# Corn & Soybean News

**February 2023**

Volume 5, Issue 2

COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT

Grain and Forage Center of Excellence

University of Kentucky


# Thoughts on Corn Nitrogen Sources for 2023 – What Really Matters?

Corn planting is fast approaching, and pre-plant nitrogen (N) applications will soon start. One question that arises every year is the "best" source of N to use for corn production. This year there is a pricing anomaly driving the question – prices for anhydrous ammonia (AA) and urea. In western Kentucky, the cost of urea is $0.15 to $0.20/lb N cheaper than the cost of AA. In prior years AA has been the cheapest source of N. Some corn producers are rethinking their N program – a change in N source can cause changes to the entire N management protocol. Other important factors in the decision include local availability of different N sources and appropriate application equipment; and expected soil, field, and weather conditions that could drive the different N losses and necessitate addition an N loss inhibitor, which raises the cost.

That said, <u>all major corn fertilizer N sources (Table 1) can be effectively utilized if properly managed</u>. We know enough to make any N source agronomically equal (same yield at the same N rate) as long as we optimize management to deal with the specific strengths and weaknesses of each fertilizer material. Growers who are comfortable with one N source often have a good grasp of what they need to do for the particular material they are using. This article is to remind ourselves of needed management considerations when thinking about a corn N source change.

**Table 1. Pros and Cons for the Major Nitrogen Sources Used for Corn Production in Kentucky.**

| Source | Pros | Cons |
|---|---|---|
| Anhydrous Ammonia (82% N) | Highest N concentration, retards nitrification initially | Hazardous to humans, large losses with improper application |
| Urea (46% N) | Low storage and handling costs, fast, easy application | Ammonia volatilization losses high under certain conditions. |
| UAN Solutions (28-32% N) | Easy to handle and transport, can mix with other liquid materials | Salt out potential in cold environments |
| Ammonium Nitrate (34% N) | Easy to handle, no volatilization loss concerns | Low N content, explosive potential, scarce, expensive |

***Pre-Plant/At-Plant Application.*** Anhydrous is a pre-plant N favorite because of its high analysis and tendency to retard initial nitrification after injection. Injection is required to minimize ammonia gas loss and also avoids fertilizer N immobilization by soil microbes as crop/cover crop residues with a high C:N ratio are decomposed. This causes injected AA to be a heavy pre-plant N source choice for no-till corn after corn, or for no-till corn after a good rye cover crop that has been/is being terminated. Anhydrous injection is slower (acres/day), causing AA users to begin application 3 to 6 weeks prior to planting. Anhydrous N applied this early, relative to significant corn N uptake (4 to 6 weeks after planting), often benefits from a nitrification inhibitor, either nitrapyrin (N-Serve) or pronitridine (Centuro).

Pre-plant N sources also include broadcast dry urea, dry ammonium nitrate (AN), and liquid urea-ammonium nitrate (UAN) solutions, the latter can be used as a carrier for "weed and feed" herbicide applications. Dry AN is not widely available in large quantities, is usually significantly more expensive, and is not widely used in corn production. Broadcasting these N sources, especially urea, has the advantage that the producer doesn't have to start so early with pre-plant N application. Dry urea spreading rates cover a lot more acres per day. This means that the earliest applied pre-plant urea-N is not "out in the field" as long, exposed to weather driven N loss. A corn grower using urea can more easily keep up with their planter(s). Urea is more likely to be custom applied, saving the producer time (especially important when planting) and equipment investment.

There might be concern that urea and UAN-urea will interact with the soil and residue-based urease enzyme, losing N via ammonia volatilization. This is unlikely in the usual pre-plant time frame, from mid-March to mid-April, regardless of what primary tillage system is used. The weather is cool (doesn't sustain 70 F for more than a few days) and moist (rains every 3 to 5 days). Lower temps slow enzyme activity and the rainfall 'incorporates' urea so there is little worry of volatilization loss. Immobilization is the greatest N loss problem with broadcast urea/AN/UAN for no-till corn after corn or a heavy rye cover crop and this challenge is reduced for UAN by injecting or dribbling the product rather than broadcasting. If the time period is wet, and the soil is not well-drained, potential pre-plant/at-plant N loss from denitrification and nitrate leaching can be important, regardless of the N source. A good nitrification inhibitor is then needed for both urea (nitrapyrin-Instinct NXTGEN) and UAN (pronitridine-Centuro).

***Denitrification*** is the most often observed N loss mechanism in Kentucky corn production, especially with pre-plant/at-plant fertilizer N. This loss of nitrate-N occurs when soils become excessively wet for an extended period of time. The loss can be reduced by slowing nitrification, the transformation of ammonium-N to nitrate-N. Nitrate, like ammonium, is available to the plant but nitrate is more transient in the soil profile and subject to leaching and denitrification losses. Leaching of nitrate is not as likely in Kentucky, even on well-drained soils, due to the presence of red/red-brown clay subsoils common in the limestone derived soils. These red subsoils exhibit anion exchange capacity, a positive charge that holds negatively charged nitrate anions and gives crop roots a greater chance to utilize that nitrate. Denitrification occurs when the soil is water-logged (more likely with less than well-drained soils), and oxygen becomes limiting for soil microbial activity. These microbes use nitrate instead and release $N_2$ and $N_2O$ into the atmosphere. Leaching and denitrification losses are reduced by maintaining fertilizer N as ammonium-N. The nitrification inhibitors slow/reduce transformation of ammonium to nitrate for 2-3 weeks, allowing greater ammonium residence time and potential plant uptake, even as ammonium is being transformed to nitrate.

***Post-Emergence Application.*** All N sources can be applied post-emergence (side-dressed/top-dressed between V4 and V8), but anhydrous still has to be injected, which can be a bit more challenging with narrower row spacings or twin-row planted fields. Both UAN and AA injection are slow. Urea has more flexibility - can be top-dressed (faster) or surface side-dressed (slower). Liquid UAN is usually injected (slower) or dribble banded (somewhat faster) to avoid leaf burn. Conditions are generally warmer and rainfall less regular - a good volatilization-urease inhibitor (Table 2) might be needed for surface applied urea or UAN (especially with no-till corn).

***N Loss Inhibitors*** are added to the fertilizer prior to application and should be considered integral to N source behavior and value/cost. Generally, inhibitors useful in corn N management come in two classes, urease-volatilization inhibitors and nitrification inhibitors (Table 2). Again, growers are reminded that urease driven volatilization losses are lower when pre-plant fertilizers are being applied due to cooler temperatures and the greater likelihood of rain sufficient to incorporate the urea. If a urease inhibitor is needed, both the active ingredient and its use rate must be chosen carefully for effective N loss inhibition. There are many products that claim to inhibit volatilization. Urease inhibitors tend to be more numerous than effective. The use of a nitrification inhibitor might be warranted because the full rate of N is to be applied pre-plant, the field soil drainage class is less than well-drained, and/or the greater length of time between when N is applied, prior to planting, and significant crop N uptake (V5).

To calculate the amount of a product to be added to a fertilizer material for effective inhibition, the user will need to know the active ingredient concentration in the product and, if the product is a liquid, the product density (weight) per gallon. Example: Product XYZ contains 30% NBPT and has a density of 10 lb per gallon. To deliver 1.5 lb ai/ton urea, you need to apply 1.5/(0.3 x 10) = 0.5 gallon (2 quarts) per ton.

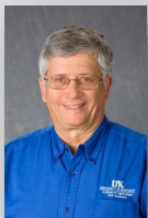
Table 2. Inhibitors Shown Effective Under Field Conditions In Peer Reviewed Research.

| Active Ingredient (ai) | Inhibitor Class | N Source Applied To | Use Rate |
|---|---|---|---|
| NBPT (Agrotain and other generics) | urease | urea, UAN | 1.3 – 1.6 lb NBPT* |
| NPPT (Limus – also contains NBPT) | urease | urea, UAN | 0.26 – 0.38 lb NPPT & 0.75 – 1.15 lb NBPT* |
| Duromide (Anvol – also contains NBPT) | urease | urea, UAN | 0.94 lb Duromide & 0.56 lb NBPT* |
| Nitrapyrin (N-Serve, Instinct NXTGEN) | nitrification | AA (N-Serve); urea, UAN (Instinct NXTGEN) | 0.25 – 1.0 lb ai/acre |
| Dicyandiamide (DCD) | nitrification | urea (SuperU), UAN | 12 – 17 lb ai/ton |
| Pronitridine (Centuro) | nitrification | AA, UAN | 3.725 lb ai/ton UAN; 7.45 lb ai/ton AA |

*Urease inhibitor rates are given as lb active ingredient (ai) per ton urea. As UAN is only about 50% urea, inhibitor use rates per ton UAN are one-half those shown.

***Other Considerations.*** Experience has shown that there are probably more dry urea application errors with spinner spreaders than with AA injection equipment. Still, we do see fields where the anhydrous applicator did a poor, uneven, application. Any N application tool can mess up – and this seems to depend on machine maintenance, pre-season calibration, and in-season performance monitoring. One thing the broadcast urea user can do is to ask for the rate to be cut in half and the field then double spread.

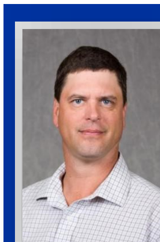
***Summary.*** Going back to the original question posed – what N source should I use for corn production in 2023? The decision should come down to equipment availability, N source availability, and N source cost, including any inhibitor. The overall cost should also include the cost of any change in N application management.



**Dr. John Grove**

Professor of Agronomy/

Soils Research and Extension



**Dr. Edwin Ritchey**

Extension Soils Specialist

(859) 562-1331

## The Kentucky Agriculture Training School has two new trainings coming soon.

### In-Depth Pesticide Mode of Action

February 23, 2023 (9:00 - 12:30 central)

- How herbicide resistance occurs
- How herbicides kill weeds
- Understanding how fungicides work
- The importance of insecticides mode of action and biorational approach for their use in IPM.

### Soil Fertility and Assessment

March 9, 2023 (8:30 -12:30 central)

- Improving predictions of phosphorus response in KY
- Information on soil-based rate recommendations, and
- How to determine what products work & if they are compatible in your production system.

These first two KATS trainings will be held at the Caldwell County Extension Office in Princeton, KY. The cost is $60 for each event, lunch is included. A full list of 2023 KATS workshops can be found at kats.ca.uky.edu/upcoming-workshops.

If you have questions about these or any KATS workshops, please contact Lori Rogers lori.rogers@uky.edu or 270-365-7541 ext 21317.

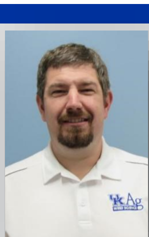
# What bugs you about using certain pest management methods? We need to know!

The University of Kentucky Grain Crops IPM Group is inviting you to take part in a survey of current grain crop pest management practices that you use on your farm or recommend to others. Although you may not get personal benefit from taking this survey, your responses may help us understand more about how the Grain Crops IPM group can best serve agricultural clientele now and in the future. This survey should take about 10 minutes to complete.

If you do not want to participate, you do not need to take the survey. If you do not feel comfortable answering certain questions, you may skip them and/or discontinue the survey at any time. You will not be penalized in any way for skipping questions or discontinuing the survey. Participation in the survey is voluntary and your decision on whether or not to participate will not affect your affiliation with the University of Kentucky. Please fill out the survey only if you are 18 years of age or older. Your response to the survey is anonymous which means no names, IP addresses, email addresses, or any other identifiable information will be collected with the survey responses. We will not know which responses are yours if you choose to participate. We will make every effort to safeguard your data, but as with anything online, we cannot guarantee the security of data obtained via the Internet. Third-party applications used in this study may have Terms of Service and Privacy policies outside of the control of the University of Kentucky.

Survey link: https://uky.az1.qualtrics.com/jfe/form/SV_6X2GCR3w2NvpOke

Please fill out the survey to the best of your knowledge. If you have questions about the survey, please feel free to contact Travis Legleiter at travis.legleiter@uky.edu.



**Dr. Travis Legleiter**
Assistant Extension Professor - Weed Science
(859) 562-1323

**Dr. Kiersten Wise**
Extension Plant Pathologist
(859) 562-1338

# Use Winter to for Preventive Maintenance on Your Sprayers

As winter begins to wind down, we need to get our equipment ready for the coming growing season. When it is time to begin spraying and planting, we don't want to spend precious time to fix and repair equipment. It is during this down time when we should do some routine maintenance on our sprayers. Spray equipment in poor repair can lead to poor application which will cost you money.

***Look for Leaks***

Before your start, put on a pair of gloves to protect yourself from pesticide residues. Begin by filling your sprayer with clean water, but before you engage the pump, look for leaks from around the pump, hoses, strainers, and nozzles. Pay particular attention to the hoses, as these often show signs of wear sooner than other more durable parts. Besides obvious leaks from hoses, inspect hoses for cracking and signs of dry rot as these can burst when pressurized. Places where hoses might crimp with folding booms are prone to cracking as hoses age. Engage the pump and look again for leaks. Check the pressure gauge and test the cutoff valves to be sure they are working.

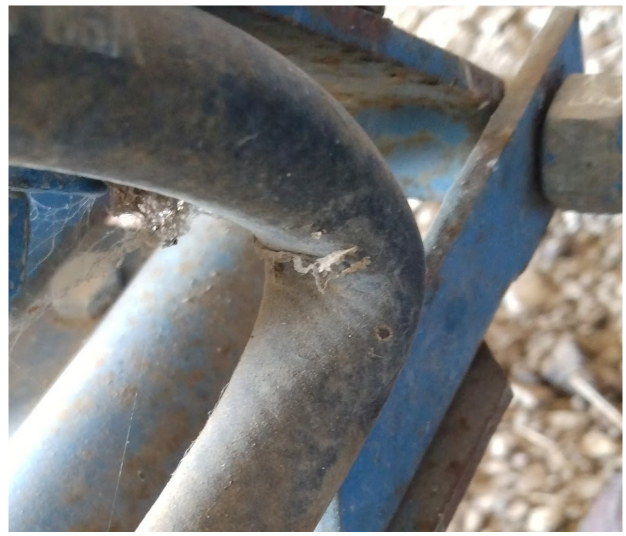


*Figure 1. Crimps in hoses may lead to cracking.*

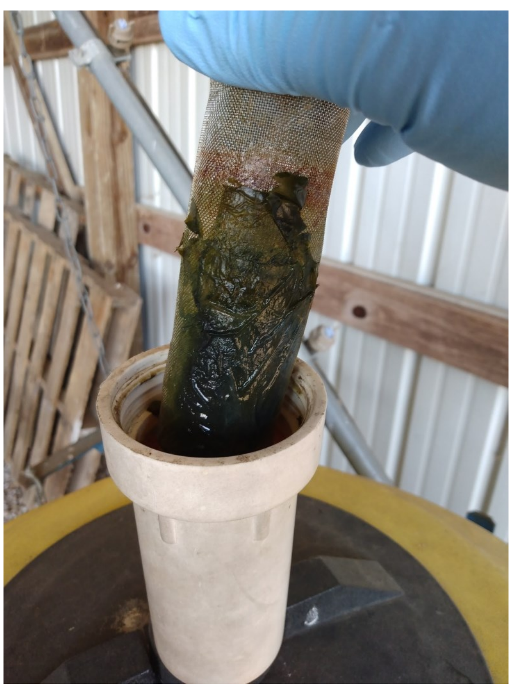


***Figure 2. Check strainers regularly and clean or replace them as needed.***

***Scrutinize Strainers***

The job of strainers is to keep gunk from reaching and plugging nozzles. With just routine use there can be significant debris buildup with the inline strainer from the tank or the individual strainers in front of each nozzle. Sometimes these can be cleaned with a soft brush, other times they need to be replaced.

***Next, the Nozzles***

All nozzles wear over time. This leads to increasing and irregular flow rate from nozzles and poor spray patterns. In place of uniform applications across a field, there may be streaks due to places of over and under applications. While some nozzles materials, such as ceramics and stainless steel, may be more resistant to wear, all nozzles will show signs of wear eventually.

Sprays containing abrasive materials such as wettable powders and flowables cause more wear to nozzles. Before conducting a catch test, be sure each of the nozzles are of the exact same type and are not mismatched. Start your sprayer with the clean water and observe the pattern from each of the nozzles, look for streaks and clogs. The pattern from each nozzle should be the same. Run a 30-second or 1-minute catch test for each nozzle, output from each nozzle should be within 5% of the average output from all nozzles. Nozzles that are worn or cannot be unclogged need to be replaced and the catch test repeated.

***Regularly Recalibrate***

Now that your sprayer is working properly, it needs to be recalibrated. As new strainers and nozzles can change the spray output. Calibration should be done at a minimum once a year, but for those that use a sprayer more frequent or after changing to different nozzles (going from flat fan to hollow cone for example) recalibration must be done more often. For instructions for calibrating a sprayer are in the Recordkeeping Manual for Private Pesticide Applicators.

**Ric Bessin**
Extension Entomologist
(859) 257-7456
Ric.bessin@uky.edu

# The Plant Disease Diagnostic Laboratory Wants to Hear From You!

The Plant Disease Diagnostic Laboratory (PDDL) The PDDL is inviting you to take part in a survey of current and future PDDL services and policies. Although you may not get personal benefit from taking this survey, your responses may help us understand more about how the PDDL can best serve agricultural clientele now and in the future. This survey should take about 10 minutes to complete. Your responses will help PDDL personnel understand what issues are important to you.

If you do not want to participate, you do not need to take the survey. If you do not feel comfortable answering certain questions, you may skip them and/or discontinue the survey at any time. You will not be penalized in any way for skipping questions or discontinuing the survey. Participation in the survey is voluntary and your decision on whether or not to participate will not affect your affiliation with the University of Kentucky. Please fill out the survey only if you are 18 years of age or older. Your response to the survey is anonymous which means no names, IP addresses, email addresses, or any other identifiable information will be collected with the survey responses. We will not know which responses are yours if you choose to participate. We will make every effort to safeguard your data, but as with anything online, we cannot guarantee the security of data obtained via the Internet. Third-party applications used in this study may have Terms of Service and Privacy policies outside of the control of the University of Kentucky.

Take the survey here:
https://uky.az1.qualtrics.com/jfe/form/SV_3lWR32WdBoZ9W8m?Q_CHL=email

Please fill out the survey to the best of your knowledge. If you have questions about the survey, please feel free to contact Kiersten Wise at Kiersten.wise@uky.edu.

**Dr. Kiersten Wise**
Extension Plant Pathologist
(859) 562-1338

# Stand Uniformity and Soybean Yield

Are precise plant-to-plant spacings in the row and uniform seedling emergence necessary for high soybean yield? The importance of precise uniform stands is well known in corn, but is it important for soybean? The short answer is NO!

Plant-to-plant spacing in the row (spatial uniformity) and the timing of emergence of individual seedlings (temporal uniformity) are determined by the characteristics of the planter, the planting process and the seed bed. The proportion of the seeds that germinate and produce emerged seedlings and the planting date also influence stand uniformity.

Spatial and temporal non-uniformity have the same effect on plant growth. Plants with wider in-row spacings or plants that emerge first (dominant plants) have access to more sunlight and grow faster than plants that are closely spaced or emerge later (dominated plants). The faster growing plants set more seeds than the slow growing plants. The effect on yield depends on the ability of the fast-growing dominant plants to produce enough 'extra' seeds to compensate for the reduced seed number on the dominated plants.

The key for soybean is that it can compensate - the early emerging (or widely spaced) plants produce enough 'extra' seeds to make up for the reduction in seeds on the late emerging (or closely spaced) plants so that the total seeds per acre and yield are not affected (compared to a perfectly uniform stand). The dominant plants have enough plasticity to make up for the loss of seeds on the dominated plants. Corn, on the other hand, usually cannot produce enough 'extra' seeds to make up for the loss on the dominated plants, so the seeds per acre and yield may be reduced.

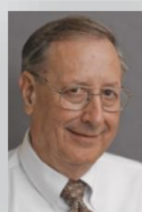
The difference between corn and soybean lies in their reproductive plasticity. Plasticity (or flexibility) refers to the ability of the plant to increase the number of seeds it produces when grown in more productive environments. Soybean plants are very plastic; they can easily increase the number of pods and seeds they produce by branching to increase the number of nodes per plant, by increasing the number of flowers per node, and by decreasing flower and pod abortion when grown in favorable environments.

Most modern corn hybrids are not very plastic; they seldom produce multiple tillers and they often have only one ear per plant. When all of the florets on that ear produce seeds, the plant can no longer increase seed number which limits the capacity of the dominate plants to produce the necessary 'extra' seeds. When the dominant plants in non-uniform stands cannot compensate, seed number per acre and yield are reduced. Corn hybrids that are more flexible (i.e., produce multiple ears or ears on tillers) would do a better job of maintaining seed number and yield in non-uniform stands.

We tested these relationships in a soybean field experiment where we planted every other seed in the row either 4- or 7-days after the original planting and compared it to a control where all seeds were planted at the same time. The early emerging plants in the 4-day delay treatment produced 86 seeds per plant vs. 52 seeds per plant on the delayed plants. Similar numbers for the 7-day delay treatment were 96 and 39 seeds per plant. The total combined yield of early and late emerging plants was the same as the uniform planted control in both years of the study. The soybean plant had the flexibility to adjust and maintain a constant yield in non-uniform stands.

It is important to note that soybean yield will be reduced if the variation of in-row spacing is so large that the plants cannot fill in the gap (creating a skip). If the gap is so large that you can see the soil when the soybean plants start flowering, the interception of sunlight by the plant community and yield will be reduced. Even a flexible plant like soybean can't compensate for gaps that reduce sunlight interception.

Interest in ultra-early plantings of both corn and soybean to increase yield have ballooned in recent years. Unfortunately, ultra-early plantings may reduce the uniformity of emergence and reduce corn yield. Low soil temperatures, often associated with these early plantings, delay emergence which increases non-uniformity of emergence. The longer the delay, the greater the non-uniformity. Low soil temperatures can also reduce the percentage emergence which would decrease spatial uniformity. Reducing average soil temperature from 68 to 58°F increased the time to 10% of final emergence of corn seedlings from 6 to 12 days in greenhouse and growth chamber experiments. This delay roughly doubled the non-uniformity of the resulting stand. Experiments with soybean produced similar results. Since soybean yield is not influenced by non-uniformity, planting soybean before corn in the early spring (as others have proposed) would reduce the effects of this temperature induced non-uniformity on overall-all yield. Planting in warm, moist soil and avoiding heavy rainfall before seedling emergence provides the best opportunity for rapid uniform emergence of both corn and soybean seedlings.



**Dr. Dennis Egli**
Professor Emeritus
(859) 218-0753

# Join us for an Open House

**UK Research and Education Center**
**February 21, 2023**
**9:00 AM-4:00 PM CST**

Our temporary offices are ready and we are excited for you to see them. Join us for an open house and light refreshments at the University of Kentucky Research and Education Center. You'll be able to talk with staff and faculty and tour the space. Join University of Kentucky President Eli Capilouto at 10 AM for a welcome message.

**348 University Drive | Princeton, KY 42445**

College of Agriculture, Food and Environment

# UPCOMING EVENTS

| | |
|---|---|
| Feb 21, 2023 | Open House at UK Research and Education Center |
| Feb 23, 2023 | KATS In-depth Mode of Action |
| March 8, 2023 | IPM Training School |
| March 9, 2023 | KATS Soil Fertility and Assessment |
| March 9-11, 2023 | National Commodity Classic - Orlando FL |
| May 09, 2023 | UK Wheat Field Day |
| May 18, 2023 | KATS Crop Scouting Clinic |
| June 7-8, 2023 | KATS Drone Pilot Certification Prep Course |
| June 29, 2023 | Pest Management Field Day - Princeton (IPM-Grain Crops) |
| July 13, 2023 | KATS Spray Clinic |
| Jul 25, 2023 | UK Corn, Soybean and Tobacco Field Day |