Volume 2
Issue 2 October 2012

PoultryPractices

Oklahoma Cooperative Extension Service

A newsletter for poultry producers and poultry litter applicators...

Oklahoma State University Extension

This issue

poultrywaste.okstate.edu

Poultry Litter vs. Commercial Fertilizer Study

Josh Payne, Ph.D., Area Animal Waste Management Specialist

Questions exist regarding whether poultry litter or commercial fertilizer result in better forage yields and soil quality. To help answer these questions, a recent study was conducted by Oklahoma State University researchers and Extension specialists comparing equal rates of broiler litter and commercial fertilizer on mixed grass plots, predominately common Bermudagrass. The study was conducted at the Eastern Research Station located in Haskell, OK, from 2007-2009. The objectives were to measure potential changes in soil quality and compare forage production between the two nutrient sources.

Methodology

Both poultry litter and commercial fertilizer were applied each year in May at four different fertility levels (A, B, C, and D). For each fertility level, the same amount of N, P, and K was applied for litter and commercial fertilizer (Table 1). Soil quality characteristics and forage yields were determined annually.

Table 1. Poultry litter and commercial fertilizer application rates.

Treatment		Total N	Total P_2O_5	Total K_2O
	Tons acre^{-1}	lbs. acre^{-1}		
Litter A	1	60	60	45
Litter B	2	120	120	90
Litter C	3	180	180	135
Litter D	4	240	240	180
Commercial A	-	60	60	45
Commercial B	-	120	120	90
Commercial C	-	180	180	135
Commercial D	-	240	240	180

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Editor's Column

This issue focuses on current OSU research projects, including a 3-year study comparing commercial fertilizer to poultry litter and a new study with some interesting initial findings related to Bermudagrass recovery after a drought. We also explore some facts about hormone use in beef production, a secondary enterprise for many poultry producers. Finally, we share an update on an Oklahoma litter transfer incentive.

For publications, regulatory information, and upcoming poultry waste management classes, visit your local County Extension Office or poultrywaste.okstate.edu where you can also obtain an electronic version of this newsletter.

Josh Payne

Results

2007 - 2009, June to September rainfall comparisons are listed below. Note: 2007 was the wettest year (Figure 1).

Poultry litter maintained soil pH levels at low application rates (A and B) and increased soil pH levels at high application rates (C and D; Figure 2). The impact of litter on soil pH levels can be attributed to calcium and magnesium found in litter which forms bases that neutralize soil acidity. Commercial fertilizer decreased soil pH with increasing application rates. The decrease in soil pH is most likely due to nitrification of ammonium. This occurs during the breakdown of nitrogen fertilizer which releases acidic hydrogen ions into the soil.

Figure 1. Yearly rainfall comparison from June to September (inches).

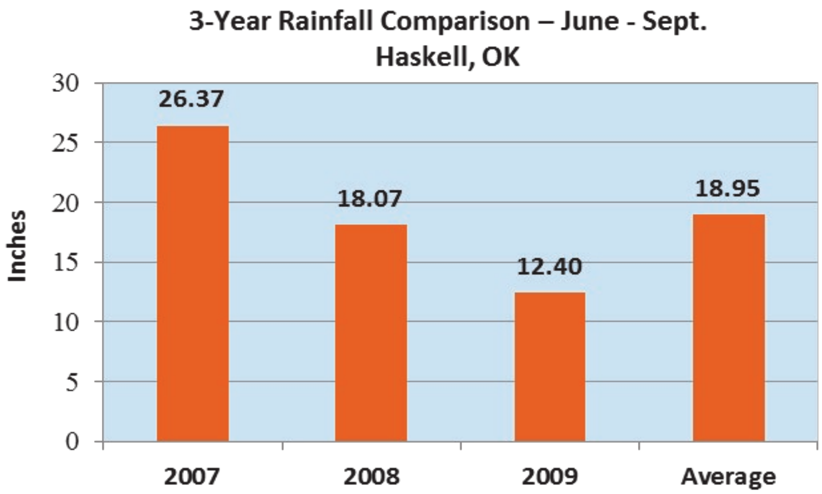
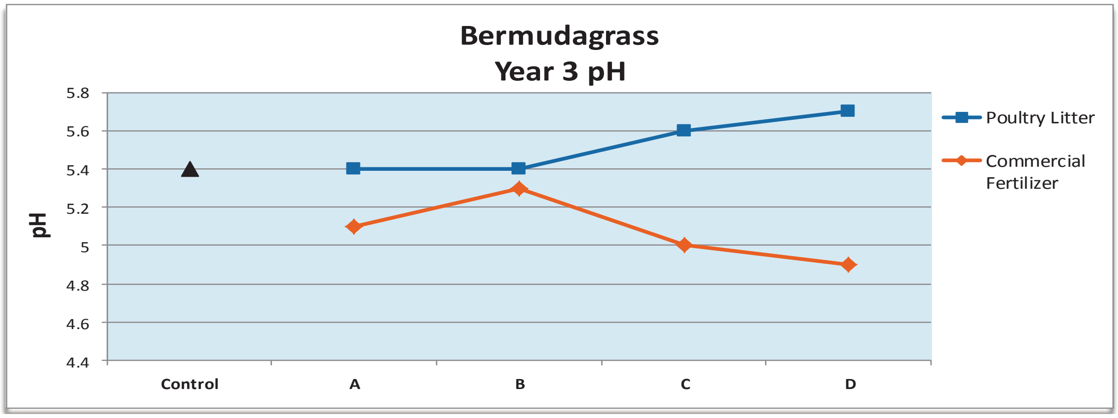
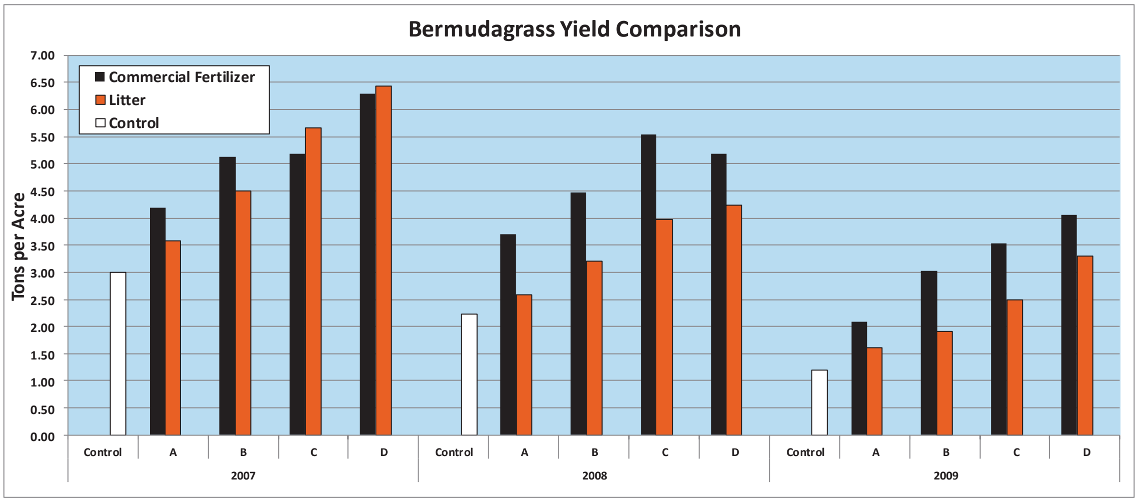


Figure 2. 2009 soil pH levels in common Bermudagrass plots.



Bermudagrass yields increased with increased fertilization rates (Figure 3). Plots treated with commercial fertilizer averaged higher Bermudagrass yields than plots treated with poultry litter. However, during the wetter year, 2007, no differences were observed between commercial fertilizer and poultry litter treatments. This may have been due to increased nitrogen mineralization (breakdown) in litter combined with increased nitrogen leaching from commercial fertilizer.

Figure 3. 2007-2009 common Bermudagrass Yield Comparison (tons/acre)



Soil test phosphorus (STP) levels increased with increased fertilization rates. Plots treated with commercial fertilizer treatments averaged higher STP levels compared to plots treated with poultry litter. This may be due to more readily available and soluble phosphorus in commercial fertilizer compared to litter. No significant differences were observed in soil test potassium levels between treatments. Soil calcium, magnesium, sulfur, zinc and copper increased with increasing rates of poultry litter.

Conclusions

During average or less than average rainfall years, commercial fertilizer treatments produced higher Bermudagrass yields compared to equal rates of poultry litter. However, during wetter years, Bermudagrass yields were comparable between commercial fertilizer and poultry litter. Over time, poultry litter maintained or increased soil pH while commercial fertilizer decreased soil pH. Commercial fertilizer treatments had a greater impact on increasing STP compared to poultry litter. Soil secondary nutrients and micronutrients were increased with poultry litter applications.

When determining which fertilizer source to choose for forage production, purchasing decisions should factor differences in cost, differences in nutrient availability or release, and the additional organic matter, secondary nutrients and micronutrients supplied by poultry litter. Furthermore, if a wetter than average year is anticipated, forage yields between equal applications of poultry litter and commercial fertilizer should be similar.

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The Facts about Hormones and Beef

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Hormone use in US meat production, or the lack thereof, is a controversial and often misunderstood subject. For example, hormones are not used in poultry or swine production but growth hormones are sometimes used in beef production to produce a leaner meat product more efficiently. Questions exist in the public sector regarding the safety of consuming hormone-implanted beef. In short, the use of supplemental hormones in beef production has been scientifically proven as safe for consumers and is approved by the US Food and Drug Administration (FDA). In an effort to better understand the use of hormones in beef production, let's explore the science supporting these facts.

Hormones are products of living cells naturally found in both plants and animals that often stimulate cellular activity. There are six hormones approved for use in beef production. Three are natural hormones (testosterone, estradiol, and progesterone) and three are chemically similar synthetic hormones (trenbolone acetate, zeranol, and melengestrol acetate).

Growth hormones in beef are primarily administered using a small pelleted implant that is placed under the skin on the back of the ear. The implants are designed to release the hormone slowly over time into the bloodstream. This ensures that hormone concentrations remain constant and low. Since the ear is discarded at harvest, the implant does not enter the food chain. Implants work by enhancing the secretion of natural growth regulating hormones and through stimulation of other cellular mechanisms in tissues. This, in turn, increases feed efficiency, protein deposition and growth rate. Implanted calves usually result in a 10-20% increase in average daily gain (growth rate) compared to non-implanted calves. Moreover, because of the increased feed efficiency, less feed is required which decreases production costs by 5-10%.

Since implant doses are low, the use of implants in cattle has very little impact on hormone levels in beef. Table 1 illustrates that 500 grams (~ 1 lb) of beef from an implanted steer contains approximately 7 nanograms of estrogen compared to 5 nanograms of estrogen from non-implanted beef. Furthermore, there are many common foods that are naturally much higher in estrogenic activity than implanted beef. For example, 500 grams of tofu contains 16,214,285 times the estrogenic activity compared to the same amount of implanted beef. To gain additional perspective on the minuteness of these measurements, nanograms are equivalent to one billionth of a gram. One gram is roughly equal in weight to 1 small paper clip. If we were to divide the same paper clip into 1 billion tiny pieces, one of those tiny pieces would equal 1 nanogram.

Table 1. Estrogenic activity of common foods.

Food	Estrogenic Activity [a]
Soy flour defatted	755,000,000
Tofu	113,500,000
Pinto beans	900,000
White bread	300,000
Peanuts	100,000
Eggs	555
Butter	310
Milk	32
Beef from implanted steer	7
Beef from non-implanted steer	5

[a] Nanograms of estrogen for animal products and isoflavones for plant products per 500 grams of food.

Some consumers question whether consuming beef implanted with hormones can cause cancer or early puberty in children. Hormone implanted beef has never been implicated in adverse health effects in humans. Height, weight, diet, exercise and family history, however, have been found to influence the age of puberty. Furthermore, the amount of estrogen consumed in implanted beef is negligible compared to the amount the human body produces each day (Table 2). The average non-pregnant woman produces 513,000 nanograms per day. The average man's body produces 136,000 nanograms per day. An average child will produce 41,000 nanograms of estrogen per day.

Table 2. Estrogen production in humans and potential estrogen intake from implanted beef.

Item	Estrogen amount
Pregnant woman	19,600,000 nanograms/day
Non-pregnant woman	513,000 nanograms/day
Adult man	136,000 nanograms/day
Pre-pubertal children	41,000 nanograms/day
500 g of beef from implanted steer	7 nanograms

Regarding potential environmental concerns associated with growth hormones, the FDA has determined that the use of natural hormones in beef does not pose a risk to the environment as the amounts administered to calves are much lower than amounts naturally produced by adult cattle. Regarding synthetic hormones, extensive environmental risk studies have been conducted and the FDA has determined that the use of these hormones will not significantly impact the environment.

Most of the beef produced in the US spend most of their lives in a pasture and are then finished in a feedlot where they are given a grain-fed diet. Beef that are finished in a feedlot with the aid of growth hormones require less total land mass, less feed crops and create fewer greenhouse gasses per pound of beef produced compared to non growth hormone pasture-based finishing systems.

Consumers who prefer to purchase naturally produced or organic beef raised without growth hormones should be prepared to pay a premium. Implanted beef reduce the cost and resources required in beef production and that results in lower costs that are passed on to the consumer.

For more information on hormone use in beef production including additional data on hormone concentrations, refer to the publications listed below.

References:

Avery, A., and D. Avery. The environmental safety and benefits of growth enhancing pharmaceutical technologies in beef production. Hudson Institute. Center for Global Food Issues. Available at: http://www.cgfi.org/pdfs/nofollow/beef-eco-benefits-paper.pdf

Doyle, E. 2000. Human safety of hormone implants used to promote growth in cattle: A review of the scientific literature. Food Research Institute, University of Wisconsin. Available at: http://fri.wisc.edu/docs/pdf/hormone.pdf

Loy, D., 2011. Understanding hormone use in beef cattle Q&A. Iowa State University Extension. Available at: http://www.iowabeefcenter.org/information/IBC48.pdf

Bermudagrass Recovery Following and During Drought Conditions

Brian C. Pugh, Area Agronomy Specialist

There has been much speculation by producers, educators and specialists over the last year regarding recovery of our warm season grasses following a drought. Yet, Bermudagrass has a potential to recover very quickly from adverse conditions when given the opportunity. This opportunity must consist of strategies that allow the plant to restore lost energy reserves, which include: increasing potential plant health and water use efficiency through fertility, reducing competition via weed control and "resting plants" through reduced grazing/haying pressure. These strategies promote increased leaf area and therefore faster recovery of root systems. Arguably, a combination of these strategies is better than just one.

Collected data from the first 60 days of a long-term study on Bermudagrass at the Eastern Research Station near Haskell, OK indicates the importance of the aforementioned management strategies for forage recovery. Although the goal of this research study was not to determine drought impacts on Bermudagrass health, preliminary findings illustrate the role management has on forage health and yield. A degraded stand of Midland 99 Bermudagrass was chosen in early 2012 to serve as the research site which consisted of 10 treatments with 4 reps. Due to reduced management and the drought of 2011, stand loss was approximately 70%. Treatments consisted of common agronomic rates of poultry litter (PL) and "nutrient equivalent" treatments of commercial fertilizer (CF) on an annual, two, or three year basis and were applied on May 28, 2012. Future sampling will assess nutrient uptake by the plant as well as nutrient drawdown or banking in the soil. Harvest during 2012 has been delayed due to drought and as such these preliminary results are not replicated. However, this information is a good indicator of the potential change in overall stand health with proper management.

The plot area only received 2.97" of rainfall during the 2 months after fertility applications. For perspective, this is less rain than areas of western Oklahoma have received (Figure 1). Additionally, the cumulative rainfall has been well below average, further convincing many producers that stand improvement for 2012 is impossible (Figure 2).

Figure 1. *Yearly rainfall comparison during June and July at Eastern Research Station (inches).*

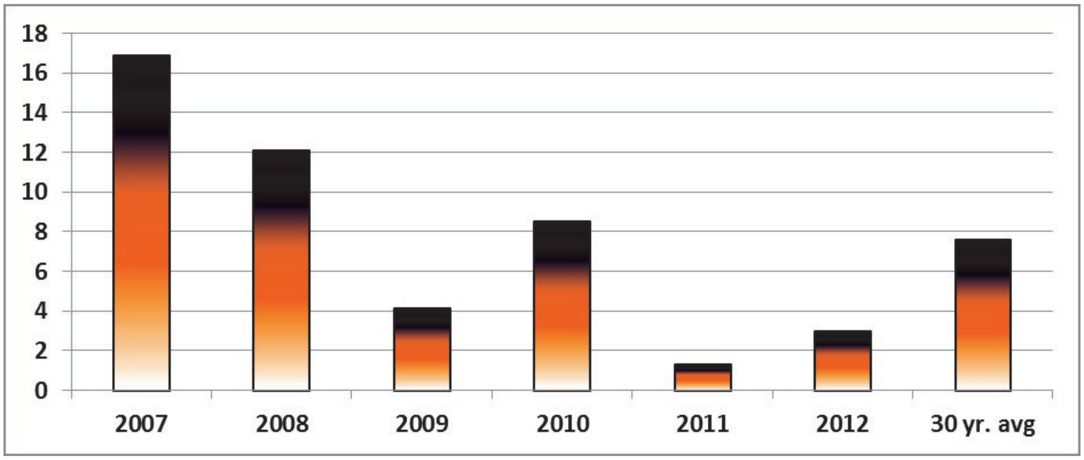
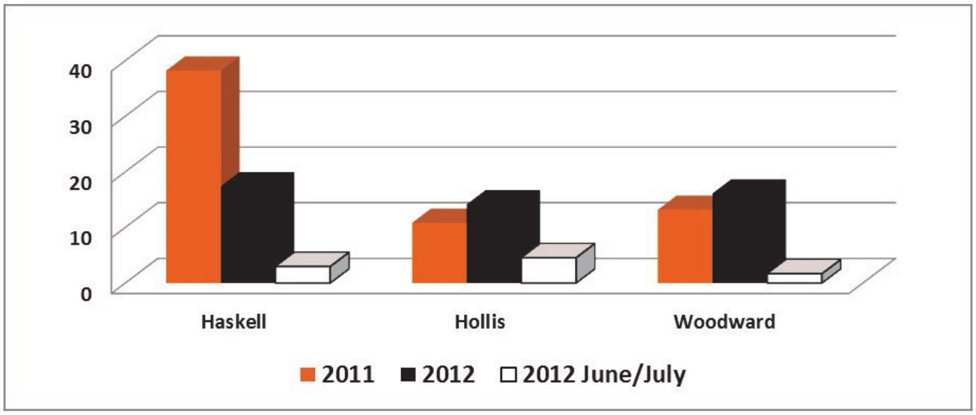


Figure 2. *Cumulative rainfall comparison between Mesonet weather stations (inches).*



Dry matter samples were harvested on July 24, 2012, which corresponded to 57 days of growth. The non-treated area produced a yield of 1,290 lbs. dry matter/acre, with approximately half of that resulting from foxtail and broadleaf forb production (Figure 3). Whereas, one of the fertilized treatments (130N-120P-133K, 2 ton PL equivalent) produced 3,705 lbs. dry matter/acre of predominantly Bermudagrass forage (Figure 4).

Figure 3. *Yield and visual assessment of unfertilized Midland 99 Bermudagrass.*

Figure 4. *Yield and visual assessment of fertilized Midland 99 Bermudagrass.*

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Bermudagrass Recovery—continued from page 7

Although the fertilized treatment is roughly half of the expected yield under normal rainfall, this is a three-fold increase in forage production during a year where forage is extremely valuable. Interestingly, a 1958 Texas study found it took 20 inches of rainfall to produce 1 ton of unfertilized Bermudagrass or 4 inches to produce 1 ton with fertility. This stand produced an additional 2,500 lbs. of forage with just less than 3 inches of rainfall, illustrating that fertility dramatically improves the water use efficiency of forages. Fertility also demonstrated an improvement in the stand density and canopy height of Bermudagrass, which aided in reducing the amount of undesirable grasses and forbs through competition.

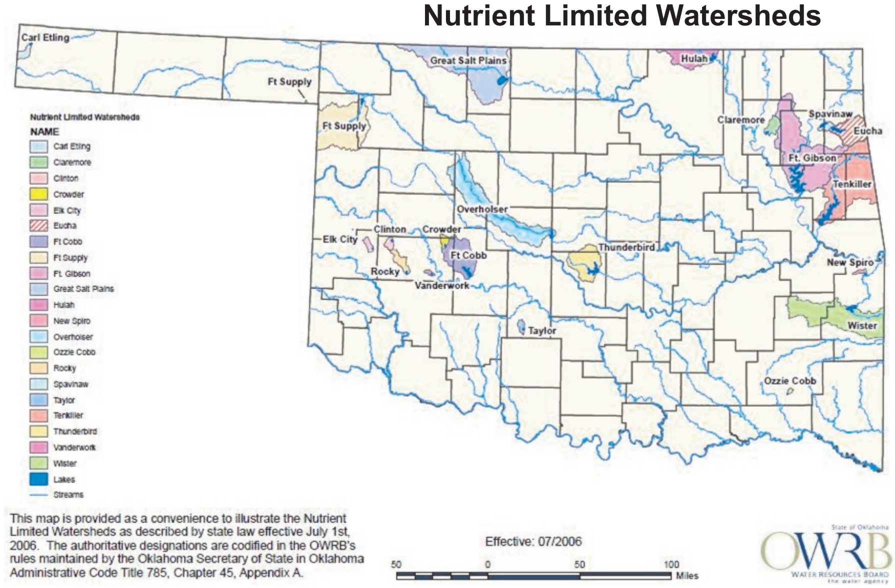
These results occurred during what most are considering a drought similar to last year, a time in which stand improvement is difficult at best. Although there are still canopy openings in the fertilized plots, it is obvious that fertility assists plants in replenishing lost carbohydrate reserves within the roots, restores overall plant health, increases forage plant competitiveness and allows more efficient use of rainfall.

This study is being conducted in conjunction with Dr. Josh Payne. Ongoing results from this study will be released as field reports when collected in the future.

Poultry Litter Transfer Tax Credit Reinstated

Josh Payne, Ph.D., Area Animal Waste Management Specialist

Nutrient Limited Watersheds



The $10/ton tax credit available for buyers purchasing and transporting poultry litter outside of Oklahoma Nutrient Limited Watersheds has been reinstated as of July 1, 2012, lifting the moratorium in place since July 1, 2010. Litter must originate from Oklahoma Nutrient Limited Watersheds and be applied outside of those watersheds. If the tax credit exceeds an individual's income tax due, the unused credit may be carried over for up to 5 years. This program is funded at $375,000 annually. The OTC has included the Poultry Litter Tax Credit on form #511CR, "Schedule for Other Credits" for filing with the state income tax return. Visit ok-littermarket.org for more information.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 70 cents per copy. 1012