The Graves - Chapple Farm is a research and demonstration site located in southwest Atchison County. Graves - Chapple East is located on the east side of I-29 at the foot of the bluffs. Graves - Chapple Heitman Farm is on the west side of I-29 adjacent to State Hwy 111.

The site was established in 1988 as a collaborative effort between Atchison County Extension, Holt County Extension, University of Missouri Extension Commercial Agriculture Program, the University of Missouri’s Agricultural Experiment Station, local agribusinesses and local producers. Primary funding is provided by University of Missouri Extension and the Agricultural Experiment Station.

Projects at this site are devoted to various agronomic practices, with a major emphasis on the production of corn and soybeans. Work with forages, other row crops and alternative crops is also conducted. This site is somewhat unique in the state due to the soil types and the predominance of no-till planting techniques. Soil conservation and water quality issues are also addressed. The farm strives to perfect practices that will maintain or increase the profitability for area crop producers.

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**Acknowledgements**

The staff appreciates the time and effort of the advisory committee that guides the work at this site.

**Atchison County**

Steve Klute - Chairman  Phil Graves  
Russell Herron - Vice Chair  Jason Garst

**Holt County**

John Dudek - Secretary  Greg Hall  
Greg Biermann  Morris Heitman

**Andrew County**

Dick Townsend  Greg Furst

**Nodaway County**

Monica Wood

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Larry Hecker  Keith Lutz  Jay McCoy  Dean Adkins  
Tom Brand  Louis Byford  Wayne Bailey  Donna Thomas  
Michael Peeler  Robert Gibson  Bruce Burdick  Tim Reinbott

Regional Extension Faculty:

Jim Crawford - Natural Resources Engineering Specialist  
Amie Schleicher - Livestock Specialist  
Shawn Deering - Livestock Specialist  
Wayne Flanary - Agronomy Specialist  
Bob Kelly - Ag Business Specialist  
Tom Fowler - Horticulture Specialist
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Objective

The objective of this demonstration is to evaluate the effect of different tillage systems on corn yields and profitability of the enterprise. This is the 19th year for this demonstration.

Methods & Materials

The four most common tillage systems practiced in this region were used for this demonstration. The tillage systems used were:

Fall & Spring Disk
Spring Disk
No-till
Fall Chisel & Spring Disk

Each plot consisted of eight rows spaced 30 inches apart and 250 feet long. Yield results were taken from the center six rows of each plot. The plots were planted on May 6, 2009 with a population of 30,187 seeds/acre into a field that raised soybeans in 2008. Harvest was conducted on October 19, 2009.

Results and Discussion

In 2009, the highest yielding system was the Spring Disk plot with a yield of 259.8 bu/acre. The lowest yielding system was the Fall and Spring disk plot which yielded 219.4 bu/ac. The average for the four systems was 232.8 bu/ac with a standard deviation of 18.3 bu/ac. Yield results for all four tillage systems are shown in Table 1 and Figure 1.

Perhaps the best comparison can be made by looking at the 19-year results of the study as shown in Figure 2. This long term collection of data allows the weather variable
to be minimized since we have had greatly varying weather patterns during this time period. During this 19 year period, the Spring Disk system averaged 165.9 bu/acre. The Fall and Spring Disk treatment had the lowest average of 161.5 bu/acre. With a standard deviation of 1.9 bu/acre over this period, there is no significant difference between the yields.

<table>
<thead>
<tr>
<th>Corn Tillage System</th>
<th>Harvest Moisture (%)</th>
<th>Yield at 15.5% Moisture bu/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall &amp; Spring Disk</td>
<td>17.5</td>
<td>219.4</td>
</tr>
<tr>
<td>Spring Disk</td>
<td>15.9</td>
<td>259.8</td>
</tr>
<tr>
<td>No-Till</td>
<td>16.5</td>
<td>228.5</td>
</tr>
<tr>
<td>Fall Chisel/Spring Disk</td>
<td>16.7</td>
<td>223.7</td>
</tr>
<tr>
<td><strong>Trial averages</strong></td>
<td><strong>16.7</strong></td>
<td><strong>232.8</strong></td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td><strong>18.3</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - 2009 Corn tillage systems yield results.

Figure 1 - 2009 Corn tillage systems yield results.

The most important aspect of the tillage trials is the net bottom line. The application of fertilizer, herbicides, seed, planting and harvesting were identical for each of the tillage systems used. Thus, the economic differences shown are a result of the tillage procedures conducted on each plot and the associated costs.
Table 2. Gross income per acre minus tillage costs over a 19-year period.

<table>
<thead>
<tr>
<th>Corn Tillage System</th>
<th>19 Year Yield Ave bu/acre</th>
<th>Gross Income @ $3.50/bu</th>
<th>Tillage Costs per Acre</th>
<th>Gross Income less Tillage Costs per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall &amp; Spring Disk</td>
<td>161.5</td>
<td>$565.23</td>
<td>$23.32</td>
<td>$541.91</td>
</tr>
<tr>
<td>Spring Disk</td>
<td>165.9</td>
<td>$580.52</td>
<td>$11.44</td>
<td>$569.08</td>
</tr>
<tr>
<td>No-till</td>
<td>164.5</td>
<td>$575.71</td>
<td>$0.00</td>
<td>$575.71</td>
</tr>
<tr>
<td>Fall Chisel/Spring Disk</td>
<td>163.1</td>
<td>$570.82</td>
<td>$29.04</td>
<td>$541.78</td>
</tr>
</tbody>
</table>

Table 2 provides a summary of the gross income per acre minus the costs for the tillage work that was conducted. If we use a value of $3.50 per bushel, over this 19 year period the no-till plots grossed between $6.63 and $33.92 per acre more than the other tillage systems.

Another important factor that is sometimes not considered is the benefit to the environment of different tillage practices. No-till programs greatly reduce the amount of soil erosion caused by wind and water runoff. Soil particles are the number-one contaminant found in the rivers and streams of Northwest Missouri. These particles not only cloud the water but they also may have other pollutants (herbicides, insecticides, fertilizer) adhered to them which may contaminate the water.

It is very difficult to estimate tillage costs as each grower's operating costs will be different. Age and size of the equipment, field shape and size as well as soil type will all affect the tillage costs. A large variable most seasons is fuel cost. To come up with a standard comparison value, we used the rates from the MU Custom Rates guidesheet for the various tillage operations performed. These values are based on data collected from producers across Missouri. The most recent guide was updated in 2009. There is no assurance that these rates would cover a particular producers costs. However, this is the best estimate we can find for a comparison.

One factor not considered in the economic analysis is labor. It is almost impossible to place a value on a producer's labor per hour. Therefore, no labor costs are included in the analysis.
Objective

The objective of this demonstration is to evaluate the effect of different tillage systems on soybean yields and profitability. This is the ninth year for this demonstration.

Methods & Materials

The four most common tillage systems practiced in this region were used for this demonstration. The tillage systems used were:

Fall Chisel & Spring Disk
No-till
Spring Disk
Fall & Spring Disk

Each plot consisted of eight rows spaced 30 inches apart and 250 feet long. Yield results were taken from the center six rows of each plot. The plots were planted on May 21, 2009 with a population of 182,700 seeds/acre into a field that was planted in corn in 2008. Harvest was conducted on November 2, 2009.

Results and Discussion

In 2008, the highest yielding system was the Spring Disk plot with a yield of 65.4 bu/acre. The lowest yielding system was the Fall Chisel and Spring Disk plot which yielded 61.4 bu/acre. The average for the four systems was 63.9 bu/acre with a standard deviation of 1.7 bu/acre. Yield results for all four tillage systems are shown in Table 1 and Figure 1.

If you compare the data obtained over the nine years of the study, the Spring Disk treatment has had the highest average yield for any of the tillage methods with an average of 57.0 bu/acre per year. The No-till treatment had the lowest average yield for any of the treatments with an average of 56.2 bu/acre per year. These averages are shown in Figure 2.

With nine years of data, you can see a trend developing in the yields for each tillage method. This longer term collection of data allows the weather variable to be minimized since we had varying weather patterns during this time period. The eight year average for all the plots is 56.3 bu/acre with only a 0.7 bu/acre standard deviation. This is not a significant variation between the various tillage systems.

<table>
<thead>
<tr>
<th>Soybean Tillage System</th>
<th>Harvest Moisture (%)</th>
<th>Yield at 13.0% Moisture bu/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Chisel/Spring Disk</td>
<td>11.8</td>
<td>61.4</td>
</tr>
<tr>
<td>No-till</td>
<td>12.0</td>
<td>63.9</td>
</tr>
<tr>
<td>Spring Disk</td>
<td>13.3</td>
<td>65.4</td>
</tr>
<tr>
<td>Fall &amp; Spring Disk</td>
<td>12.6</td>
<td>64.7</td>
</tr>
<tr>
<td><strong>Trial averages</strong></td>
<td><strong>12.4</strong></td>
<td><strong>63.9</strong></td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td><strong>1.7</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - Soybean tillage systems yield results for 2009.

Fig 1 - 2009 Soybean tillage systems yield results.
Table 2 - Gross income per acre minus tillage costs over a nine year period.

<table>
<thead>
<tr>
<th>Soybean Tillage System</th>
<th>9 Year Yield Ave bu/acre</th>
<th>Gross Income @ $9.00/bu</th>
<th>Tillage Costs per Acre</th>
<th>Gross Income Less Tillage Costs per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Chisel/Spring Disk</td>
<td>55.3</td>
<td>$497.85</td>
<td>$29.04</td>
<td>$468.81</td>
</tr>
<tr>
<td>No-till</td>
<td>56.2</td>
<td>$505.87</td>
<td>$0.00</td>
<td>$505.87</td>
</tr>
<tr>
<td>Spring Disk</td>
<td>57.0</td>
<td>$512.63</td>
<td>$11.44</td>
<td>$501.19</td>
</tr>
<tr>
<td>Fall &amp; Spring Disk</td>
<td>56.5</td>
<td>$508.88</td>
<td>$23.32</td>
<td>$485.56</td>
</tr>
</tbody>
</table>

Table 2 provides a summary of the gross income per acre minus the costs for the tillage work that was conducted. Even though it does not have the highest yield average for the five years of this study, the No-till plots still grossed between $4.68 and $37.05 per acre more than the other tillage systems assuming a price of $9.00 per bushel for soybeans.

Another important factor that is sometimes not considered is the benefit to the environment of different tillage practices. No-till programs greatly reduce the amount of soil erosion caused by wind and water runoff. Soil particles are the number-one contaminant found in the rivers and streams of Northwest Missouri. These particles not only cloud the water but they also may have other pollutants (herbicides, insecticides, fertilizer) adhered to them which may contaminate the water.

The economic analysis follows the trend we have seen in the corn tillage demonstrations. The application of the fertilizer, herbicides, seed, planting and harvesting were identical for each of the tillage methods used. With only a 0.7 bu/acre variation between the treatments, the economic difference is a result of the tillage procedures conducted on each plot and the associated costs. It is very difficult to estimate tillage costs as producer's operating costs will be different. Age and size of the equipment, field shape and size, and soil type will all affect the tillage costs. As with the corn tillage demonstration, we used the 2009 MU Custom Rates guidesheet to estimate the tillage costs for each system used.

One factor not considered in the economic analysis is labor. It is almost impossible to place a value on a producer's labor per hour. Therefore, no labor costs are included in the analysis.
Introduction

Soybean Cyst Nematode is a damaging pest affecting soybean production in Missouri. A survey conducted by (Heinz, 2005) across Missouri indicated more than 75% of the fields are infested with soybean cyst nematode. Furthermore, 61 percent of the producers had medium or high egg counts above the University of Missouri damage threshold.

Soybean cyst nematode egg count recommendations by University of Missouri Extension are developed into three strategies based on egg counts. If no SCN eggs are detected or a low egg level is found, soybeans without SCN resistance may be planted if the egg count is below the damage threshold of 500 eggs per cup (250 cm³) of soil.

If a moderate egg level is found, plant SCN-resistant soybeans if the egg count is above the damage threshold of 500 eggs per cup of soil and below 10,000 eggs per cup of soil.

If a high egg level is found, plant a non-host if egg counts are above 10,000 eggs per cup of soil. SCN non-host crops include alfalfa, barley, canola, clover (red, white, ladino), corn, cotton, forage grasses, oats, rye, sorghum, tobacco and wheat.

The use of non-host crops is part of our recommended strategy to manage this pest under high levels. The use of a corn and soybean rotations is common and sometimes growers use two crops of soybeans followed by one crop of corn in our region. This impacts the use of rotation as a management tool.

Weed control is another consideration to managing soybean cyst nematode as many winter annuals are hosts of soybean cyst nematode (Mock, V.A.). Henbit is identified as a strong host and field permycress as moderate host. Controlling of winter annuals with the use of fall applied herbicides and other control strategies are another consideration when utilizing rotations to reduce nematode numbers.

Growers often ask “how many years will I have to grow continuous corn to reduce my soybean cyst nematode levels?” This is the goal behind this demonstration.

Methods & Materials

Thirty point sampling sites are used each year to monitor the impact of crop rotation on soybean cyst nematode egg levels. The number of plots sampled were increased in 2006 but were reduced to 30 because of budget constraints.

The sampling points are 15 feet apart stretched in a line from North to South. They are located 50 feet from the East Graves Chapple field border. Ten core soil samples are taken from each point sample site within a 3-foot radius.

Samples are annually taken in May. The initial demonstration nematode sampling was started in spring of 2004 and continues with a spring sampling strategy. The crops grown in the sampling sites are recorded each year.

During the first two years, there was a mix of crops grown across the sampling points. Soybeans were planted with PI88788 resistance in the rotations. During the 2007 growing season and on, all sampling points have had corn grown across them.
Results and Discussion

The data collected during the spring of 2004 represents baseline nematode levels. Shown in the following chart are the cyst nematode egg count means of different crop rotations which had at least 3 replications of sampling points.

CCSC = Corn-Corn-Soybean-Corn Rotation  
CCCC = Corn-Corn-Corn-Corn Rotation  
CSCC = Corn-Soybean-Corn-Corn Rotation  
CWCC = Corn-Winter Wheat-Corn-Corn Rotation

only points that had three or more replications were used to calculate means. High populations in 2004 were reduced dramatically by 2009.

The following chart shows the cyst levels of each point in 2004 compared to 2009. Points 16, 17, 18, 19 and 25 remain above 10,000 eggs per pint of soil.

If growers are using a continuous corn rotation, they may want to target fields containing high levels of cyst nematode level fields to reduce this pest.

![Graph showing cyst nematode egg count means with time](image)

Figure 1 - Soybean cyst nematode egg count means with time.

Five cropping years indicate soybean cyst nematode levels are decreasing. There was an increase in 2005 with the C-S-C-C rotation and whereas the wheat rotation dropped cyst levels in 2005. Mean cyst levels are below the high level of 10,000 in four years. Also, a full rate of atrazine applied to corn at planting time continued to provide control of winter annuals following corn harvest.

The effect limiting soybeans in rotations was apparent across all sampling points. Other sampling points are not included in this chart as

![Effect of corn on soybean cyst nematode levels](image)

Figure 2 - Effect of rotations on individual sampling points.

![Image of Soybean Cyst Nematode eggs on a soybean root](image)

Soybean Cyst Nematode eggs on a soybean root.
Introduction

Measure the effect of different liming products on soybean yields and changes in soil acidity levels when applied to the soil surface.

Liming materials are sold and purchased based on Effective Neutralizable Material (ENM) on a per ton basis. The number of pounds of ENM a liming material contains is based on purity of the material and how finely ground the material. Those who sell lime products are required by law to provide the purchaser with this information so the buyer knows how much ENM the material contains. To price liming materials, one should always determine the ENM contained in a ton of liming material and calculate the price per pound of ENM. Also, spreading and distance of travel will influence the cost of liming material and should be considered.

Methods & Materials

The University of Missouri liming recommendation was 2390 pounds of ENM. Quarry lime containing an ENM of 377 per ton and a pelletized lime containing an ENM of 580 per ton were applied to plots measuring 10 X 30 feet. The quarry lime was applied June of 2005 as a one time application and 200 pounds of pelletized lime material was applied annually in the spring of 2005, 2006 and 2007.

Soil samples were taken at 1-inch increments in each of the three replications and analyzed for pHs. Soybeans have been planted in this site from 2006 to 2009. The soil was a Haynie silt loam located on Heitman site.

Previous Crop: Soybean
Variety: Pioneer 93M61
No of treatments: 4

![Lime Product Movement 48 Months After Application](image)

**Figure 1 - Sampling depth and pH levels.**
No. of replications: 3
Planting Population: 180,000
Planting Date: 11-May-09
Plot Size: 10 X 30
Row Spacing: 30-inch
Design: RBCD
Herbicide Program: BD Glyphosate + 2,4-D + Prefix; FB Glyphosate

Treatments:
  Check
  200 lb Pelletized lime
  6-ton Ag lime
  12-ton Ag lime

Harvest Date: Nov 3, 2009

Results and Discussion

The pHs treatment sampling depth means are plotted in Figure 1. Ag lime material moved downward into the soil increasing the pHs. Both Ag lime rates increased pHs to the 6-inch depth. The pelletized lime was only applied for 3 years and did not provide enough ENM to move pHs values higher. Soil pHs differences between the check and pelletized lime are not significantly different even though the check graphed lower. This is caused from variability in sampling and plot to plot variability.

The quarry lime at the 6-ton rate contained 2262 pounds of ENM and 12-ton rate contained 4524. Pelletized lime contained 58 pounds of ENM in each of the 200 pounds of material applied. Ag lime at the 6-ton rate contained 2262 pounds of ENM and the 12-ton rate contained 4524. Ag lime with a greater amount of ENM applied changed pHs to recommended levels. Pelletized lime could also be applied at a rate that would equal the effectiveness of Ag lime by applying 4,120 pounds of material that would contain the required amount of ENM.

![Figure 2 - Effect of lime products on soybean yield.](image-url)
Background

With an increase in oil prices and new government mandates requiring larger percentages of our fuels come from renewable sources, the country is looking to the agriculture sector to help fill the gap.

The most commonly talked about resource is cellulosic ethanol, or the production of ethanol from the cellulose of plants. Cellulose, the structural component of the primary cell wall of green plants, is made up primarily of chains of glucose. Glucose, or simple sugar, can be easily converted into ethanol. Unlike the glucose found in corn grain, glucose found in cellulose is tightly bonded to the structure and is difficult to separate from the other materials. While the conversion of plant material to ethanol is possible in the laboratory, an economically feasible method of production on a large scale does not yet exist.

Many different crops grown specifically for biofuel production have been suggested. Harvesting corn stover from corn grain fields and using wood wastes are also being examined for biofuel production. Some of these specialty crops have been grown in various quantities and qualities in different places in the United States. Currently, research on several of these crops is being conducted at various institutions across the United States.

Objective

The objective of this demonstration is to plant some of the most promising crops in demonstration plots to see how difficult they are to establish in NW Missouri, and what we can expect as potential yields. Since in most cases they are perennial grasses we want to examine their survivability in the Northwest Missouri climate.

Miscanthus x giganteus, a natural hybrid of Miscanthus sinensis and Miscanthus sacchariflorus.

Methods & Materials

A total of 14 different potential biofuel crops were planted in plots 60 feet x 10 feet. The row crops were planted in May while the warm season grasses were planted on June 30. Crops planted included:

- Miscanthus
- Kentucky 31
- Cody Buffalo
- Prairie Magic - Short
- Prairie Magic - Tall
- Side Oats
- Little Bluestem
- Big Bluestem
- Blue Grama grass
- Kanlow Switchgrass (Lowland variety)
- Cave-In-Rock Switchgrass (Upland variety)
- Continuous Corn with stover removal
- Continuous Corn
- Corn/Soybean rotation
Results

The early results have been positive. As stressed in most of the literature, early weed control is critical in the establishment of these grasses. A pre-plant application followed by a post-emerge spraying to control the weeds should provide the best results at the smallest input cost.

Another important factor is water during the early stages of growth. Adequate rainfall is essential to the plants becoming established. Due to July and August being quite dry, we were forced to supplement the rainfall with irrigation in order to assure establishment. Research in other states indicates that while the plant growth is stunted if it is dry during establishment, when moisture does come the grass will grow and spread. This usually results in a yield reduction for the first year - assuming that it rains in year two. Due to the small size of our plots, we were unwilling to take that chance so we supplemented the water.

Being the first year, no harvest data was collected.
Objective

Measure the effect of different nitrogen fertilizer rates using urea treated with Agrotain on corn yield.

Nitrogen rates are determined by yield goal and experience of most growers. Growers often adjust nitrogen rates based on yield risk. Research indicates there are many pathways for nitrogen to move and change in the field environment resulting in a different rate of nitrogen being the optimum from year to year.

Methods & Materials

Urea was treated with 3 qt. rate of Agrotain. Nitrogen treatments were hand applied.

Previous Crop: Corn
Variety: Pioneer 33T57
No of treatments: 6
No. of replications: 5
Planting Population: 34,500 seeds/acre
Planting Date: 5-May-09
Plot Size: 10 X 35
Row Spacing: 30-inch
Design: RBCD
Nitrogen Source: Urea + Agrotain
Insecticide: Lorsban banded
Herbicide Program: BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post
Treatments:
0, 60, 120, 180, 240, 300 lbs N
Harvest Date:
Oct 9,2009 - Heitman Farm
Oct 13,2009 Graves-Chapple East

Results

The 2009 growing season was wet resulting in high corn yields around the area. However, with the wet season, there was nitrogen loss that also occurred. During the field day in late August, lower leaves of the 300 pound nitrogen treatment were showing nitrogen deficiency at the G-C location along with all of the other lesser rates of nitrogen. Nitrogen denitrified at this location as water stood in the tractor and planter wheel tracks during the spring. As shown in Figure 1, the nitrogen rates showed increasing yields with increasing rates of nitrogen.

At the Heitman site, the optimum nitrogen rate for yield occurred between 120 and 180 pounds. The plot area was well drained and did not have standing water. These results are summarized in Figure 2.

The nitrogen rate to optimize corn yields differ from field to field and within field. The differences from the responses from the sites indicate there is variability in the soil to supply nitrogen to the growing crop.
Effect of Nitrogen Rate on Corn Yield - G/C East

Yield (Bu/A)

0 100 200 300
0 60 120 180 240 300

Nitrogen Rate

Planary 2009 LSD .05 = 36

Figure 1 - Corn yield for different nitrogen rates on Graves-Chapple East site.

Effect of Nitrogen Rate on Corn Yield - G/C Heitman

Yield (Bu/A)

0 100 200 250
0 60 120 180 240 300

Nitrogen Rate

Planary 2009 LSD .05 = 15

Figure 2 - Corn yield for different nitrogen rates on the Heitman Farm.
**Effect of Doubling of Point Rows on Corn Yield**

**Objective**

Measure the corn yield effect of point rows compared to single planted rows. Automatic planter shut-off is technology allows growers to prevent overlap of rows. This technology reduces the amount of wasted seed and results in the number of plants desired by the grower. Also, the reduction of overlap results in less lodging.

**Methods & Materials**

Overlapped corn rows were compared to those that were not lapped. Corn was planted at 45 degrees to create overlapped rows.

- **Previous Crop:** Soybean
- **Variety:** Pioneer 33T57
- **No of treatments:** 2
- **No. of replications:** 5
- **Planting Population:** 34,500 seeds/acre
- **Planting Date:** 5-May-09
- **Plot Size:** 10 X 35
- **Row Spacing:** 30-inch
- **Design:** RBCD
- **Insecticide:** Lorsban Banded
- **Nitrogen Source:** 180 pounds ammonia
- **Herbicide Program:** BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post
- **Treatments:** Single and Overlapped rows
- **Harvest Date:** Oct 13, 2009

**Results**

The 180 pounds of nitrogen fertilizer limited yields as plots exhibited nitrogen deficiency. The doubled rows were lodged compare to single rows. There were not any significant differences in corn yield between the overlap and single rowed corn. This may change from season to season especially with doubling plant population in a stressful growing season.

**The Effect of Doubling Rows compared to Single Rows on Corn Yield**

![Graph showing corn yield comparison between single and doubled rows.](image)

**Figure 1 - Corn yields for single and point row plots.**
**Objective**

Demonstrate the value of adding supplemental nitrogen to corn if conditions exist for pre-plant nitrogen loss. Nitrogen loss can occur during warm, saturated soil moisture conditions resulting in denitrification. Denitrification is a process in which nitrogen is lost to the air in saturated soil moisture conditions.

**Methods & Materials**

The Heitman site was showing early season nitrogen deficiency where 180 pounds of nitrogen was fall applied as anhydrous ammonia. Supplemental nitrogen was applied at rate of 60, 120 and 180 pounds of nitrogen per acre.

**Previous Crop:** Soybean  
**Variety:** Pioneer 33T57  
**No of treatments:** 4  
**No. of replications:** 4  
**Planting Population:** 34,500 seeds/acre  
**Planting Date:** 5-May-09

**Plot Size:** 10 X 35  
**Row Spacing:** 30-inch  
**Design:** RBCD  
**Insecticide:** Lorsban Banded  
**Nitrogen Source:** 180 pounds ammonia applied 11/28/2008  
**Herbicide Program:** BD Glyphosate + Lunax + Atrazine; FB Glyphosate Post  
**Treatments:** Urea Applied June 12, 2009:  
0 lbs/a - Check  
60 lbs/a  
120 lbs/a  
180 lbs/a  
**Harvest Date:** Oct 19, 2009

**Results**

The fall applied 180 pounds of nitrogen did not provide enough nitrogen to maximize yields. The addition of supplemental nitrogen as urea significantly increased yields with 60 and 120 pounds of nitrogen. The addition of another 180 pounds did not increase yield.

---

**Figure 1 - Effect of supplemental nitrogen on corn yield.**
**Objective**

Demonstrate the effect of crop removal on soil test values and impact P and K applications on corn yields.

Many growers use soil tests optimize crop yields. Phosphorus and potassium recommendations are based on adding nutrients to soils to a point where the soil can supply the nutrients. Once these levels are obtained, the soil test recommendations then replace those which are removed from the soil as grain or harvested forage.

**Methods & Materials**

Phosphorus applications were made at a rate of 64 lbs/A and potassium at rate of 50 lbs/A per acre with a yield goal of 200 bushel corn.

**Previous Crop:** Soybean  
**Variety:** Pioneer 33T57  
**No of treatments:** 4  
**No. of replications:** 5  
**Planting Population:** 34,500 seeds/acre  
**Planting Date:** 5-May-09  
**Plot Size:** 10 X 35  
**Row Spacing:** 30-inch  
**Design:** RBCD  
**Nitrogen Source:** Ammonia/ Urea supplement N at rate of 120 lbs/A  
**Herbicide Program:** BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post  
**Harvest Date:** Oct 9,2009

---

**CONTINUOUS CORN PLOTS**

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*Figure 1 - Corn plot pH levels.*

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*Figure 2 - Corn plot phosphorus and potassium test levels.*
Results

Soil tests were taken spring of 2009 in each individual plots. The pHs is high among all plots as shown in Figure 1.

Figure 2 shows the phosphorus and potassium test levels for each plot. There are 5 plots testing below 45 pounds per acre of phosphorus. All potassium levels are not limiting yield.

The application of P and K and both nutrients did not increase yields. Figure 3 shows the yields in bushels per acre for each of the treatments.

Effect of P and K on Corn Yield

![Graph showing the yield of corn with different treatments.]

Figure 3 - Effect of phosphorus and potassium levels on corn yield.
Effect on Soybean Yields and P and K Applications on Soil Test Levels

Objective

Demonstrate the effect of crop removal on soil test values and impact P and K applications on soybean yields.

Many growers use soil tests optimize crop yields. Phosphorus and potassium recommendations are based on adding nutrients to soils to a point where the soil can supply the nutrients. Once these levels are obtained, the soil test recommendations then replace those which are removed from the soil as grain or harvested forage.

Methods & Materials

Fertilizer was applied to 40 lbs P2O5/A and 65 lbs K2O/A per acre with a yield goal of 50 bushel soybeans.

Previous Crop: Soybean
Variety: Pioneer 93M61
No of treatments: 4
No. of replications: 5
Planting Population: 180,000 seeds/acre
Planting Date: 5-May-09
Plot Size: 10 X 35
Row Spacing: 30-inch
Design: RBCD
Insecticide: Lorsban Banded
Nitrogen Source: 180 pounds ammonia
Herbicide Program: BD Glyphosate + 2,4-D
      + Prefix FB Glyphosate Post
Harvest Date: Oct 9, 2009

CONTINUOUS SOYBEAN
PLOTS
pHs

Figure 1 - Soybean plot pH levels.

Bray P lbs/A

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Figure 2 - Soybean plot phosphorus and potassium test levels.
Results

Soil tests were taken spring of 2009 in each individual plots. The pHs is high among all plots as shown in Figure 1.

Figure 2 shows the phosphorus and potassium test levels for each plot. There are 4 plots testing below 45 pounds per acre of phosphorus. All potassium levels are not limiting yield.

The application of P and K did not significantly increase yields compared to the check. Figure 3 shows the yields in bushels per acre for each of the treatments.

Effect of P and K on Soybean Yield

Figure 3 - Effect of phosphorus and potassium levels on soybean yield.
Objective

Measure the effect of fall compared to spring ammonia nitrogen application timing on corn yield.

University of Missouri recommends fall ammonia application be delayed until soil temperatures reach 50 degrees or colder north of Highway 36. If ammonia is applied before soil temperatures reach these levels, there is increased risk of ammonia converting into nitrate which can move with soil moisture. Two processes can occur. One being leaching where nitrogen can move out of the root zone and the second is denitrification, in which nitrogen can be converted by anaerobic soil microbes releasing nitrogen into the air under water saturated soil conditions.

Methods & Materials

Six knife applicator equipped with ground drive mechanism was used apply nitrogen at a rate of 180 pounds per acre. The Graves Chapple site typically has higher yields so the rate was used to indicate any losses. The Heitman site typically has yields that 180 pounds of nitrogen would be adequate.

Previous Crop: Corn
Variety: Pioneer 33T57
No of treatments: 3
No. of replications: 6

Planting Population: 29,900 seeds/acre
Planting Date: 5-May-09
Plot Size: 15 X 100
Row Spacing: 30-inch
Design: RBCD
Insecticide: Lorsban Banded
Nitrogen Source: ammonia
Herbicide Program: BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post Treatments:
Fall timing: Nov 28, 2008
Spring timing: April 24, 2009
Check with 0 pounds of N applied

Harvest Date:
Oct 9, 2009 - Heitman
Oct 13, 2009 Graves-Chapple East

Results

Application timing caused a significant difference of corn yield in the East site of G/C whereas the West site at the Heitman location did not show any significant difference between fall and spring applications.

The east site was nitrogen deficient with each application timing. Stress was seen during the summer time and the nitrogen rate of 180 pounds was short for 2009 crop year and the rainfall that was received. Also, the site was influenced by standing water. Planter and tractor wheel tracts had standing water during the spring which may have led to de-nitrification.

Regarding the west site, the nitrogen rate of 180 pounds would be more typical rate for the Salix silty clay loam. However, there was not a significant difference between fall and spring treatments. Yield was not maximized at either location based on supplemental nitrogen applied top-dressed over pre-plant ammonia plots.
Effect of Ammonia Application Timing on Corn Yield - Graves
Chapple East Location

![Graph showing yield for different application timings.]

Figure 1 - Treatment yields for ammonia application timing at Graves-Chapple East.

Effect of Ammonia Application Timing on Corn Yield - Graves
Chapple/Heitmans

![Graph showing yield for different application timings.]

Figure 2 - Treatment yields for ammonia application timing at the Heitman Farm.
Objective

Measure the effect of Poncho insecticide seed treatment rates on soil insects.

Poncho® contains the insecticide clothianidin, a systemic insecticide, of the neonicotinoid class of insecticides. They work by blocking elements of the insect’s nervous system.

According to the Bayer label of Poncho® 600 (Bulk 30 gallon drum for commercial seed treaters), plant back for corn is immediate with a 30-day delay for soybean. The labeled rate for Poncho 600 has a range for soil insects. For cinch bug, corn flea beetle, corn leaf aphid, black cutworm, grape colaspis, seedcorn maggot, southern corn leaf beetle, southern corn rootworm beetle, southern green stinkbug, White grub (including European, Chafer larva, May/June beetle larvae, Japanese beetle larvae) thrips, and wireworm, the range of rates is from 1.13 fl oz (0.25 mg a.i./Kernel) to 2.26 fl oz (0.50 mg a.i./Kernel) per 80,000 seed unit. The label states higher rates of 5.64 fl oz (1.25 mg a.i./Kernel) is required for protection of seeds and seedlings of corn rootworm (including Northern, Western, Southern and Mexican.). Some labeled insects are not present in Northwest Missouri.

Wilde, 2004, found that clothianidin was effective against wireworm and white grub. However, higher rates of compounds were needed to reduce the feeding of black cutworm.

Research at MU indicates that under high levels of insect pressure, seed treatments may not provide effective control. High levels of wireworm and true white grub activity may require the use of an additional soil insecticide treatment applied in-furrow or banded. Black cutworm may be scouted and treatment applied when insect injury reaches economic threshold.

Methods & Materials

Site selected was Haynie silt loam located on Heitman site at Graves Chapple Farm. The site was low lying area that had a high risk of cutworm activity.

Previous Crop: Soybean
Variety: AgVenture 8441
No of treatments: 4
No. of replications: 4
Planting Population: 34,500 seeds/acre
Planting Date: 5-May-09
Plot Size: 10 x 35 feet
Row Spacing: 30-inch
Design: RBCD
Nitrogen Source: ammonia
Herbicide Program: BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post
Treatments:
No Poncho®
Poncho® 250
Poncho® 500
Poncho® 1250 Rates
Harvest Date:
Oct 19,2009

Figure 1 - Black cutworm.
Results

Cutting was measured 23 days after planting. Black cutworm cutting primarily occurred underground and with little surface feeding. There was not a significant difference of cutting between treatments. However, all treatments had cutworm feeding. This is of importance as using a insecticide seed treatment even at higher rates does not mean that one will always obtain control. One should always scout fields for insects.

The check had more cutting; however, there was not a significant difference between treatments. There was cutting across all treatments.

When selecting an insecticide seed treatment or soil insecticide, it is important to know which insects are likely to attack corn in the coming year. This information can be obtained by scouting history, examining field history, field characteristics that increase the probability of a particular pest species to attack your crop. Insecticide seed treatments are primarily effective against insect pests that attack seeds and seedlings.

---

**Figure 2** - Black cutworm cutting means with Poncho® treated corn seed.
Effect of Three Nitrogen Rates and Two Populations on Corn Yield

Objective

Measure the impact of nitrogen fertilizer application rates and planting populations on corn yield. Population and adequate amounts of nitrogen are critical for high corn yields.

Methods & Materials

Previous Crop: Corn
Variety: Pioneer 33T57
No of treatments: 6
No. of replications: 5
Planting Date: 5-May-09
Plot Size: 10 x 35 feet
Row Spacing: 30-inch
Design: RBCD
Insecticide: Lorsban Banded
Nitrogen Source: Urea + Agrotain
Herbicide Program: BD Glyphosate + Lumax + Atrazine; FB Glyphosate Post

Treatments:

Corn Planting Populations:
24,500 seeds/acre
35,000 seeds/acre

Nitrogen Application Rates:
0 lbs/acre
180 lbs/acre
240 lbs/acre

Harvest Date: Oct 13, 2009

Results

Planting population of 35,000 and adequate nitrogen rates of 180 and 240 pounds were more consistent compared to lower planting rates and limiting nitrogen. The 35,000 plant populations provided increased consistent yields; however, the 0 nitrogen rate had reduced yield from nitrogen stress. The planting population of 24,500 is not adequate at this site and resulted in lower yields. The variability of plots also shows the differences of nitrogen supplying ability across the field.

Treatment Means

![Graph showing mean yield by treatment]

Figure 1 - Yield Means for various planting populations and nitrogen rates.
The 21st annual Graves - Chapple Farm Field Day was held on August 25, 2009. Over 150 participants registered at the event.

The day was made possible through the assistance of many local organizations. Atchison-Holt REA provided doughnuts and coffee to the attendees in the morning. A pork loin lunch was sponsored by the farm with ice cream sandwiches provided by MO Valley Ag. KMA Radio from Shenandoah and KFEQ Radio from St. Joseph conducted live remote broadcasts from the farm during the event.

Attendees could participate in three tours that highlighted some of the work being conducted on the farm. These tours were:

**Red Tour – Pest Management**

**Stop 1** - *Impact of Corn and Soybean Insecticide Seed Treatments*
Steven Kirk and Heather Benedict

**Stop 2** - *The Impact of Different Types of Cyst Nematode Resistance*
Dr. Laura Sweets

**Stop 3** - *Using PREs with Glyphosate Applications and a New Product Update*
Dr. Kevin Bradley

**White Tour – Nutrient Management**

**Stop 1** - *Fine Tuning Fertility Management Through Using Precision Ag Technologies*
Kent Shannon

**Stop 2** - *Managing Supplemental Nitrogen in Wet Springs*
Dr. Peter Scharf

**Stop 3** - *Results of Graves-Chapple Farm Soil Fertility Demonstrations*
Wayne Flanary

**Blue Tour – Crop Economics**

**Stop 1** - *Fall Marketing Outlook and Strategies*
Melvin Brees

**Stop 2** - *Production Costs: Don't Forget to Count the Machinery*
Randa Doty

**Stop 3** - *Seed and Fertilizer Economics: Prices and Risks*
Dr. Ray Massey
### Corn Variety Demonstrations

Planted - May 7, 2009  
Harvested - October 20, 2009  
Planted rate - 29,900 seeds/acre  
Row Spacing - 30 inches  
Tillage - No-till  
Soil Type - Haynie Silt Loam

Fertilizer - 250 lbs N, 50 lbs P per acre  
Pre-Herbicide - Lumax, Atrazine  
Post-Herbicide - Calisto, Atrazine  
Previous Crop - Soybeans  
Check variety - Wyffles W7251  
Check Average - 217.9 bu/acre

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**Average:** 18.1  
**Standard Deviation:** 1.3  
**Median:** 199.1
**Soybean Variety Demonstrations**

Planted - May 20, 2009  
Harvested - November 6, 2009  
Planted Rate - 178,000 seeds/acre  
Row Spacing - 30 inches  
Tillage - No-till  
Soil Type - Haynie Silt Loam  

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Average: 12.6  | Adjusted Yield: 56.7
Std Deviation: 0.5 | 5.1
Median: 56.1
Two hundred and sixty two high school students from 7 area schools attended the annual Student Field Day at the Graves-Chappell Farm on September 25. The goal for the event is to show some of the various aspects of agriculture to demonstrate to our youth that there is more to agriculture than planting crops.

Each learning station was designed to provide hands on learning opportunities for the students on some of the cutting edge technology and practices used in today’s agriculture as well as provide safety information when working around equipment.

7 Cannulated Cow - This cow has a door surgically implanted into its digestive tract so that students can access the rumen and observe food in the digestive system of the cow.

8) Genetic Zoo – How altering a gene or using selective breeding has transformed corn produced in the United States.

9) Body Condition Scoring – Visual determination of a cow’s energy reserves based on her fat cover.

10) Field tour to show some of the projects and research being conducted at the farm.

The learning stations were:

1) PTO Safety – The dangers associated with tractor power take-off shafts.

2) Agri-business Entrepreneurship and Agri-Tourism - A look at different approaches taken by entrepreneurs to start their businesses.

3) Farm Service Agency Youth Loans - Low interest loans for youth to help fund agricultural related projects.

4) Representative from MU with opportunities in agriculture at MU.

5) Rollover Safety – The importance of wearing a seatbelt every time you get in a vehicle.

6) Insect and Pest Management – Various insect pests affecting agriculture in Missouri.
A lunch of hotdogs and hamburgers was provided by the farm and local area businesses and prepared by the Rock Port Rotary club.

Sergeant Sheldon Lyon with the Missouri State Highway Patrol explains why a seat belt is so important in the picture above, then demonstrates their effectiveness in using the rollover simulator in the bottom photo.

Shawn Deering, MU Regional Livestock Specialist, explains how to visually grade a cow's condition based on her fat cover.

Steve Klute, Graves-Chapple Farm advisory board chair, shows a group of students some of the various corn plants in the genetic zoo.

The students were asked to complete an evaluation at the conclusion of the event. Based on the responses, over 96% indicated an increase in knowledge of current agricultural practices from information presented at the event. The PTO safety station made the biggest impact on 43% of the respondents with the cannulated cow and rollover safety each receiving 21%.

With Bob Chapple as their guide, a group of students sets out on a tour of the research and demonstration plots at Graves-Chapple Farm.
# Daily Precipitation Data, April - September 2009

**Daily Precipitation in Inches**

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**TOTAL**

4.19 | 1.74 | 5.75 | 2.77 | 3.59 | 0.88
## 2009 Graves - Chapple Farm

**Daily Temperature Data, April - September 2009**

Daily Temperature in °Fahrenheit

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Asgrow Seed, Monsanto & Dekalb  
Jerrod Groce  
6303 Oak Ridge Ct  
St. Joseph, MO 64504  
Phone: (314) 443-3049  
E-mail: jerrrod.groce@monsanto.com

AgriGold Hybrids  
Justin Warren  
RR2 Box 203  
St. Francisville, IL 62460  
Phone: (618) 943-5776  
E-mail: justin.warren@agrigold.com

Best Seeds  
Alan Voiles  
P O Box 45  
Eldred, IL 62027  
Phone: (800) 556-8406  
E-mail: jlan925877@aol.com

Burrus Power Hybrids  
M.G. Kennedy  
237 NE 20th St  
Trenton, MO 64683  
E-mail: kennedy@burrusseed.com  
Phone: (800) 529-7475

Garst Seed  
Erin Dinsdale  
5007 University Ave  
St. Joseph, MO 64503  
E-mail: Erin.dinsdale@garstseedco.com  
Phone: (816) 232-1948

Garst Seeds  
Troy & Travis Milne  
31072 Hwy O  
Oregon, MO 64473  
Phone: (816) 390-4611  
E-mail: milnet@william.jewell.edu

Hoegemeyer  
M. Jordan McCrery  
409 N. US Hwy 169  
Smithville, MO 64089  
Phone: (712) 310-3044  
E-mail: j.mccrery@hoegemeyer.com

Morning Sun Seed  
Dave Laur  
13919 R. Ave  
Westboro, MO 64498  
Phone: (660) 984-5604

Mycogen Seeds  
John Laffey  
27159 State Hwy F  
Maryville, MO 64468  
Phone: (660) 582-2379  
E-mail: jlaffey@dow.com

Producers Hybrids  
Steve Showalter  
20915 Hwy 275  
Rock Port, MO 64482  
Phone: (660) 744-2034  
E-mail: steve.showalter@producershybrids.com

Taylor Seed Farms  
Brad Taylor  
2467 Hwy 7  
White Cloud, KS 66094  
Phone: (785) 595-3236  
E-mail: brad@taylorseedfarms.com

Wyffels Seed  
Clark Jackson  
607 East 17th St.  
Atlantic, IA 50022  
Phone: (712) 243-5755  
E-mail: CJackson@wyffels.com