

## Meeting the Nitrogen Needs of Wheat and Corn Using Livestock Manure 2007 Ohio Agricultural Research and Development Field Day Proceedings

Glen Arnold, Extension Educator, Ohio State University Extension  
[Arnold.2@osu.edu](mailto:Arnold.2@osu.edu)

Jon Rausch, Extension Program Director, Environmental Management, The Ohio State University  
[Rausch.7@osu.edu](mailto:Rausch.7@osu.edu)

Albert Maag, District Technician, Putnam County SWCD

Animal manure has historically been applied as a soil amendment to Ohio farm fields in summer months following a wheat crop or in the fall following a corn or soybean crop. Farmers have utilized manure for many years to improve soil tilth, increase crop yields and reduce the need to purchase fertilizer.

The majority of the ammonia nitrogen fertilizer found in animal manure can be lost to the surrounding environment when surface applied to farm fields without a growing crop. Farmers and university researchers have started utilizing late season cover crops to capture the ammonia nitrogen from manure and transform it into organic nitrogen that is more stable and can be used by crops in succeeding years.

Replicated research plots were undertaken in 2006 and 2007 in Putnam County, Ohio comparing swine manure to urea as a topdress nitrogen source for wheat. One plot was completed in 2006 and two plots were completed in 2007. All plot treatments were applied on the same day in March and all plots were replicated four times at each location.

In 2006, 105 pounds per acre of nitrogen was applied as urea and approximately 3250 gallons per acre of liquid swine manure was applied using an AgCo Grassland Applicator (See picture #1 and #3 for a view of the AgCo Grassland Applicator). The tool cut a narrow 2 inch deep slot in the ground at a 7.5 inch spacing using a smooth coulter. A boot located immediately behind the coulter allowed the liquid manure to flow into the slot. Applications were made on March 1<sup>st</sup> while soil conditions were dry enough (not frozen) to support the application equipment.

The plot received adequate rainfall through the growing season. Each replication was 1250 feet in length and approximately 40 feet in width. The center of each plot replication was harvested using a 30 foot grain head. The results of the 2006 Niese wheat plot are listed in Table 1.

**Table 1. 2006 Niese Wheat Topdress Test Plot**

<b>Topdress Nitrogen Applied</b>	<b>Average yield of four replications bu/ac</b>
Swine Manure 3,250 gallons per acre (incorporated)	95.7
Urea Fertilizer 105 units of nitrogen per acre	87.1

In 2007, urea and manure were compared in replicated wheat plots at two Putnam County locations. At the Leopold location 94 pounds of nitrogen was applied as urea on April 2<sup>nd</sup> and nursery swine manure was incorporated at a rate of 5000 gallons per acre the same day. Field conditions were firm but some tracking and subsequent wheat damage from the 3000 gallon manure tanker did occur. The amount of ammonia nitrogen applied on the swine nursery manure was similar to the amount applied as urea. The manure application toolbar used was built in the Niese farm shop and it cut a groove in the wheat field at 7.5 inch spacings and had a boot located immediately behind the opener to allow manure to flow into the soil (See Picture #2 and #4 for a view of the toolbar and manure tanker). The manure application toolbar was 13 feet in width and three passes were needed to make each of the manure replications 39 feet in width. Urea was applied using a standard fertilizer buggy with a 40 foot fertilizer spread. The plot received two half-inch rainfall events within 10 days of the topdress applications. The remainder of the growing season was abnormally dry. The results of the 2007 Leopold plot are listed in Table 2.

**Table 2. 2007 Leopold Wheat Topdress Test Plot**

<b>Topdress Nitrogen Applied</b>	<b>Average yield of three replications bu/ac</b>
Swine Nursery Manure 6,000 gallons per acre (incorporated)	84.46
Urea fertilizer (46-0-0) at 94 lbs. of nitrogen per acre	83.70

At the Niese location in 2007, three treatments were applied on replicated plots on April 1st. Treatment #1 was swine finishing manure incorporated at approximately 5000 gallons per acre. Treatment #2 was 5000 gallons of swine finishing manure applied on the surface of the wheat. Treatment #3 was urea applied at 105 pounds of nitrogen per acre. Urea was applied using a standard fertilizer buggy with a 40 foot fertilizer spread.

The plot received two half-inch of rainfall events within 10 days of the topdress applications and a two inch rainfall event in the last week of April. Manure analysis results later indicated the manure plots received approximately 150 pounds of nitrogen per acre instead of the 105 pounds per acre researchers were aiming for. The remainder of the growing season was abnormally dry which might explain why the wheat did not go down due to an overabundance of nitrogen. Results of the Niese 2007 wheat plot are listed in Table #3.

**Table 3. 2007 Niese Wheat Topdress Test Plot**

<b>Topdress Nitrogen Applied</b>	<b>Average yield of four replications bu/ac</b>
Swine Finishing Manure 5,000 gallons per acre (Surface applied)	102.2
Swine Manure 5,000 gallons per acre (Incorporated)	98.0
Urea (46-0-0) fertilizer at 105 units of nitrogen per acre	86.5



Picture 1. AgCo Grassland Applicator



Picture 2. Niese manure toolbar



Picture 3. AgCo toolbar incorporation



Picture 4. Niese toolbar incorporation

Replicated research plots were undertaken in 2005 and 2006 in Putnam County comparing swine manure to 28% UAN nitrogen as the sidedress nitrogen source to a growing corn crop. Side dress nitrogen was applied at the agronomic rate historically used by the farmer and confirmed with a pre-side dress nitrogen testing. This was typically 150 units of nitrogen per acre. Manure application equipment was calibrated, as closely as possible, to match the amount of nitrogen applied as 28%. Generally, plots required 5000 to 6000 gallons per acre of manure. Plot lengths were 800 to 1000 feet in length and 30 feet (12 rows) wide. The manure was applied using a 2400 gallon manure tanker fitted with narrow wheels and an AerWay toolbar with rolling tines that incorporated the manure.

Sidedress applications were made in mid June of both 2005 and 2006 while the corn was in approximately the V-4 stage. Manure and 28% UAN applications were made on the same day in each of the replicated plots. The 2005 crop season was abnormally dry while the 2006 crop season received above normal amounts of rain.

There was no statistical yield difference between the corn plots receiving purchased 28% nitrogen and the corn plots receiving swine manure in 2005 or 2006. One of the plot replications in 2006 involved “spiking” or blending the livestock manure with 28% nitrogen to cut the needed manure application rate in half. Approximately 16 gallons of 28% UAN nitrogen was added to a 2500 gallon manure tank to double the acreage the

manure could cover and still provide the needed nitrogen rate. Plot yields using the spiked manure were statistically similar to the other plots. Results of the 2005 and 2006 corn plots are listed in Table #4.

**Table 4. Swine Manure Yield Summary (Two Years Data)**

	<b>Manure (nursery)</b>	<b>28%</b>	<b>Blended</b>
<b>2006</b>	195bu/ac	194bu/ac	192bu/ac
<b>2005</b>	125bu/ac	125bu/ac	-----



Picture 5. AeroWay tool bar



Picture 6. AeroWay incorporated manure

**Summary:** These replicated research plot results indicate livestock manure is an excellent source of nitrogen for growing crops. In the wheat plots, the manure topdress yields were significantly higher than the urea topdress yields in both 2006 and 2007. In the corn plots, there was no significant yield difference between the manure and 28% UAN sidedress plots in 2005 and 2006.

In recent years there has been a substantial increase in the amount of liquid manure stored on both swine and dairy livestock farms. The large dairy farms built in Ohio in recent years, capable of housing 2000 cows, may have 20 million gallons of liquid manure storage. Newer swine contract finishing facilities, capable of holding 2400 pigs, can have approximately 800,000 gallons of liquid manure storage. The application of livestock manure to a growing wheat and corn crops potentially opens a new window of opportunity for manure utilization in Ohio. Capturing the ammonia nitrogen in livestock manure can save crop farmers from purchasing this increasing expensive nutrient.

The volume of livestock manure needed to meet the nitrogen needs of the growing corn or wheat crop is similar to the rate livestock farmers historically apply. While many livestock farmers are accustomed to hauling liquid manure in tankers or honey wagons, this is usually accomplished during months when the soil is drier and perhaps farmers are less hurried. In addition, applying manure on growing crops using tanks could be a source of soil compaction. To address these concerns research on applying manure to wheat and (preemergence) corn fields using a dragline application system is needed. If this manure application method proves successful, it would be a much more efficient system for applying liquid manure to growing crops and reduce concerns about soil compaction.