agrologists

The active involvement of people from these disparate backgrounds ensured that the program would meet the wide array of demands being placed on agriculture by society at large. We also found — and continue to find — a tremendous benefit in working together. The credibility of this program is based on both this local expert input and the linkage to the largest agronomic science society in the world. The standards are identical on either side of the Canada-U.S. border.

Becoming a CCA involves a strong commitment. First, there is a requirement for experience. Second, there are two exams to pass. Third, a candidate who has successfully passed both exams submits references and signs a code of ethics. And fourth, there is a requirement for continuing education.

In summary, the CCA program boosts professionalism. It sends a strong message to consumers, policy-makers and critics that those working in agribusiness have the knowledge and skills, and thus can provide the proper advice, products and services that help farmers produce a safe and abundant supply of food, fiber and energy.

Continuing Education Self-Study Course

Nutrient Management



Particulate and Dissolved Phosphorus Chemical Separation and Phosphorus Release from Treated Dairy Manure

By Thanh H. Dao and Tommy C. Daniel

Earn one CEU!

All CCAs may earn up to 20 Continuing Education Units (CEUs) per two-year cycle as board-approved self-study articles which will include CCA Advantage articles. The CCA CEU logo (above) marks all pre-approved material, with the CEU value indicated by the number in the middle. To receive one CEU in nutrient management, read this article, fill out the attached exam and mail the tear-out form, along with \$10, to the American Society of Agronomy.

There is increasing interest in post-excretion treatments to chemically bind or remove dissolved reactive phosphorus (DRP) in manure before it is applied to fields, as many soils in the U.S. contain excessive levels of nutrients (especially P) due to repeated heavy applications of animal manure. A promising technology to sequester manure P and other organic nutrients is the separation of liquid manure into particulate and liquid fractions. However, the inefficiency of mechanical liquid–solid separators used in dairy or swine production has led to the rapid loss of capacity in waste storage facilities.

Particulates fill up retention ponds or lagoons rapidly, requiring frequent maintenance and cleaning. Typical mechanical separation efficiencies have ranged from 5 to 30 percent of particulate removal. Improving the solid–liquid phase separation process by chemical coagulants used in the drinking water treatment industry

may help to remove organic and mineral matter and nutrients from the suspension and dispose of a relatively small volume of solids.

The solid–liquid separation process is a complex function of component processes of coagulation, flocculation, flotation, sedimentation or filtration. Coagulation or aggregation increases the tendency of dispersed particulates in a wastewater suspension to interact and attach to one another, forming larger aggregates. The process is also used to remove certain dissolved components of the suspension that attach or sorb onto solid surfaces and settle out of solution as insoluble precipitates.

For efficient aggregation to occur, the stability of a wastewater suspension must be first disturbed to increase the tendency of suspended particles to attach to one another. Particle destabilization mechanisms include surface charge neutralization, interparticle bridging and particle diffuse-layer compression. Double-layer compression is an important mechanism to effect aggregation of colloidal suspension in wastewater and natural systems. Increasing the quantity of an electrolyte in the suspension increases the counterion concentration in the diffuse layer, which in effect reduces the thickness of the particle double layer.

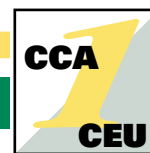
Surface charge neutralization involves a net reduction in the surface charge of the particles in the suspension, which also reduces the thickness of the diffuse layers of suspended particles. Interparticle bridging by a long-chained organic polymer would adsorb one or more particles and cross-link the particles together. High molecular weight organic

polymers have been used to treat and clarify municipal wastewater to remove suspended solids and promote sedimentation of aggregated particles. Long-chained, water-soluble polyacrylamides (PAM) and polyamines destabilize suspended charged particles by adsorbing onto them and building bridges between suspended particles. This results in larger aggregates that float or settle out of the liquid phase.

PAM have been shown effective in reducing suspended particulates in flushed swine and dairy manure. A study in 1999 used PAM to reduce total suspended solids (TSS) in a swine manure suspension containing 18 g L⁻¹ of solids. The cationic polymers reduced solution phase TSS by 33 percent, chemical oxygen demand (COD) by 38 percent and organic N by 80 percent.

Metal salts have been used alone as manure flocculation aids. A study in 1997 reported that FeCl₃ was more effective than CaO, CaSO₄, or CaCO₃ in increasing particulate sedimentation in dairy manure suspensions containing 5 to 15 g TSS L⁻¹. Using 0.3 g L⁻¹ of FeCl₃ in combination with CaO resulted in a 94 percent increase in sedimentation, 56 percent manure N removal and 92 percent manure P removal from suspensions.

Co-blending animal manure and P-immobilizing mineral by-products reduced DRP concentrations but has raised concerns about the availability of P when the amended manure solids are reused in agronomic production. Given the complexity of P reactions, information is needed on the efficacy of the alternate metal sources and by-products in



particulate and nutrient removal and manure DRP immobilization in particular from concentrated manure suspensions.

The objectives for this study were to (1) develop improved understanding of key manure characteristics that control particulate aggregation and reduction in DRP from the solution phase of concentrated dairy manure (30 and 100 g L⁻¹), and (2) determine whether organic water treatment polymers and mineral P immobilization chemicals alter N and P release from the treated manure solids and amended soil.

Phosphorus extractability as affected by polymer and mineral amendments was determined in Christiana silt loam amended with untreated and treated dewatered solids in 100 g L⁻¹ manure suspensions (TSS100). Differences in treatment main effects and interactions were detected following analysis of variance and the Duncan multiple range test at the 0.05 level of probability using the Statistical Analysis System.

Results and Discussion

Individual polymer and mineral amendment effect. Individually, the cationic organic polymers increased particulate aggregation in both 30 g L⁻¹ TSS30 and TSS100 manure suspensions. Manure particulates formed an aggregated layer that floated to the surface of the manure suspension. To a large extent, the TSS concentration of the manure suspension controlled the amount of polymer required to initiate visible particulate aggregation and clarification of the equilibrium solution.

The hydrated aggregated fraction increased with increasing rates of polymer addition, corresponding to the decrease in equilibrium solution phase TSS. The congealed or thickened aggregates entrapped large amounts of wastewater. About 2 to 19 percent and 12 to 30 percent of the suspension, by weight, were entrapped in the aggregated fraction in TSS30 and TSS100 manure suspensions, respectively. The aggregation, absorption and ensuing increase in physical size produced large flocs, potentially facilitating the screening and particle filtration phases of the solid-liquid separation process. Polymers were more efficient in the TSS100 suspension, attaining

a 2- to 3-fold increase in aggregated fractions. Reduced interparticle distances facilitated particle bridging by the long-chain polymers and manure particulate sorption and enmeshment onto the large organic flocs.

Mineral amendments also reduced the solution phase TSS as the result of increased aggregation and sorption onto amorphous hydroxide species such as Al(OH)₃ and Fe(OH)₃ or onto porous spheroid fly ash particles. Increased TSS of the manure suspension also required less mineral amendment to initiate TSS reduction in the equilibrium-solution phase.

The insoluble coal-combustion by-product exhibited some particle destabilization capacity at rates ≥ 50 g L⁻¹ and appeared to act as an in situ screen. Fibrous manure particulates aggregated and were dragged down by the settling of denser ash particles, resulting in the reduction in solution-phase TSS by co-sedimentation of fly ash and manure particulates.

Combinations of flocculant polymers and mineral amendments.

The effects of manure suspension TSS on particulate aggregation remained evident in polymer and mineral amendment combinations. At marginally effective polymer rates between 0.01 and 0.25 g L⁻¹, maximal aggregation was attained in combination with 1 and 10 g L⁻¹ of aluminum sulfate (3 and 30 mmol Al³⁺ L⁻¹), iron chloride (3.7 and 37 mmol Fe³⁺ L⁻¹) in 30 g L⁻¹ (TSS30) and 100 g L⁻¹ TSS (TSS100) suspensions, respectively. Co-application exceeded the level of aggregation achieved with individual manure amendments and resulted in 80 and 90% reduction in metal salt and polymer rates, respectively. Fly ash induced particulate destabilization at rates ≥ 50 g L⁻¹.

However, the suspensions can re-stabilize as aggregates disintegrated at amendment rate of 100 g L⁻¹ of metal salts. At high metal salt concentrations, Al(H₂O)₆³⁺ or Fe(H₂O)₆³⁺ aquo-metals ions surrounded and complexed individual manure organic particles, resulting in less interparticle bridging. The increased electrical conductivity suggested a more positively charged solution and a surface charge reversion.

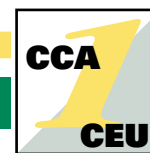
Liquid phase nutrient removal. The combinations of polymers and mineral

amendment in TSS30 suspensions did not affect ammonium N concentrations of the equilibrium solution, except possibly for Fe salt added at rates of 100 g L⁻¹. In TSS100 suspensions, Al and Fe salts appeared to lower the equilibrium solution N concentrations and no plausible explanation was found except for the potential formation of insoluble precipitate involving NH₄-N similar to struvite, a magnesium-ammonium phosphate.

The suspension TSS, polymers and mineral amendments had a marked effect on manure DRP. Although fly ash did not reduce suspension TSS until addition rates equaled or exceeded 50 g L⁻¹, fly ash consistently reduced solution-phase DRP at all rates by 52 and 71 percent in TSS30 and TSS100 suspensions, respectively. Soluble P was removed from the liquid phase when the fly ash was used alone or in combination with the organic polymers. Sorption isotherms for PO₄-P showed that fly ash sorption capacity and retention mechanisms included chemisorption and surface complexation. In this study, the results suggested that surface hydroxyl or silanol functional groups of fly ash reacted with phosphate anions to reduce solution DRP and suppressed P solubility in the particulate fraction.

Aluminum and Fe salts also reduced solution-phase DRP at 1 g L⁻¹ when applied with either PAM or polyamine polymers. Freshly precipitated amorphous Al(OH)₃ or Fe(OH)₃ can react with either dissolved phosphate P or sorbed and entrapped AlPO₄ or FePO₄. The sorption and precipitation of PO₄-P was shown to be controlled by the integrated particles rather than the Al- or Fe(OH)₃ or Al- or FePO₄ individually. Solution DRP did not change at the 10 g L⁻¹ level, compared with the unamended manure suspensions, and then DRP substantially increased when Al and Fe salts were added at rates of 100 g L⁻¹. Therefore, caution should be exercised in manure treatment focused on P immobilization and to guard against a tendency toward overapplication.

In TSS100 suspensions, the higher TSS concentration required the higher metal salt rate of 10 g L⁻¹ to reduce DRP by 30 to 90 percent of the initial levels. Again, the equilibrium solution DRP increased when Al or Fe salts were added at the rate of 100 g L⁻¹ of manure suspension.



It was not surprising to observe the elevated DRP levels when considering the hydrolyzing potential of Al and Fe salts and the fact that the manure suspensions restabilized. The low pH induced by these metal salts increased soluble aquo metal ions and soluble P species, inducing the dissolution of mineral phosphates in manure, such as calcium or iron phosphates, whether formed in situ or added to the feed. Enhanced acidic hydrolysis of organic phosphate ester linkages of partially digested feedstuff containing calcium salts of phytic acid may also have contributed to the increase in inorganic phosphate equilibrium solution concentrations. Therefore, these findings suggested that an adequate amount of metal salt promoted aggregation and P immobilization, but more reversed and negated the benefits of P reduction by metal salts in the presence of organic polymers. These results also illustrated the complexity of the chemistry of Al^{3+} and Fe^{3+} in manure wastewater. In such cases, the role of particulate and dissolved organic matter in metal phosphate and polyphosphate solubility needs further investigation.

In the liquid phase of untreated dairy manure suspension, NH_4-N was the major nutrient component. Reduction or increase in equilibrium solution DRP changed the solution N to P ratio. These ratios ranged from 80 to 139 and were reflected in changes in those of the aggregated solid phase.

In the solid phase of untreated dairy manure, the N to P ratio averaged 5.8 and 2.5 in TSS30 and TSS100 suspensions, respectively. The ratio was narrower than what is needed in crop production in spite of our effort to maximize the conservation of manure nutrients. With polymers and mineral amendment treatments, the N to P ratio decreased with increasing metal salt rates of addition between 1 and 10 g L^{-1} in TSS30 because of the precipitation of insoluble P forms in the aggregated solid fraction of TSS 30 solids, particularly for the fly ash treatment. In the TSS100 manure solids, fly ash behaved exactly as in the more dilute manure suspensions, sequestering P in the aggregated fraction with increasing rates of addition. Aluminum and Fe salts could widen the ratios, however, by increasing the dissolu-

tion of particulate P and negating the effort to sequester solution DRP. Thus, it was important to keep mineral amendments within the narrow range of concentrations of 1 to 10 g L^{-1} to balance the need to conserve urine N and reduce DRP with the metal salts in liquid manure suspensions.

Particulate phosphorus extractability.

In manure particulates isolated from TSS100 suspensions treated with the mineral amendments alone, the release of DRP was reduced by all manure amendments at the 1 g L^{-1} rate. The synergism of the organic and mineral amendment combination on reducing P solubility was also evident as polymers further increased the reduction of DRP by fly ash and Fe salts and Al sulfate was more effective only in combination with the polyamine polymer.

One explanation for the synergistic behavior was that amorphous metal hydroxides sorbed DRP and metal phosphate precipitates were themselves enmeshed in the long-chain polymers. In addition, the high acidity of suspensions containing hydrolyzing metal salts can protonate the amino groups of the polyacrylamide and polyamine polymers to yield additional sites for sorption of phosphate anions. Thus, from an environmental perspective, the potential release of DRP to runoff from a surface application of manure particulates was minimized. The acidic-fluoride Mehlich 3-extractable P was increased between 9 and 39 percent, compared with untreated manure solids or polymer-treated manure. The results suggested that organic P forms that may have bound and were concentrated in the polymer matrix were susceptible to dissolution under acidic conditions. In soil, the amendment-manure mixtures appeared to have maintained their stability. The DRP was reduced by 63 to 96 percent in soil amended with manure treated with mineral amendments alone, and 40 to 76 percent in soil amended with manure treated with a mixture of polymer-mineral amendments. The organic polymers increased the Mehlich 3-extractable P in soil treated with polymer and metal salt combinations. Acidic extracting solutions removed significant amounts of sorbed P upon dissolution of amorphous Al and Fe hydroxides in treated soil and manure. Thus, the greater extractability of P would have to

be considered in calculations of land loading rates of treated manure. Fly ash-treated manure solids remained stable and sequestered DRP and did not affect Mehlich 3-extractable P at the 1 g L^{-1} rate of manure suspension to fly ash.

Summary and Conclusions

In confined animal feeding operations, liquid manure presents special challenges in handling, storage and manure nutrient beneficial reuse because of the large volume of diluted wastes. Organic polymers and mineral P immobilizing chemicals increased manure particulate aggregation to concentrate the solid fraction. As chemical amendments and methods of applications largely depended upon manure characteristics (particle size, TSS content, pH), concentrations of polymers or mineral amendments must be optimized to benefit from any interaction or synergism that exist in their separate mechanisms of action.

Suspension TSS had a clear effect on aggregation and rates of polymer and amendment. A synergistic aggregating reaction occurred at low concentrations of $Al_2(SO_4)_3$ and $FeCl_3$ with cationic polyacrylamide and polyamine polymers. Co-applications of polymers and mineral amendments also reduced excessive amounts of DRP in manure-amended soils to reduce offsite transport risks. Reductions in DRP were achieved consistently at all rates of fly ash and hydrolyzing metal salts at rates $\leq 10\text{ g L}^{-1}$ in the presence of organic water treatment polymers. The polymer-amendment treated particulates remained stable in soil. Release of DRP from the soil amended with treated manure was reduced. Therefore, the synergistic effect that exists between chemical aggregation aids should be optimized to achieve chemical input reduction and maximize manure particulates and P removal from liquid manure suspensions containing high TSS.

Editor's note: Content was adapted from the paper "Particulate and Dissolved Phosphorus Chemical Separation and Phosphorus Release from Treated Dairy Manure," which was published in the Journal Environ. Qual., 2002 31 and is courtesy of the authors Thanh H. Dao and Tommy C. Daniel.



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DIRECTIONS

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2. Answer the questions by clearly marking an "X" in the box next to the best answer for each question.
3. Complete the self-study exam registration form on the back of this page.
4. Clip out this self-study examination page, fold and place in envelope.
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Particulate and Dissolved Chemical Separation and Phosphorus Release from Treated Dairy Manure December Self-Study Examination

11. Typical mechanical separation efficiencies have ranged from:

- a. 5 to 30 percent of particulate removal.
- b. 10 to 35 percent of particulate removal.
- c. 15 to 40 percent of particulate removal.
- d. 20 to 45 percent of particulate removal.

2. The solid-liquid separation process is a function of:

- a. building larger wastewater lagoons.
- b. siphoning the liquid from the solid.
- c. time, allowing the sediment to settle.
- d. coagulation, flocculation, flotation, sedimentation or filtration.

3. Polyacrylamides and polyamines polymers build bridges between particles, thereby:

- a. preventing aggregation.
- b. making it more difficult to remove particulates.
- c. creating larger aggregates that either float or settle out of the liquid phase.
- d. increasing suspended particulates.

4. Co-blending of polymers and P-immobilizing mineral amendments results in:

- a. increased aggregation and reduced rates of individual additives.
- b. increased rates of polymers or P-immobilizing mineral amendments needed.
- c. increased suspended particulates.
- d. decreased manure particle aggregation.

5. It was found that suspensions can re-stabilize as aggregates disintegrate at a metal salt amendment rate of:

- a. 1 g L⁻¹.
- b. 10 g L⁻¹.
- c. 30 g L⁻¹.
- d. 100 g L⁻¹.

6. High rates of additions of hydrolyzing metal salts exceeding 10 g L⁻¹ can result in:

- a. destabilized manure suspensions.
- b. increased particle aggregation and reduction in rates of manure additives.
- c. increased manure particle aggregation.
- d. lower suspension pH that induces charge reversal and dispersion of manure particles.

7. Fly ash increases liquid-solid separation by:

- a. forming amorphous hydroxides gels that entrapped particulates.
- b. de-stabilizing the manure suspension.
- c. coalescing particles and causing co-sedimentation.
- d. increasing suspended particulates.

8. Metal salts such as Al₂(SO₄)₃, AlCl₃, or FeCl₃ reduce dissolved P in the liquid phase by:

- a. destabilizing and dispersing manure suspensions.
- b. forming metal amorphous hydroxide gels that sorb and retain manure phosphorus.
- c. lowering solution pH that induces charge neutralization and reversal on manure particulates.
- d. forming aquo-metal ions that surround and complex individual manure particles.

Over

Continuing Education Self-Study Test

Nutrient Management Test (continued)

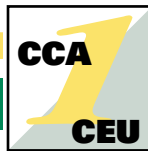


9. Fly ash reduces dissolved P from the liquid phase when

- a. fly ash particles act as in situ screen.
- b. inter-particle distances are reduced.
- c. manure and ash particles coalesce and co-settle.
- d. phosphate reacts with surface hydroxyl and silanol groups of the ash particles.

10. Release of manure P from soil that received treated manure was:

- a. reduced because DRP immobilized in treated manure remained insoluble.
- b. increased because DRP immobilized in treated manure did not remain insoluble.
- c. insignificant because DRP immobilized in treated manure remained insoluble.
- d. undetermined because DRP immobilized in treated manure remained insoluble.



SELF-STUDY EXAM REGISTRATION FORM

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CCA Certification #: _____
Credit Card #: _____ Type of Card: Visa Mastercard Discovery Am Express
Expiration Date _____ Name on Card: _____
A \$2 processing fee will be added to all credit card charges, or enclose \$10 check payable to American Society of Agronomy.
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Signature of Registrant as it appears on Code of Ethics _____
I certify that I alone completed this self-study course and recognize that an ethics violation may revoke my CCA status.
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SELF-STUDY EXAM EVALUATION FORM

Rating Scale: 1=Poor 5=Excellent

Information presented will be useful in my daily crop advising activities: 1 2 3 4 5
Information was organized and logical: 1 2 3 4 5
Graphics/tables were appropriate and enhanced my learning: 1 2 3 4 5
I was stimulated to think how to use and apply the information presented: 1 2 3 4 5
This article addressed the stated competency area and performance objective(s): 1 2 3 4 5
Briefly explain any "1" ratings: _____
Topics you would like to see addressed in future self-study materials: _____

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