Project Title: Effectiveness of short-term poultry litter storage options for protecting Kansas water quality.

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Introduction and Justification:
Southeast Kansas has experienced an influx in poultry litter being transported into the region during the last 3 to 5 years. This trend has been driven by increased environmental regulations in surrounding states and the recognition by Kansas producers that poultry litter can be a cost effective source of nutrients (N, P, K and micro-nutrients) and organic matter. Poultry integrators began establishing litter export programs in nutrient sensitive watersheds in Arkansas and Oklahoma as early as 2005. It has been reported that more than 100,000 tons of poultry litter are exported annually from the Illinois River Watershed in Arkansas and Oklahoma with most of this material going to Kansas and central Oklahoma (Herron et al., 2012).

Poultry litter can provide a significant and important supply of nutrients for crop production. Phosphorus (P) content in poultry litter is usually high (≈ 60 lbs P_2O_5/ton), and applications rates should be based on P levels to avoid building excessive soil P levels contributing to potential surface water contamination. When properly managed it provides an excellent complement to commercial nitrogen (N) fertilizers. In the last three years concern has grown in Kansas that the influx of poultry litter is contributing to water quality problems. Storage for poultry litter on the edge of fields in close proximity to ditches and waterways is a contributing factor (Figure 1). Currently, in Kansas no recommended practices, guidelines or regulations exist for the storage of poultry litter.

Figure 1. Poultry litter stored at the edge of a field with runoff flowing to the adjacent road ditch.

A critical research need exists to evaluate **poultry litter storage best management practices that effectively control runoff and minimize the transport of nutrients to the waters of Kansas.** This research need is further supported by producer requests for information on effective, low cost poultry litter storage options. Limited research is available on effective best management practices for in-field poultry litter storage since historically poultry litter has been hauled directly from the poultry house to the field or

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stored on farm in a litter stacking shed. Arkansas and Oklahoma regulation discourage the outside storage of poultry litter and require outside poultry litter piles to be covered. Covering poultry litter with plastic is highly effective at reducing volatilization of ammonia, leaching of nitrate and the loss of N and P via runoff (Payne and Zhang, 2012); however, this practice has not been adopted by Kansas producers because of the time and effort it takes to keep the plastic cover in place for periods of time beyond a few days.

Project Goals and Objectives:

The goal of the proposed project is to address the priority area **"Use of poultry litter in Kansas, including, storage and understanding agronomic use and environmental impacts."** Specifically this project addresses the effectiveness of in-field temporary containment measures and improved temporary storage demonstration sites for controlling runoff losses of N and P.

The specific project objectives are:

1. Identify effective low cost run-off containment options for short-term in-field storage of poultry litter.
2. Evaluate effectiveness of improved temporary poultry litter storage sites for the reduction of runoff.

To accomplish the research objectives containment options will be evaluated during the summer of 2015 and water samples will be collected from August of 2014 through December of 2015 from two improved temporary poultry litter storage demonstration sites.

Procedures:

A. In-field Containment Practices: A simulated in-field storage site with a 2 to 3% slope will be established for the evaluation of temporary poultry litter storage practices. Poultry litter piles containing approximately 5 ton of material or a ¼ of an average tractor trailer load of poultry litter will be used for this study and all practices will be replicated three time.

   Practices to be evaluated will include, but not be limited to:

   1. No practice (control) – No containment will be placed around the pile of poultry litter
   2. Earthen berm – An earthen berm will be constructed around the pile of poultry litter.
   3. Straw bales – Straw bales will be placed in a ring around the pile of poultry litter and staked to prevent movement.
   4. Wood chip filled erosion control socks – Commercially available erosion control socks filled with wood chips will be places around the pile of poultry litter and staked to prevent movement.
   5. Plastic pile covering – A plastic tarp will be placed over the pile of poultry litter and the edges covered with soil to keep it in place.

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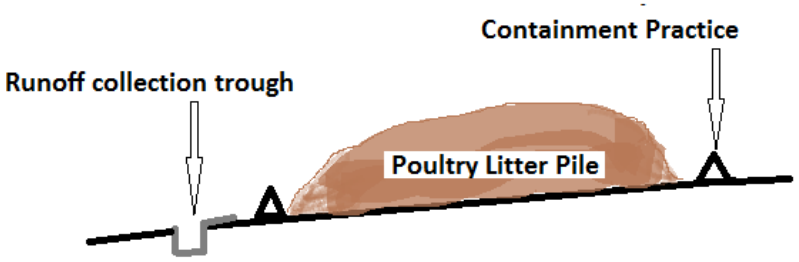
Immediately down slope of the pile a metal collection trough the width of the pile will be installed level with the soil surface and equipped with a runoff collection bucket (Figure 2).

Figure 2. A diagram showing the location of the containment practice being tested and the runoff collection trough.



Rainfall simulators will be used to simulate rainfall intensities representative of Southeast Kansas. The rainfall event will proceed until runoff occurs. Rainfall events will be repeated monthly over a 6 month period to test the longevity and robustness of materials. Runoff water will be collected to determine the volume of runoff and a composite sample will be analyzed for total and dissolved N and P.

B. Improved Poultry Litter Storage Sites: In the fall of 2013, Spring and Middle Neosho WRAPS provided cost share funding for the construction of improved temporary poultry litter storage demonstration sites. Two of these sites will be equipped to evaluate edge of field nutrient losses over the next two years. A diversionary structure will be constructed to divert runoff from natural rainfall events to a central location at each site for the collection of flow-weighted composite water samples using an automated water sampler. Water samples will be analyzed for total N, nitrate, ammonium, and total and dissolved P.

C. Technology Transfer: Poultry litter storage options will be showcased in K-State Research and Extension programs including producer field days. Furthermore, the data generated by this project will be published in an M.S. student's thesis, peer reviewed publications, research conference proceedings and used to develop new Extension presentations and print materials.

Duration of the Project:
This two year project will be conducted from June 1, 2014 to May 31, 2016.

Expected Outputs and Outcomes:
This project will provide critically needed information on simple cost effective containment options producers can use to control the runoff from poultry litter,

temporarily stored at the edge of fields. Additionally we will evaluate the effectiveness of improved temporary poultry litter storage sites with the goal of generating sufficient data to support the development of technical standards for the Natural Resource Conservation Service.

Project outputs will include graduate student training, M.S. thesis, Extension presentations, and research and Extension publications. Additionally the project PI will prepare annual reports detailing research progress, findings and technology transfer.

References:

Herron, S, A. Sharpley, S Watkins, and M. Daniels. 2012. Poultry Litter Management in the Illinois River Watershed of Arkansas and Oklahoma. Cooperative Extension Service, Division of Agriculture, University of Arkansas. Fact Sheet FSA9535. 4 pages.

Payne and Zhang. 2012. Poultry Litter Nutrient Management: A Guide for Producers and Applicators. Cooperative Extension Service, Oklahoma State University. Fact Sheet E-1027. 12 pages.

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Project Budget:
Total: $60,000 ($30,000/year for 2 years). These funds will be used to support a graduate student, site modifications, materials and supplies, poultry litter hauling, and analytical fees associated with the proposed research.

Proposed Budget Summary	Year 1	Year 2	Totals
A. Salaries and Wages:			
Graduate Student(s) - MS	$22371	$22371	$44742
Undergraduate Student	$1500	$1500	$3000
B. Fringe Benefits (5.9% for graduate students and 1.0% for undergraduate student)	$1335	$1335	$2670
C. Travel (Mileage to and from the field site in both years and funds for the graduate student to attend a professional meeting in year two to present research results.)	$1000	$2000	$3000
D. Other Direct Costs			
Material and Supplies (Containment and water diversion materials and fuel for equipment. Expendable research supplies for sample collection and processing.)	$2464	$682	$1578
Other - Contractual Services (Poultry litter hauling and Soil Testing Lab - Cost calculated based on the established fee schedule for water analysis)	$1330	$2112	$3442
E. Total Amount of This Request	$30,000	$30,000	$60,000