

Extension Agronomy

eUpdate

08/01/2014

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 cthompso@ksu.edu.

eUpdate Table of Contents | 08/01/2014 | Issue 468

1. Methods for estimating corn yield potential at this time of year	
2. Correlation of soil test nitrate level, N rates, and wheat yields	12
3. Fall planting of alfalfa	18
4. Canola School scheduled for Aug. 7 in Sedgwick County	20
5. Southwest Research-Extension Center Cropping Systems Field Day, Aug. 28	22

1. Methods for estimating corn yield potential at this time of year

Most corn in Kansas is at a stage of growth now that allows us to begin to make reasonable estimates for corn yield potential. If no ear was formed within a week or two after pollination, then that specific corn plant will remain "barren" till the end of the season. In that unfortunate situation, you only need to choose whether to harvest it for silage or leave it in place for grazing the residue.

The number of potential kernels per ear can be adversely affected either before silking time (Figures 1 and 2), if no potential ovule develops, or after silking. After silking, kernel numbers are reduced under any or all of the following conditions:

- If the fertilization was not effective (unpollinated ovules).
- If there is abortion of the fertilized ovules.
- If there is early abortion of developing kernels (before or at milk stage, R3 stage) (Figure 3).



Kansas State University Department of Agronomy 2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506 www.agronomy.ksu.edu | www.facebook.com/KState.Agron | www.twitter.com/KStateAgron



Figures 1 and 2. Determination of the potential kernel number in corn ears as seen under a microscope (left) and magnifying glass (right). The tip kernels are the first one to start the abortion process under any environmental (abiotic) stress. Photos by Ignacio Ciampitti, K-State Research and Extension.

If ears are present a week or two after silking, producers can get a reasonable yield estimate by the time the corn plants are at the milk or dough stages. Before the milk stage, it is difficult to tell which kernels will develop and which ones will be aborted. The milk stage takes place about 15-25 days after flowering time (depending on the environmental conditions), and we can easily recognize this stage by opening the husk. In the milk stage, a milky white fluid will be evident when the kernels are punctured with a thumbnail.



Figure 3. Early (top of the ear, light color) and late kernel abortion (mid-section of the ear, brown coloration). Photo by Ignacio Ciampitti, K-State Research and Extension.

Farmers can get some estimate of the failure or success of the pollination process by examining several corn ear silks. Pollination is successful when silks turn brown (R2 stage, kernel blister stage) and when they can be easily detached from the ear structure as husks are removed. If the silks remain green and are still attached to the ear, growing several inches in length, pollination has failed (Figure 4). In this situation, the ovules will not be fertilized, and kernels will not develop.



Figure 4. Unpollinated silks have grown in several inches in length. Photo by Ignacio Ciampitti, K-State Research and Extension.

Estimating yields using "yield component method"

The concept of estimating yields using the "yield component method" has advantages and disadvantages. The primary advantage is that it can be used early enough in the crop growing season (milk stage, R3) and involves the assumption that the kernel weight is "constant." The method only estimates the "potential" yield because the kernel weight component is still unknown until the crop reaches maturity (R6 stage).

Estimating potential corn yield using yield components is calculated using the following elements:

1) Total number of ears (ears per acre): This is determined by counting the number of ears in a known area (Figure 5). With 30-inch rows, 17.4 feet of row = one-thousandth of an acre. This is probably the minimum area that should be used. The number of ears in 17.4 feet of row x 1,000 = the number of ears per acre. Counting a longer length of row is fine, just be sure to convert it to the correct portion of an acre. Make ear counts in 10 to 15 representative parts of the field or management zone to get a good average estimate (in order to fairly represent the field variation). The more ear counts you make (if they are representative of the rest of the field), the more confidence you have in your yield estimate.



Figure 5. Total number of corn ear per unit area. Photo by Ignacio Ciampitti, K-State Research and Extension.

2) Final kernel number per ear: Count the number of rows within each ear and the number of kernels in each row (Figure 6). The final number of kernels per ear is calculated by multiplying the number of rows by the number of kernels within each row. This is just a quick estimation of the potential yield. The number of kernels within each row is not standard and can vary from row to row (more if a large proportion of kernels aborted, "abnormal ears"). Do not count aborted kernels or the kernels on the tip of the ear; count only kernels that are in complete rings around the ear. Do this for every 5th or 6th plant in each of your ear count areas (but the more you can count, the more precise will be the estimation). Avoid odd, non-representative ears.





Figure 6. Two different size of ears with similar number of rows (16 rows in total) but different

Kansas State University Department of Agronomy 2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506 www.agronomy.ksu.edu | www.facebook.com/KState.Agron | www.twitter.com/KStateAgron kernel number per row and kernel sizes (upper photo). The lower photo shows the determination of rows per ear from a vertical position (20 rows in total). Final rows per ear is defined earlier in the season than kernels per row, and can be affected by the hybrid and growing conditions. Photos by Ignacio Ciampitti, K-State Research and Extension.

Finally the number of kernels per acre is estimated by multiplying the first and second components.

Kernels per acre = Ears per acre x Kernels per ear

Kernels per bushel: This will be more precisely defined at maturity. For this case, common values range from 75,000 to 80,000 for excellent grain filling conditions, 85,000 to 90,000 for average, and 95,000 to 105,000 for poor conditions. The best you can do at this point is estimate a range of potential yields depending on expectations for the rest of the season.

Example:

For corn in 30-inch rows with an average total number of ears in 12 areas of the field (17.4-foot lengths of row) of:

Number of ears = [(25 + 24 + 22 + 21 + 24 + 26 + 20 + 21 + 22 + 20 + 25 + 26)]/12 = 23 (a)

An average of 23 ears were counted within the 17.4-foot lengths. This can be scaling up to an acre basis by multiplying the number of ears by 1,000 (constant factor if the counts were taken in a 17.4-foot length).

Ears per acre = $23 \times 1000 = 23,000$ (b)

From those 23 ears, we will take between 2 and 5 ears to calculate the rows per ear and the kernels per row. The average number of rows was 14 with 27 kernels per row.

Kernel number per ear = 14 rows per ear x 27 kernels per row = 378 (c)

The final number of kernels per acre is the outcome of the multiplication of (b) ears per acre and (c) kernel number per ear.

Kernels per acre = 23,000 ears per acre x 378 kernels per ear = 8,694,000 (d)

Kernels per bushel

Under hot, dry conditions, grain filling duration and biomass translocation from the whole plant to the ear (kernels) can be severely affected. Otherwise, a reasonable value to use is about **105,000** kernels per bushel (e).

The final number of kernels per bushel is affected by diverse factors such as genotype, management practices (for example, plant density), and the environment. Plant density can strongly affect the kernel weight and the number of kernels per bushel. Lower plant densities (if growing conditions are optimum) will result in lower values for kernel number per bushel. Also, expect a lower kernel

number per bushel as N is more deficient. More information regarding the influence of these management practices on the kernel weight and the number of kernels per bushel is available from an article titled "Corn Grain Yield Estimation: The Kernel Weight Factor" from Dr. Tony Vyn, Purdue University, at: <u>http://extension.entm.purdue.edu/pestcrop/2010/issue22/index.html#corn</u>

Final yield: Calculation of bushels per acre

The final calculation of the potential yield to be obtained at the end of the season is simply the outcome of dividing the component (d) by (e).

Bushels per acre = 8,694,000 kernels per acre ÷ 105,000 kernels per bushel = ~83

In this example, if projected conditions prove to be accurate, the corn should obviously be kept and harvested for grain. From previous experiences, the yield component method of estimating yields often seems to provide optimistic outcomes (slightly overestimation). If the conditions during the reproductive period are predicted to worsen (severe heat stress and lack of precipitation); then the kernel weight can be reduced, and the number estimated for component (e), kernels per bushel, should be higher. That will reduce the yield expectations.

New technologies for estimating corn yields: App

If you have smartphone or tablet devices, there is a "free" App that can provide assistance in estimating corn yield at on-farm scale. The App, developed by the University of Wisconsin, is named "Crop Calculators for Corn" and can be downloaded at: http://ipcm.wisc.edu/apps/

The Crop Calculators App has a section for estimating yields "Grain Yield Estimator." In that section only four inputs are needed for predicting the final yield: (1) plants per 1000th acre (17.4-ft length row); (2) rows per ear; (3) kernels per row; and (4) kernel weight, or mass. The last factor refers to the individual kernel weight for corn and it is expressed in mg per kernel. This factor normally varies from 150 to 400 mg per kernel. If the conditions from the time the estimate is made until harvest will probably be favorable, then the "kernel mass" component should be a higher number (e.g., 300 mg per kernel). On the opposite end, if conditions are unfavorable and it looks likely there will be a short-grain filling period, then this factor should be a lower (e.g., 180 mg per kernel). This factor will be ultimately defined at maturity, but a projection can be used based on forecasted weather conditions for the remainder of the season.

Links with further discussions on the yield estimation can be found at:

http://corn.osu.edu/newsletters/2010/2010-25/201cpredicting201d-corn-yields-prior-to-harvest The Ohio State University

http://www.ca.uky.edu/agc/pubs/agr/agr187/agr187.pdf University of Kentucky

http://www.agry.purdue.edu/ext/corn/news/timeless/yldestmethod.html Purdue University

http://corn.agronomy.wisc.edu/AA/pdfs/A033.pdf

Ignacio Ciampitti, Cropping Systems and Crop Production Specialist <u>ciampitti@ksu.edu</u>

2. Correlation of soil test nitrate level, N rates, and wheat yields

Soil testing for nitrate-N in the fall for making nitrogen (N) recommendations on winter wheat is a valuable practice, particularly when using 24-inch profile sampling. Unfortunately, few farmers utilize this tool, and its value has been questioned in some areas due to the potential for overwinter N loss. However, with the exception of sands, N losses over winter in Kansas are normally quite low due to our low rainfall in December, January, and February.

To evaluate the relationship between wheat yield and fall soil nitrate-N -- and to determine if it is still a viable practice to utilize in N management of wheat -- we summarized data from 26 different N management experiments conducted across Kansas from 2007 through 2014. Most were from 2010 through 2013.

The driving force behind this study is the growing interest in improving N management in winter wheat production. Recent efforts have been focused on improving nitrogen use efficiency (NUE), or the portion of the fertilizer N we apply which is used by the plant. This has resulted in the creation of N fertilizer products designed to reduce N loss, optical sensors that can evaluate wheat's N status, and changes in methods and timing of N applications. With so many new practices incorporated into N management systems, older practices are starting to be considered dated and discarded.

Taking fall soil profile-N samples has been a recommended practice for making an N recommendation for winter wheat for many years. However, due to the mobility of nitrate-N in the soil, soil test values observed in the fall may be completely different than values observed in the spring, particularly on soils prone to leaching. Because many producers wait until spring greenup to make their N application, does soil sampling in the fall for nitrate-N really provide useful information for N management in wheat? That's a legitimate question.

The objective of our study was to evaluate the relationship between N fertilizer response by wheat and fall soil nitrate-N and determine if it is still a viable practice to utilize in N management of wheat.

Procedures

Data were drawn from 26 dryland wheat experiments conducted in 2007 through 2014 throughout Kansas in cooperation with producers and Kansas State University experiment stations. Locations included Manhattan, Tribune, Partridge, Johnson, Randolph, Rossville, Ottawa, Sterling, Pittsburg, Silver Lake, Solomon, and Gypsum.

Soil samples to a depth of 24 inches were taken prior to planting and fertilization. Samples from 0 to 6 inches were analyzed for soil organic matter, phosphorus, potassium, pH, and zinc. Soil profile 0- to 24-inch samples were analyzed for nitrate-N, chloride, and sulfate. Fertilizer needs other than N were applied in the fall at or near seeding.

Results

1) Analysis of yields taken from plots that received no N fertilizer shows a strong positive relationship with fall soil profile nitrate-N (Figure 1). Wheat yields increased rapidly as soil N levels increased to about 80 pounds soil N per acre, and then leveled off.



Figure 1.Relationship between fall soil profile nitrate-N level and wheat yield with no N fertilizer applied

2) We then converted check plot yields to a relative yield, or percentage of the maximum fertilized yield obtained at each location (Figure 2). The results reveal not only the yield of the check plot, but also the N responsiveness of the site. This shows that at low soil nitrate levels, sites respond well to applied fertilizer. When fall soil profile nitrate-N levels are greater than 80 to 100 lb/acre, relative yield is approaching 100%, and it is unlikely the site will respond to additional fertilizer N applied in the spring.



Figure 2. Relationship between fall soil profile nitrate-N and Relative Yield, or percent check plot yield of the maximum obtained with fertilizer at each site.

3) A third way to show this relationship between fall soil nitrate and N response is to calculate the Delta Yield, or the increase in yield obtained from the addition of fertilizer at each site. This is a good measure of N responsiveness of an individual research site. The relationship between fall profile N level and Delta Yield is shown in Figure 3. It is clear from this graph that at low soil nitrate levels in the profile, sites respond well to applied nitrogen fertilizer. However, as the profile N level increases beyond 75 to 80 pounds N per acre, little or no N fertilizer response was found.



Figure 3. Increase in yield due to N fertilization, Delta Yield, as a function of soil N level

4) A commonly used way to measure the efficiency of N use is to determine the amount of N fertilizer required to produce one additional bushel of yield. This relationship is shown in Figure 4.



Figure 4. Pounds of N fertilizer required per bushel of yield increase at different levels of N responsiveness, or Delta Yield.

On highly N-responsive sites, those with a large Delta Yield, the amount of N required to increase yield by one bushel is relatively low, near the 2.4 pounds N per bushel used in the K-State fertilizer recommendations. However, as the yield response decreases, the amount of N required to obtain that response increases dramatically. This relationship provides a good explanation of why fertilizer recommendations are generally made not to obtain the maximum yield, but rather the economic optimum yield. The efficiency of squeezing out those last one or two bushels is just too low. The cost of the added fertilizer will exceed the value of the extra grain produced. A number of additional conditions such as drought, disease, and poor root growth can influence this relationship. Many of the new technologies being developed to enhance N management and NUE, should help reduce the pounds of N fertilizer required to obtain a bushel of N response.

Summary

Wheat yield with no N fertilizer applied was compared with fall nitrate-N levels and a strong relationship was established. Although new practices have been developed to improve N management in winter wheat, soil sampling in the fall for nitrate-N remains an important practice to manage N efficiently and can result in considerable savings for producers.

When soil sampling for N is not done, the K-State fertilizer recommendation formula defaults to a standard value of 30 lb/acre available N. In this particular dataset, the average profile N level was 39 lb N/acre. However the N level at individual sites ranged from 11 to 197 lbs N/acre. Most recommendation systems default to a standardized set of N recommendations based on yield goal

Kansas State University Department of Agronomy 2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506 www.agronomy.ksu.edu | www.facebook.com/KState.Agron | www.twitter.com/KStateAgron and/or the cost of N. Without sampling for N or using some alternative method of measuring the soil's ability to supply N to a crop, such as crop sensing, the recommendations made for N will be inaccurate, resulting in a reduction in yield or profit per acre and increased environmental impact.

Due to the drought of the past three years, there have been many situations where large amounts of N have been present in the soil at planting of wheat or summer crops such as corn or grain sorghum. Early samples requesting soil N tests from western Kansas coming to the lab are already showing high soil N levels from some areas. Failure to account for that valuable resource can result in excess foliage, increased plant disease, inefficient use of soil water, and reduced yield.

Soil sampling in fall for nitrate-N can have a significant impact on N recommendations for winter wheat, thus improving N management, and is still strongly recommended.

Dave Mengel, Soil Fertility Specialist dmengel@ksu.edu

Ray Asebedo, Agronomy Graduate Student ara4747@ksu.edu

3. Fall planting of alfalfa

Late summer and early fall are often the best times to plant alfalfa in Kansas. With the June rains in most areas of Kansas, there may be enough moisture to achieve good stand establishment in at least some fields. A fall-seeded crop is more productive during the first growing season than a spring-seeded crop. After the first season, however, yield potential is about the same.

Growers in northwest Kansas can plant as early as Aug. 10-15. Those in southeast Kansas can plant in mid- to late September. In other parts of Kansas, planting time is late August or early September.

Producers just need to plant early enough to have three to five trifoliate leaves before the first frost. Alfalfa is a three- to five-year or longer investment. Some producers shy away from alfalfa because of its high establishment cost and risk of stand failure. In the long run, however, it's relatively inexpensive, if amortized over the life of the crop.

If managed properly and if we have a good year in terms of weather, dryland alfalfa can produce four to six tons of forage per acre per year. Irrigated fields can produce 8 to 12 tons per acre per year.

When planting alfalfa, producers should keep the following in mind:

Test the soil. Alfalfa grows best in well-drained soils with a pH of 6.5 to 7.5. If the land needs lime, add it before planting. Apply the needed phosphorus and potassium, too. Phosphorus is an annual input.

Plant certified, inoculated seed. Inoculation helps alfalfa seedlings fix available soil nitrogen for optimum production.

Plant in firm, moist soil. A firm seedbed ensures good seed-soil contact; therefore, use a press wheel with the drill to firm the soil over the planted seed. No-till planting in small-grains stubble will usually provide a good seedbed.

Don't plant too deeply. Plant one-fourth to one-half-inch deep on medium- and fine-textured soils and three-fourths-inch deep on sandy soils. Don't plant deeper than 10 times the seed diameter.

Use the right seeding rate. Plant 8 to12 pounds of seed per acre of dryland in western Kansas, 12 to15 pounds per acre in irrigated medium- to fine-textured soils, 15 to 20 pounds per acre on irrigated sandy soils, and 12 to 15 pounds per acre of dryland in central and eastern Kansas.

Check for herbicide carryover that could damage the new alfalfa crop – especially when planting alfalfa no-till into corn or grain sorghum stubble. In areas where row crops were drought-stressed and removed for silage, that set up a great seedbed for alfalfa, but may still bring a risk of herbicide damage.

Choose pest-resistant varieties. Resistance to phytophthora root rot, bacterial wilt, fusarium wilt, verticillium wilt, anthracnose, the pea aphid, and the spotted alfalfa aphid is essential. Some varieties are resistant to even more diseases and insects.

More information about growing alfalfa in Kansas can be found in the *Alfalfa Production Handbook*. That information also is available on the web at: <u>www.ksre.ksu.edu/bookstore/pubs/c683.pdf</u>

Jim Shroyer, Crop Production Specialist Emeritus jshroyer@ksu.edu

Kansas State University Department of Agronomy 2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506 www.agronomy.ksu.edu | www.facebook.com/KState.Agron | www.twitter.com/KStateAgron

4. Canola School scheduled for Aug. 7 in Sedgwick County

A Winter Canola Risk Management School will be held Aug. 7, from 10 a.m. to 3 p.m. at the Sedgwick County Extension Education Center 4-H Hall, 7001 W. 21st St. North in Wichita.

The school provides an opportunity for producers to learn from university agronomists and industry experts about managing canola, which is relatively new to Kansas, and how it can fit into cropping systems in the south central part of the state.

Winter canola faced the same challenges as wheat last season. At the meeting, there will be a discussion of how the canola crop responded to the stressful conditions of this growing season, and how that may affect management decisions going forward.

Specific topics of discussion include:

- Varieties and Winter Survival
- Stand Establishment
- Nutrient Uptake
- Update on Winter Canola Crop Insurance
- Harvest Management

The school is free, with a lunch provided. For an accurate count for the meal, please preregister for the school by Tuesday, Aug. 5 by contacting Jackie Fees at the Sedgwick County Extension office, at <u>jfees@ksu.edu</u> or 316-660-0143.

The risk management school fulfills the requirements of a U.S. Department of Agriculture Risk Management Agency-sponsored grant titled "Bringing Risk Management Tools to Kansas Winter Canola Producers."

Mike Stamm, Canola Breeder mjstamm@ksu.edu



Figure 1. Map to Sedgwick County Extension office in Wichita

5. Southwest Research-Extension Center Cropping Systems Field Day, Aug. 28

Farmers, ranchers and anyone interested in how crops are grown in southwest Kansas can hear the

latest in key research findings at the Southwest Research-Extension Center Field Day 2014 on Aug. 28

in Garden City.

The day starts with registration at 8 a.m. and the program beginning at 9:15 a.m. at 4500 E. Mary St. in Garden City. The event features tours and seminars by K-State Research and Extension specialists and researchers, agricultural product displays and a sponsored, complimentary lunch.

Topics of the two field tours, plus seminars include:

- Comparisons of Weed Control in Irrigated Corn with 60 Herbicide Tank Mixes
- Herbicide-Resistant Inzen Sorghum for Postemergence Grass and Broadleaf Weed Control
- Weed Control with 37 Herbicide Tank-Mix Options for Irrigated Sorghum
- Corn Insect Caterpillars and Bt Hybrids: Controls, Efficiency, and Cross Pollination
- Effects of Drought-Tolerant Corn on Spider Mites
- Integrating Summer Annual Forage into Cropping Systems
- Advances in Remote-Sensing of Crop Water Stress for Irrigation Management
- Using Crop Models for Assessing Limited Irrigation Management Strategies
- Revisiting Soil Moisture Sensors
- Fireflies in Western Kansas

The field tours will be repeated so all attendees have an opportunity to participate in both.

Continuing education credits are available for commercial pesticide applicators.

More information is available by calling 620-276-8286.



Figure 1. Map to Southwest Research-Extension Center in Garden City