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1. Foliar nitrogen fertilizer products for wheat

Various foliar nitrogen (N) fertilizer products are being promoted as an option for spring fertilization of wheat. These products range in analysis and can include straight nitrogen products or mixtures of N plus other macro and micro nutrients. The straight nitrogen products will typically have an analysis similar to traditional liquid N fertilizers, such as 28 to 30 percent N.

One of the main differences between traditional UAN and the foliar products is that a certain percentage of the N in the foliar fertilizers is in some type of slow-release form. As a result, these specialty products are generally safer for application directly to the foliage in later stages of growth and result in less leaf burn than traditional UAN products. This has some appeal, especially where producers have been unable to get into the fields early and topdress applications have been delayed.

K-State has tested many different types of foliar N fertilizer products over the years. Foliar N fertilizer products are just as effective as traditional N fertilizers on a pound-for-pound basis, but they *are not more effective* than traditional N fertilizers. They can be applied in a broadcast spray application at later growth stages of wheat growth than traditional N fertilizer products without damaging the wheat. For that reason, they may have some value in situations where late applications of N are either necessary because earlier applications could not be made, or where a late application is desired in order to increase protein levels.

However, at the normal topdress time (prior to jointing), producers should simply compare a foliar product to a traditional N fertilizer product based on the cost of a pound of N per acre to determine which product gives the best value. Invariably, the foliar products will be several times higher in terms of cost-per-pound-of-N than the traditional N fertilizers. In unusual situations (well after jointing or when trying to increase protein levels), the foliar N products would have some premium value since traditional N products could not safely be used in a broadcast spray application.

To reduce the potential for leaf burn, there are alternative ways to apply traditional liquid N sources other than the standard spray nozzle. Streamer bars, a 10- to 15-inch long plastic bar which can be used with traditional spray booms in place of the nozzle, provide a solid stream of liquid fertilizer spaced every 5-6 inches. These streams of liquid greatly reduce foliar burn as compared to complete foliage coverage with standard flat fan spray nozzle. Broadcast granular urea also produces limited leaf burn as compared to sprayed UAN. In a study we conducted in 2008, applying 60 pounds of N as UAN sprayed on at Feekes 7 or 9 yielded 47 bushels per acre; broadcast urea at the same time yielded 51 bushels per acre, and UAN applied with streamer bars yielded 56 bushels per acre.

What kind of yield response can producers expect with later N applications, assuming the crop needs significantly more N? In 2009 a study was conducted to look at the effects of delayed N application using granular urea. The check plots, which received no N in fall or spring, yielded 46 bu/acre. In all the other plots 30 pounds of N was applied prior to planting. Applying an additional 60 pounds N at Feekes 4 (late tiller) produced 83 bu/acre; at Feekes 6 (jointing) 82 bu/acre; at Feekes 7 (second joint) 79 bu/acre, and at Feekes 9 (early boot) 65 bu/acre.

The bottom line is, there is still plenty of time to get N applied to wheat using traditional N products, especially if you put some N on last fall. As it gets later and the temperatures warm up, spraying liquid UAN solutions on wheat can result in leaf burn. Alternative application methods such as broadcasting granular urea or applying UAN with streamer bars are safer options. Foliar N products could also be used for later applications, but the limited amounts of N which can be applied based on the labels of many of these foliar products limits their use in situations where large amounts of N are needed.

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2. First hollow stem in wheat

As soon as wheat begins its first flush of growth in late winter or early spring, producers should start examining plants to determine if the wheat has reached the “first hollow stem” (FHS) stage. This stage occurs as the wheat switches from the vegetative stage to the reproductive stage of growth.

When the leaf sheaths become strongly erect, the growing point, which is below the soil surface, will soon begin to develop a tiny head. Although the head is quite small at this point, it has already established some important yield components. At this stage, the maximum potential number of spikelets is determined. Sufficient nitrogen (N) should already be available in the root zone at growth stage in order to affect the potential number of seeds per head.

Once the embryo head has developed, the first internode will begin to elongate pushing the head up through the leaf sheaths. This first internode will be hollow. This will be visible before you can actually feel the first node (joint, located just above the first internode). Prior to this stage the nodes are all formed but tightly packed together and hard to see.

FHS is the point at which a half-inch or so of hollow stem can first be identified above the root system and below the developing head. FHS occurs when the developing head is still below the soil surface, which means that producers have to dig plants out of the ground to do the examination.

To look for FHS, start by digging up some plants from fields that have not been grazed. Select the largest tillers to examine. Cut off the top of the plant, about an inch above the soil surface. Then slice the stem open from the crown area up. Look for the developing head, which will be very small. Next, see if you can find any hollow stem between the developing head and the crown area. If there is any separation between the growing point and crown, the wheat plant is at FHS. FHS will occur between a few days and a week or more prior to jointing, depending on temperatures.

If the wheat has reached FHS, cattle should be removed to prevent grain yield loss. Yield losses from grazing after FHS may be up to 1.25 bushels per day according to OSU data, although losses may not be this great for the first few days of grazing after FHS. Still, it is easy for producers to be late by a few days in removing livestock as they wait for obvious nodes and hollow stems to appear, and even the first few days can be significant.

Two things are observed when wheat is grazed too long: 1) fewer heads per acre because the primary tiller has been removed and 2) smaller and lighter heads than expected because leaf area has been removed. As cattle continue grazing, the wheat plant is stressed and begins to lose some of the tillers that would produce grain. A little later, if there is not enough photosynthate, the plant begins aborting the lower spikelets (flowers where seed develops) or some of the florets on each head. Finally, if there is not enough photosynthate during grain filling, the seed size will be reduced and if the stress is severe enough, some seed will abort.

Figure 1. First hollow stem. (Photo courtesy of Gene Krenzer, former Oklahoma State University Extension wheat specialist.)

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3. Alfalfa response to low and high pH levels

For optimum alfalfa production, soils should have a pH in the range of 6.5-7.5. If soil pH levels are either below or above those levels, stand establishment and production can be reduced. In Kansas, soil pH changes dramatically from east to west. Generally, soil pH is relatively low in the east and excessively high in the west.

Low pH effects

The following case is from Osage County in the summer of 2009, and was in consultation with Rod Schaub, Osage County Agent. The field was planted in the fall of 2008 and fertilized with 100 lbs of 18-46-0. Two adjacent fields, separated by a grass waterway, were planted and have been managed the same for at least the last 10 years (Figure 1). However, one field had a good stand of alfalfa while the other field had a large portion that was weak and dying. After visiting with the producer, it was determined that there were no herbicide, disease, or insect issues that would have caused a difference between the fields.

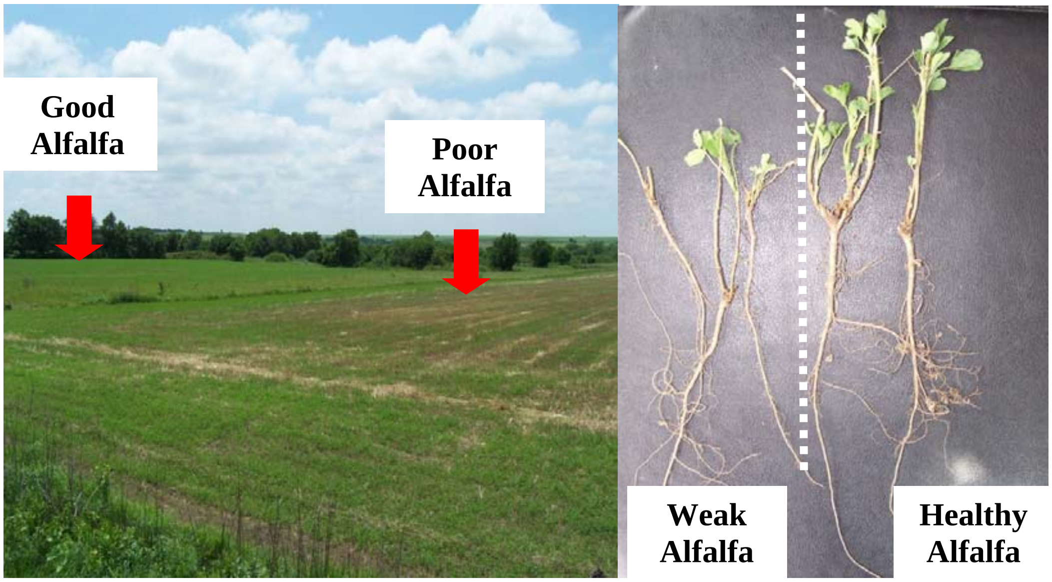

Figure 1. Adjacent fields of newly established alfalfa managed similarly, but one field had good establishment while the other had poor establishment (left picture). The field with the poor establishment actually had plants in a range of physiological condition. The photo on the right shows the root systems from weak and healthy plants in the field with the poor stand.
(Photos by Doug Shoup, K-State Research and Extension)

The field with the poor stand was not uniformly poor. There was a range of plant conditions in this field, from healthy to weak. Along the edge of the waterway in the poor alfalfa field, plants were noticeably healthier. After examining the roots, we found that nodulation was reduced severely in the weak alfalfa while the healthy alfalfa had fair nodulation (Figure 1).

Using a hand-held pH meter, measurements were taken across both fields. In the field with poor stands, we measured the pH level starting with the strip of relatively well-established alfalfa adjacent to the waterway and then 50 and 100 feet away from the waterway (Figure 2). Where the alfalfa was in better condition, the pH was 6.1. In the weaker alfalfa 50 and 100 feet away from the waterway, the pH was 5.9 and 5.7, respectively. In the small adjacent alfalfa field with good overall establishment, the soil pH was 6.4.

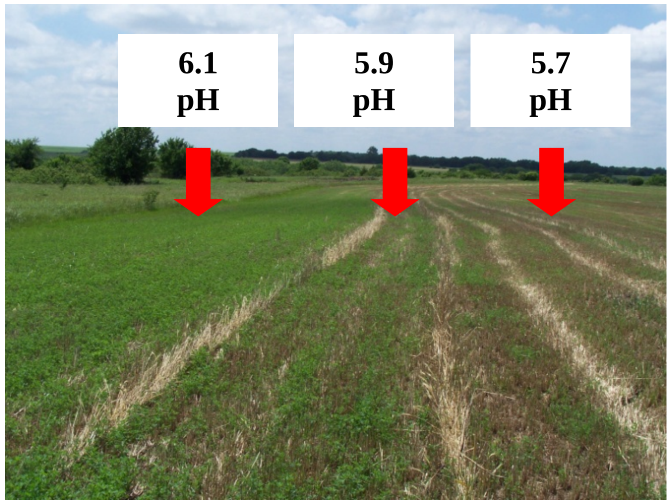

Figure 2. Differences in establishment of alfalfa based on differences in soil pH measured with a hand-held pH meter.

While taking the pH reading in the good field, we noticed a large amount of gravel in the soil. The producer remembered that the small field was the storage site for a large gravel pile when road construction had been done more than 20 years ago. We concluded that the differences in pH on these fields was caused by the gravel, and wind-blown dust from the gravel.

This field problem is a good reminder that it is very important to take a soil sample and correct any pH or fertility problems prior to establishing a new stand of alfalfa. Alfalfa is one of the more sensitive legumes to lower pH levels, as well as phosphorus and potassium deficiencies. The hand-held pH meter did a good job of showing the sensitivity of alfalfa to a gradient of lower pH levels. Although the alfalfa was able to establish and produce nodules in the marginal pH soil of 6.1, the nodules were generally fewer, larger, and more malformed, as shown in the photos in Figure 1.

The field conditions above illustrate the impact of low pH on alfalfa production. In these conditions, lime application is required for proper growth and production. The following table shows recommended lime application rates based on the buffer pH of an acidic soil.

Buffer pH	----------Target pH----------	
	6.0	6.8
	Lime recommendation (lbs ECC/acre)*	
7.4	0	0
7.2	375	750
7.0	875	1,750
6.8	1,500	3,500
6.6	2,250	4,500
6.4	3,125	6,250
6.2	4,125	8,250
6.0	5,125	10,250
5.8	6,250	12,500
5.6	7,625	15,250
5.4	9,000	18,000
5.2	10,375	20,000

* This data is based on a 6-inch soil sample. If incorporation depth differs, an adjustment must be made (for no-till, use a 1/3 rate).

High pH effects

Moving west in Kansas, high pH becomes a concern. The most common problems with high pH are zinc and iron deficiencies. Both deficiencies can sometimes occur in soils with low soil organic matter or high pH, and in areas that have portions of the field that have been eroded or leveled.

Alfalfa is extremely tolerant to low zinc in the soil and thus zinc deficiencies are very rare. Iron deficiencies are most recognized in sensitive crops such as sorghum and soybeans. It is less common in corn, which has an intermediate level of susceptibility; and is least common in wheat and alfalfa.

However, in cool springs with soils that have high levels of free carbonates, iron chlorosis may occur in young alfalfa stands. Correcting these conditions are difficult as many soil-applied iron fertilizers are ineffective or cost prohibitive. Another option is to apply foliar iron to the young alfalfa plants to correct the deficiencies. Since alfalfa is somewhat tolerant to iron deficiency, responses may be difficult to achieve. If foliar application is warranted, recognize that multiple applications will be needed to recover from the deficiency.

Manure applications are also often effective in improving alfalfa growth in high-pH situations. In some areas where manure is readily available, it may be the best source of iron as well as many of the micronutrients. Often times, the severity of iron chlorosis and responsiveness of alfalfa is not great enough to offset the cost of these treatments.

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4. Oat forage production

For the past several years for a variety of factors, the acreage of oats planted for forage, hay, or grazing, has increased. This year, oat pasture may be even more valuable to producers needing feed for their livestock.

Many wheat fields that were planned as pasture were either planted late or not at all due to wet fall planting and harvesting conditions. Many producers have used most if not all of the feed they had stockpiled due to the lack of winter cereal pasture and the cold, unsettled weather experienced in Kansas this winter. Also, if this late winter/early spring is similar to last year, perennial pastures will be slow to green up and provide adequate growth for grazing. There are positives to this year's winter weather however.

Conditions appear favorable for an excellent oat forage crop this year. As long as oats are planted by late March in southern Kansas and mid-April in northern Kansas, prospects for a good oat forage crop are excellent. There are a few factors that producers should pay attention to in order to optimize production.

- Take a profile soil N test. Much of the state experienced well above-average precipitation over the last twelve months. This, combined with above-average summer crop yields for many producers, may result in lower-than-average soil N levels. The cool weather, combined with later planting, makes it essential for producers to supply adequate nitrogen to optimize forage production.
- If you are planning on tillage, make sure the soil is dry enough to prevent smearing and/or compaction, which can have a very negative effect on oat germination, emergence, and growth.
- If pasture is needed as soon as possible, producers may want to increase seeding rates by 25% to 50% since soil moisture levels are good.
- If the below normal temperatures persist, be patient and make sure plants have adequate above- and below-ground development before grazing. Try to avoid placing livestock on excessively wet ground.
- Pay attention to grazing livestock and be ready to adjust stocking rates up or down depending on conditions.
- For hay production, make sure to pay attention to foliar disease levels in your area and be ready to swath before diseases dramatically reduce leaf area. This becomes more and more important as planting is delayed.
- Some producers might want to consider planting winter triticale as a pasture forage. It won’t vernalize when planted at this time of year, and will grow more like a lawn than a cereal grain. If weather doesn’t become too hot and dry, it may be possible to graze winter triticale into June in southern Kansas.
- Avoid pricey oat varieties as they typically produce no more forage than regularly priced varieties, and often less as they aren’t adapted to Kansas growing conditions.
- Finally, don’t plant treated seed. Seed treatment labels either prohibit grazing or don’t allow it for a significant period of time.

Forage production and utilization

Treat oat pasture as you would winter wheat pasture when determining stocking rates and when to place cattle in terms of vegetative growth. Since grain production is not practical or recommended under grazing, length of pasture production will be a function of stocking rate and weather. Studies at the South Central Experiment Field near Hutchinson indicate hay yields on a dry weight basis of 3 to 5 tons per acre are typical under average weather conditions -- with an average yield across twenty varieties of about 4 tons per acre Hay yield in these studies was determined at late milk/early dough stage with an average moisture of 60%. These yields were obtained with 75 lbs/acre N applied preplant and an additional 50 lbs/acre N broadcast approximately six weeks after emergence.

Oats should be harvested for silage from late milk through early dough stages. Expect silage with a TDN of approximately 60% and 9% protein on a dry weight basis. For hay, late boot to early heading is the optimal timing for harvest. Harvested at the dough stage, oat hay should have an approximate TDN of 56% with 10% protein, both on a dry weight basis. A nitrate test is recommended. Prussic acid should not be a concern.

Producers interested in planting oat pasture should order seed as soon as possible since oat seed stocks are small, especially of Kansas-produced seed. Often area seed dealers will have to have oat seed shipped into Kansas.

Cultural practices

Before planting oats, check the herbicide history of the desired field. Oats are especially sensitive to triazine herbicides.

Planting date. In southeast Kansas, the optimal planting date ranges from 2/20 - 3/15. In northwest Kansas, the optimal date is from the first week of March through the end of March. For most of the state, planting is recommended from late February through the mid-March. After the optimal planting range, production will be limited most years. These planting date recommendations are made with grain as the end use, not forage, so adequate pasture can still be produced even if planted after the optimum range. However, to maximize pasture production potential, it is necessary to plant as early as possible.

Seeding rate. A seeding rate of two bushels per acre is recommended. Under good soil moisture or irrigation, three bushels may be preferable for grazing.

Fertility. When grown for hay or silage, fertility recommendations are similar to those for grain production: 75 to 125 lbs/acre N. When planted for grazing, an additional 30 lbs/acre N is recommended. As always, a soil test is recommended.

Seedbed condition. Oats may be successfully planted no-till; however, growth and vigor are typically greater with pre-plant tillage. No-tillage is more successful if used in fields that have been under no-tillage for a period of years. It is riskier in "opportunistic" no-tillage situations. In either case, a fine, firm seedbed is necessary for optimal production. Under adequate soil moisture conditions, a seeding depth of ½ to 1 inch is preferable. Oats may be planted at depths greater than one inch under dry conditions. However, oat seedlings are less vigorous than wheat and may have a hard time emerging at deeper planting depths. This is especially true on soils crusted from precipitation after planting.

Weed control. To facilitate planting and maximize forage production, winter annual weeds should be controlled either mechanically or chemically. Weed control is best achieved through a good stand with rapid growth. Herbicides are available, although many are not permitted under forage production. Before using any herbicides consult the label.

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5. Corn seeding rates

The optimal corn population for any situation will depend on the anticipated environment and how the hybrid responds to that environment. Producers can look back to their corn crop from the previous growing season, or wait until the current growing season is nearly complete, and evaluate whether the population they used was adequate.

If more than about 5% of the plants are barren, the populations may be too high. If most ears have fewer than 400 kernels per ear, the population may be too high. If there are consistently more than 600 kernels per ear, the population may be too low.

Don’t be concerned if a half-inch or so of the ear tip has no kernels. If kernels have formed to the tip of the ear, there may have been room in that field for more plants with additional ears.

Always keep the long-term weather conditions in mind. In 2009, August temperatures were cooler than normal and growing-season rainfall was favorably distributed in much of the state. Will that be repeated this year? What is the soil water storage capacity of the field? Does the previous crop tend to deplete stored soil water more than most crops? Will irrigation water be available in the same quantity and at the same time of year as in the past? What has been the typical germination rate and stand establishment on a given field with the planting equipment to be used?

Optimal seeding rates may need to be adjusted for irrigated corn if fertilizer or irrigation rates are sharply increased or decreased. For example, research at the Irrigation Experiment Field near Scandia has shown that if fertilizer rates are increased, seeding rates also have to be increased to realize the maximum yield benefit. Consult seed company recommendations to determine if seeding rates for specific hybrids should be at the lower or upper end of the recommended ranges for a given environment.

The recommended planting rates in the following table attempt to factor in these types of questions for the typical corn growing environments found in Kansas. Adjust within the recommended ranges depending on the specific conditions you expect to face and depending the hybrid you plan to use.

The following recommend planting rates are from the K-State Corn Production Handbook.

Suggested Dryland Corn Final Populations and Seeding Rates			
Area	Environment	Final Plant Population (plants per acre)	Seeding Rate*
Northeast	100-150 bu/a potential	22,000-25,000	26,000-29,500
	150+ potential	24,000-28,000	28,000-33,000
Southeast	Short-season, upland, shallow soils	20,000-22,000	23,500-26,000
	Full-season bottomground	24,000-26,000	28,000-30,500
Northcentral	All dryland environments	20,000-22,500	23,500-26,500
Southcentral	All dryland environments	18,000-22,000	21,000-26,000
Northwest	All dryland environments	16,000-20,000	19,000-23,500
Southwest	All dryland environments	14,000-20,000	16,500-23,500

Suggested Irrigated Corn Final Populations and Seeding Rates			
Environment	Hybrid Maturity	Final Plant Population (plants per acre)	Seeding Rate*
Full irrigation	Full-season	28,000-34,000	33,000-40,000
	Shorter-season	30,000-36,000	35,000-42,500
Limited irrigation	All	24,000-28,000	28,000-33,000

* Assumes high germination and that 85 percent of seeds produce plants. Seeding rates can be reduced if field germination is expected to be more than 85%.

For more information, see the K-State Corn Production Handbook, C-560:
http://www.ksre.ksu.edu/library/crpsl2/c560.pdf

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6. Should corn seeding rates be adjusted for planting dates and hybrid maturities?

The seeding rate recommendations in the K-State Corn Production Handbook are a good starting point, but producers still have to decide whether to adjust those seeding rates depending on other factors, such as planting dates or hybrid maturity. Planting dates continue to creep earlier and earlier, especially on shallow, high-clay soils in eastern Kansas.

Recent K-State studies on dryland corn conducted at Manhattan, Ottawa, and Hesston compared planting dates ranging from mid-March to mid-April. Each planting date included three hybrids of differing maturities (98-, 106-, 112-day Relative Maturity) planted at three populations (18,000, 22,000, 26,000 plants per acre at Manhattan and Ottawa; 14,000, 18,000, 22,000 plants per acre at Hesston). Experiments were planted in 2004 to 2008 at Hesston and 2006 to 2008 at Ottawa and Manhattan. Results from these studies can be summarized as follows:

Planting Date:
* Yield response to planting date depended on year and location.
* Mid-March planting generally did not reduce yield except in 2007, when there was a late freeze (0 bushels/acre).
* Mid- to late-March planting provided a yield benefit in the drought year at Hesston.
* Cool temperatures often delayed emergence of mid-March plantings so that they emerged within a few days of the early April planting.
* The early April planting date was most consistent across locations and years. This date avoided freeze damage in 2007 and yield reductions occasionally seen for later dates.

Hybrid Maturity:
* Hybrid maturity response depended on year and location.
* Ottawa: The medium maturity hybrid was most consistent regardless of planting date.
* Manhattan: The fuller maturity hybrid was equal or superior to the others for all planting dates, except for the mid-May planting date in 2007 when the medium maturity hybrid yielded more.
* Hesston: The fuller maturity hybrid was equal or superior to the others for all planting dates, except in the drought year of 2006 when it yielded the least for all planting dates.

Population:
* More plants/acre generally resulted in greater yields.
* Ottawa: Yields were greater with medium (22,000) or high (26,000) populations, except if planted in May or June when yield decreased with more plants per acre.
* Manhattan: Yields were greater with more plants per acre; the response to increasing populations was larger in the higher-yield environments (>150 bu/a) and at earlier planting dates.
* Hesston: Yields were greater with more plants per acre regardless of planting date in 2004, 2005, and 2007. There was no response to plant population in the drought year of 2006.

Summary: Early April planting dates were generally best at these locations. Medium (106-110 RM) and fuller (111-113 RM) maturity hybrids usually resulted in the best yields. Yields were also generally highest at the higher seeding rates in these tests.

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