1. Poultry litter: Nutrient availability, value, and storage practices
2. Crop water requirements
3. Factors involved in winter survival of canola in Kansas
4. Comparative Vegetation Condition Report: November 13 – 26

1. Poultry litter: Nutrient availability, value, and storage practices

Poultry litter can provide a significant and important supply of nutrients for crop production in areas of Kansas where a supply of litter is available. Although Kansas is not a major producer of poultry, there is an abundant supply of litter from the nearby states of Arkansas, Missouri, and Oklahoma, which rank among the largest producers of poultry in the U.S. The acreage available to receive poultry litter has been declining in Arkansas, Missouri, and Oklahoma in recent years because of environmental concerns. That trend, coupled with high fertilizer prices, has meant the availability of litter to areas such as southeast Kansas has been on the rise.

Poultry litter should serve as an excellent complement to commercial nitrogen (N) fertilizers. Phosphorus content in poultry litter is usually high, and applications rates should be based on P levels to avoid potential surface water contamination.

<table>
<thead>
<tr>
<th>Source</th>
<th>Typical moisture content</th>
<th>Typical nutrient content (lbs/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Layer</td>
<td>High</td>
<td>35</td>
</tr>
<tr>
<td>Pullet</td>
<td>Low</td>
<td>40</td>
</tr>
<tr>
<td>Breeder</td>
<td>High</td>
<td>40</td>
</tr>
<tr>
<td>Turkey</td>
<td>Low</td>
<td>60</td>
</tr>
<tr>
<td>Broiler</td>
<td>Low</td>
<td>60</td>
</tr>
</tbody>
</table>

Moisture content and nutrient concentration in poultry litter can be highly variable and depends mainly upon production conditions, storage, and handling methods. Therefore, laboratory analysis is the best way to determine the level of N and P in the material to be applied. The table above presents average values for the different types of poultry manure collected over a period of time. The table below presents the actual laboratory analysis of 67 poultry manure samples from southeast Kansas. There is a large range in nutrient values, likely due to the source of the litter. However, a good sample average to expect would be a 55-55-47.
Results of analysis of 67 samples of poultry manure from Labette County. Source: Keith Martin, K-State Research and Extension, Wildcat Extension District.

For maximum efficiency of manure use, it is essential to know the nutrient content of the manure. Using a manure lab analysis will help in determining the actual nutrient rates applied. A laboratory analysis should be done on the poultry litter before applying it to land. A laboratory analyses provides information regarding nutrient levels, as well as the chemical forms of these nutrients. This information is necessary for an adequate estimation of nutrient availability and application rates. For more information, see K State Extension publication MF-2562, “Estimating Manure Nutrient Availability,” at: http://www.ksre.ksu.edu/library/crpsl2/mf2562.pdf

Nitrogen availability

Nitrogen and P crop availability shortly after application is a common question. In the case of N, it is important to consider that this nutrient is primarily in the organic form in poultry litter (up to 75-80% organic). Organic N needs to mineralize before becoming available to crops. A fraction of this organic N may become part of the soil organic matter pool and unavailable to crops in the short term.

Field and laboratory studies suggest the fraction of total nitrogen that becomes plant available the first year of application is approximately 45-55%, which includes both the inorganic N in the manure and a percentage of the organic N. This value varies depending upon components in the litter, and the method of handling and application. For example, poultry litter that contains a large fraction of bedding material will tend to have lower N availability the year of application. Reduction in N availability may also occur when litter is aged, and has undergone some level of composting. Nitrogen lost from the volatile ammonium fraction at the moment of application to the soil surface can also reduce plant available N. Ammonium volatilization is typically higher during windy and warm days. Incorporation of litter immediately after application will reduce volatilization and potential loss by water runoff in case of a rainfall event.

If the manure is applied to pastures, the percentage of nitrogen utilized by the forage the first year will depend on whether the pasture consists of cool-season or warm-season grasses. For cool-season grasses, such as fescue pasture, nitrogen utilization will likely be less than 50% the first year. Most of the growth in cool-season pasture occurs early in the year. Microbes will not mineralize as much
N early in the spring as it will later in the summer. Fall applications may utilize more N for fescue than winter or spring applications. For warm-season grasses, such as bermudagrass pasture, nitrogen utilization from manure will likely be close to 50%. In both cases, producers should base application rates on the P and K needs of the grass, and supplement additional N fertilizer to meet the N needs of the grass.

**Phosphorus and potassium availability**

When manure is applied to the soil, what percentage of this phosphorus and potassium is available to the crop during the first year?

A large fraction of the phosphorus in manure is considered to be plant available immediately after application. The fraction that is not plant available shortly after application will become potentially available over time.

Estimated values of phosphorus availability are from 50 to 100%. This range accounts for variation in sampling and analysis, and for phosphorus requirements with different soil test levels. Use the lower end of the range of phosphorus availability values (50%) for soils testing “Very Low” and “Low” (below 20 ppm) in phosphorus. In these situations, large yield loss could occur if insufficient phosphorus is applied and soil phosphorus buildup is desirable.

On the other hand use 100% availability when manure is applied to maintain soil test phosphorus in the Optimum soil test category, and when the probability of a yield response is small.

Several studies have shown that manure P is a valuable resource, comparable to inorganic fertilizer P for crop production. These two P sources are similarly effective when the manure P concentration is known and the manure is applied properly.

Nevertheless, excessive application of manure phosphorus (for example, applying manure at rates sufficient to meet the crop’s nitrogen needs) often results in excessive soil phosphorus buildup over time, resulting in higher risk of surface water contamination. This problem of excessive phosphorus buildup in the long-term can be minimized by:

* Applying manure to cover the phosphorus needs of the crop and using inorganic sources of fertilizer to complement nitrogen needs,

* Constantly monitoring soil test phosphorus levels, and

* Using the P-index to assess potential impact of phosphorus buildup on water quality.

Producers should think in terms of actual phosphorus application rates and not just tons per acre of manure being applied. Uniform application of manure at precise rates can also be difficult. Careful calibration of manure applicators is needed. If these aspects are not considered, the efficiency of manure P compared with inorganic fertilizer P may be reduced. Careful management pays off.

Availability of potassium (K) is usually near 100% with proper application, poultry litter can also provide significant amounts of secondary and micronutrients.
Value of manure

The use of poultry litter can contribute to reduce cost of fertilizer inputs for many operations, depending on the price and transportation cost of the litter. For many farmers the use of poultry litter may represent significant savings. However, for many producers there is a “hassle factor” with using poultry litter. Reliable delivery, storage site location, uniform application, access to application equipment, and odor can all be additional challenges to producers unfamiliar with its use, and should be a consideration.

How valuable is poultry manure? This may not be a straightforward answer and depends on several factors, including the nutrient(s) required for a specific field, but here’s one example using the average nutrient analysis values from Labette County of 55-55-47 (N-P-K lbs/ton):

- Year 1:
  - 35% of N is inorganic (all available) = 19.3 lbs/ton
  - 65% of N is organic (1/4th available in year 1) = 8.9 lbs/ton
  - Total N available in year 1 = 28.2 lbs/ton
  - Total value of N available in year 1 (@ $0.51/lb) = $14.38
  - P is 50% available in year 1 = 27.5 lbs/ton
  - Total value of P in year 1 (@ $0.65/lb) = $17.88
  - K is 85% available in year 1 = 40.0 lbs/ton
  - Total value of K in year 1 (@ $0.48/lb) = $19.20

Total in year 1 = $51.46/ton
Residual N and P = $31.55/ton

Storage

Proper storage of manure is important to prevent runoff contamination of water and odor problems. The following practices should be utilized:

- Avoid stockpiling litter near homes, public road ways and drainage ditches.
- Use tarps on litter piles to keep litter dry, reduce smell, and reduce N losses from volatilization.
- Stockpile litter at least 200 feet away from “Waters of the State.”

Additional considerations when selecting a suitable storage site

- Locate stockpiles in areas with minimal slope.
- Avoid sites that slope toward water ways and receive extraneous drainage.
- Locate sites in areas surrounded by grass that can serve as a buffer.
- Avoid sensitive groundwater areas and sites in close proximity to wells.
Poultry litter stockpiled away from surface water to prevent runoff contamination, being loaded into manure spreader. Photo by Doug Shoup, K-State Research and Extension.

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2. Crop water requirements

(Editor’s Note: This article is an excerpt, slightly modified, from the new K-State publication Efficient Crop Water Use in Kansas, NF-3066, available at: http://www.ksre.ksu.edu/library/crpsl2/mf3066.pdf -- Steve Watson)

The water that enters the plant roots is used by the plant in a process called transpiration. Evaporation is water that is lost from the soil and not actually used by the plant. These two values are grouped together into the term evapotranspiration, or ET. The values are expressed in units of inches.

Scientists in Kansas have determined crop water requirements for the growing season of major crops. In the table below, the “Threshold ET” refers to the amount of water required to get to the
first unit of yield. The “Slope of Yield vs. ET” is the amount of yield gained for each additional inch of water. The difference between the “Slope of Yield vs. ET” and the last column, the “Slope of Long-term Yield vs. ET,” is that the amounts in the column on the far right are lower because they include nonwater-related factors that reduce yield, such as hail, freeze damage, insects, and disease.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Maximum ET for full-season variety</th>
<th>Threshold ET</th>
<th>Slope of yield vs. ET (bu/acre/in.)</th>
<th>Slope of long-term yield vs. ET (bu/acre/in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>25 in.</td>
<td>10.9 in.</td>
<td>16.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Grain sorghum</td>
<td>21 in.</td>
<td>6.9 in.</td>
<td>12.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Sunflower</td>
<td>22 in.</td>
<td>5.4 in.</td>
<td>218</td>
<td>150</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>24 in.</td>
<td>10.0 in.</td>
<td>6.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Soybean</td>
<td>24 in.</td>
<td>7.8 in.</td>
<td>4.6</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Having crop residues in place on the soil surface is critical for reducing soil water evaporation, even in sprinkler-irrigated fields. In a long-term experiment conducted at Garden City, Norm Klocke, K-State water resources engineer, quantified the amount of water that evaporated from fields that were bare (cropped and then had the residue removed) versus fields that had the residue left on the surface. Crop residues that completely covered the soil surface reduced evaporation by 50 to 65 percent compared to bare soil. Klocke also observed, however, that there is no reduction in evaporation once the residue coverage is lower than 70 to 75 percent of the soil surface.

Since the average amount of water used through ET by the crop during the growing season is 24 to 26 inches, this would translate into 3.4 to 3.6 inches of water savings during the growing season. An additional 2 inches of soil moisture can evaporate in the absence of residue during the winter, adding up to 5 inches of water that can be lost in one year with low residue coverage. This lost water can be converted into lost potential yield by multiplying by the slope of yield columns in the table above.

Research from dryland experiments has shown that crop residues are worth 2 to 4 inches annually in the central Great Plains states as well. This means that having the full surface covered by residue can conserve about 5 inches of water per year, which can be converted into yield by multiplying by the slope of yield columns in the table above.

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3. Factors involved in winter survival of canola in Kansas

Winter survival of winter canola in Kansas is a complicated issue. A thriving canola crop depends not only upon the genetics of the cultivar, but also the environment in which it is grown and the producer’s management practices. The interaction of these factors will ultimately determine whether a crop will survive the winter.

Winter canola that is planted on time and in good soil moisture has the greatest potential for surviving the winter. The rosette stage is when winter canola is most tolerant to cold temperatures. During this stage, a crown develops at the soil surface with larger, older leaves at the base and smaller, newer leaves at the center. The stem thickens but its length remains unchanged. For
optimum winter survival, a winter canola plant needs 5 to 8 true leaves and 6 to 8 inches of fall growth.

Several questions have been asked about the effects of dry soils on survival going into the winter. This will ultimately depend upon plant growth in the fall, the severity of the winter, and whether timely precipitation is received. Canola that is well established with a thick crown and robust root system has the greatest chance to survive a cold winter in dry soils. On the other hand, canola that has too much top growth (2 feet or more) can use up what little moisture is available. Canola that emerged late with a weak root system is at the greatest risk for winterkill in dry soils.

Winter canola plot in mid-October, at the appropriate size for the winter hardening process. Photo by Scott Dooley, K-State Research and Extension.

The winter hardening process

Winter canola must go through a winter hardening process. This begins in the rosette stage after several days of near-freezing temperatures. At these temperatures, plant growth is slowed, resulting in smaller cells with a higher concentration of soluble substances more resistant to frost damage. Hardened winter canola can withstand a certain amount of time with temperatures below 0° F, depending on the cultivar. However, extended periods of temperatures below 0° F without snow cover may be detrimental to survival. Thus winter survival should improve whenever snow cover is present.

The periodic cold nighttime temperatures have started the hardening process this fall. Early growth was vigorous where soil moisture was adequate, but growth has recently slowed because of the below freezing temperatures and dry soils. When average daily temperatures drop into the lower 40s and 30s, winter canola begins to take on an overwintering appearance. This is the natural hardening process as top growth is lost.
Factors involved in the “un-hardening” of canola

Ultimately, it may not be the cold temperatures per se that cause winterkill but the rapid fluctuations in temperature, which can be a common occurrence in Kansas during the winter. Canola can “un-harden” when temperatures increase for an extended period of time, but the effect of fluctuating temperatures during the winter is complicated.

Research conducted by K-State indicates these winter warming trends can actually have a positive effect on winter survival in some ways. Green leaf tissue may increase metabolic activity, rejuvenating the overwintering plants. This partly explains why plants growing in the field can survive colder temperatures than plants acclimated at continuous cold temperatures in a controlled environment. As long as the warming trend is followed by a gradual cool down, the plants will re-harden.

Winterhardiness traits in canola cultivars

To increase canola’s consistency in the region, the canola breeding program at K-State continues to select for winterhardiness traits. Accessions possessing a longer vernalization period are being crossed into the germplasm pool. One theory on improving winter hardiness is that canola can harden more easily after a winter warming trend prior to the vernalization requirement being reached. Therefore, extending the vernalization requirement may allow plants to withstand more variations in temperature during the winter months.

Winterhardiness remains an important trait to consider when selecting a cultivar for any canola cropping system. The average winter survival is 95 percent for varieties entered in testing across Kansas over the past three growing seasons. Differences exist, however, so decisions should be based on results from multiple years and locations. Remember that there are other factors to consider when selecting a variety or hybrid including: yield potential, seed oil content, maturity, lodging tolerance, disease resistance, and herbicide tolerance to name a few.
Summary

When planted on time and managed appropriately, Kansas growers can expect winter survival to be greater than 90 percent in most years.

When scouting your canola periodically this winter, check for a green, healthy crown. If you find that, then expect to see a blooming canola field this spring. Growth will take off when average daily temperature is 40° F or greater in the spring.

-- Mike Stamm, Canola Breeder
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4. Comparative Vegetation Condition Report: November 13 – 26

K-State’s Ecology and Agriculture Spatial Analysis Laboratory (EASAL) produces weekly Vegetation Condition Report maps. These maps can be a valuable tool for making crop selection and marketing decisions.

Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5N1ggw
http://www.youtube.com/watch?v=tUdOK94efxc

The objective of these reports is to provide users with a means of assessing the relative condition of crops and grassland. The maps can be used to assess current plant growth rates, as well as comparisons to the previous year and relative to the 21-year average. The report is used by individual farmers and ranchers, the commodities market, and political leaders for assessing factors such as production potential and drought impact across their state.

NOTE TO READERS: The maps below represent a subset of the maps available from the EASAL group. If you’d like digital copies of the entire map series please contact Kevin Price at kpprice@ksu.edu and we can place you on our email list to receive the entire dataset each week as they are produced. The maps are normally first available on Wednesday of each week, unless there is a delay in the posting of the data by EROS Data Center where we obtain the raw data used to make the maps. These maps are provided for free as a service of the Department of Agronomy and K-State Research and Extension.

The maps in this issue of the newsletter show the current vegetation conditions in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:
Map 1. The Vegetation Condition Report for Kansas for November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that photosynthetic activity continues to decline as plants move into dormancy. The greatest activity is still in east central Kansas, where drought conditions are less severe and temperatures have been warmer.
Map 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for September November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that east central and southwest Kansas have the biggest increase in biomass productivity. Northwest and parts of south central Kansas have the greatest decrease. Barber and Harper counties in south central Kansas are particularly low. These counties are included in the area of exceptional drought in south central Kansas.
Map 3. Compared to the 23-year average at this time for Kansas, this year’s Vegetation Condition Report for November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that Barber and Harper counties are the most below-average in biomass productivity. Parts of Hodgeman and Ness counties in western Kansas and parts of east central Kansas are slightly above average in photosynthetic activity. These areas saw beneficial moisture in late September and those impacts on vegetation are still visible.
Map 4. The Vegetation Condition Report for the Corn Belt for November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the northern portion of the region has had some snow during the period. Only southwestern Missouri and parts of northern Kentucky still have light photosynthetic activity.
Map 5. The comparison to last year in the Corn Belt for the period October 23 – November 5 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that there has been a big decrease in biomass production in the Northern Plains. Western Minnesota is particularly visible, as is the eastern portion of the region. Note there is a splice line in eastern Ohio that affects the comparison in that region.
Map 6. Compared to the 23-year average at this time for the Corn Belt, this year’s Vegetation Condition Report for November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that parts of Minnesota, northern Wisconsin and Upper Michigan have the biggest departures. While there has been snow in the region, it is much less than average. For example, Marquette, Michigan had 14.6 inches in November. Normally, it would have 24.3 inches.
Map 7. The Vegetation Condition Report for the U.S. for November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the area of active photosynthesis is shrinking. Noticeable is the low biomass productivity along the Central Mississippi Valley. Low water levels along the Mississippi have had a negative effect on the vegetation, as well as on barge traffic.
Map 8. The U.S. comparison to last year at this time for the period November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the Northern Plains has much lower photosynthetic activity than last year. Reports are that winter wheat emergence is below average. Snowfall also has been above average for this time of the year. For example, Langdon, South Dakota reports a snow depth of 4.6 inches for November. Average is 2.6 inches and last year saw only 0.9 inches.
Map 9. The U.S. comparison to the 23-year average for the period November 13 – 26 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the Pacific Northwest has the greatest increase in biomass production, while parts of North Dakota and Southern Texas have the greatest decrease. Along the Cascades, the recent weeks have been wetter than average and the snow level is at a higher elevation. In contrast, the snow depths in North Dakota are running above average for this time of year. In southern Texas, drought is the driving factor for lower biomass productivity. The growing season is still active in this region, but moisture has been limiting. Much of the area from Brownsville north to Alice is in extreme to exceptional drought conditions.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompson@ksu.edu.