Texas A&M AgriLife Row Crops Newsletter

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Nine Considerations to Guide 2022 Fertilizer Decisions in Summer Crops

Fertilizer prices across Texas have nearly doubled since this time last year. High natural gas prices and high commodity crop prices do not appear to explain fully the price increase for N, P, and other fertilizer nutrients. P fertilizers may have supply issues. Nitrogen fertilizers appear likewise. Transportation / distribution costs and delays have also contributed to the problem.

Also, according to Dr. Mark Welch, jmwelch@tamu.edu, AgriLife Extension grains economist, College Station, high commodity prices often enable farm suppliers to justify raising prices on inputs. Depending on where you farm, where you purchase inputs, and how soon you will need them, these factors influence farmer fertilizer decisions.

1. Condition and Growth Stage of Your Crop

You don't know and can't assume the status of your future crop. Other factors will be considered for N and your placement-limited fertilizers (P, K, etc.) before planting. The growth stage of your crop—and its health—will also factor in your management decisions.

Deferring N applications will enable adjustments in-season based on current crop condition and weather outlook. While you should have a target yield goal in mind before planting based on projected cost and revenue and the agronomic potential of your environment, the ability to adjust inputs in-season can save money if crop or weather conditions become unfavorable. This could include poor stands, drought, or excess soil moisture.

Every crop has a target growth stage for optimizing in-season or side-dress N applications. Grain sorghum targets growing point differentiation. This is when panicle (head) initiation occurs, about 30 to 35 days after planting (7- fully expanded leaves with leaf collars). The target for corn in V6 (6 visible leaf collars). This growth stage proceeds initiation of ear development. While V6 is the target, corn will respond favorably to later N applications. For cotton, 20 to 40 days after planting is the best window to ensure all N is applied. Some research recommends pinhead square as the optimum timing in areas receiving less rainfall.

When deferring N application to in-season timing, its good to apply at least 25% of total N at planting. This ensures enough N supply for early growth, and provides some flexibility if weather (or supply chains) delay in-season applications.

Could the condition of a summer crop could be related to factors other than weather? Insects and plant diseases, yes. But some producers produce agronomically induced stresses. The primary one is excessive seeding rates resulting in plant populations that are too high. The resulting population, anywhere in Texas, is more than what the crop can sustain in a dry year. You may artificially impose an undesired drought condition. This is what you see happens when cotton sheds squares or blooms. Corn and sorghum can't do that, but instead you may see reduced grain fill.

Applications of P and K will not reflect growth as these nutrients are best applied an incorporated prior to planting. Knife rigs for P are also a good means to provide P closer to the time of crop requirement.

In any above case, the condition of you crop relative to growth stage is a guide to knowing if and when and how much in-season fertilizer to apply to reach an achievable yield goal.

2. Moisture Prospects

Texas is generally in a current early 2022 *La Nina* weather pattern which tends to mean drier conditions. It is normally dry anyway this time of year in the Rolling Plains, Concho Valley, and all the High Plains. Average rainfall in Central Texas in one month, even January, is more than what these westerly regions expect to receive over four months (Nov.-Feb.).

Estimating your available soil moisture, perhaps to 36" deep, requires a soil moisture probe and knowledge of the water holding capacity of your soil. Your crop will tell you if it is under stress from lack of moisture. The prospects for this crop may color your decision on crop fertilization, especially nitrogen. If existing soil moisture is poor when fertilizer N decisions come, especially in-season, then N rates decline.

3. Projections of Fertilizer Nitrogen Prices

This is hard to say. There are several factors at work here: A) natural gas prices, used in large amounts to make nitrogen fertilizer (ask us if you want to know why), are high; B) when crop commodity prices are high dealers for fertilizer, seed, chemicals, and other inputs lean toward raising prices as crop prices can support higher input prices; 3) there appears to be supply issues. N fertilizer is short and might not even be readily available. If N fertilizer must be brought from greater distance, then prices are higher.

This issue is now further compounded by Russia's invasion of Ukraine. Russia is the world's largest producer and exporter of N fertilizer. Economic sanctions on Russia will surely slow exports and tighten supplies.

Likewise, fertilizer P, which mostly must come into port on the Texas coast, has supply bottlenecks.

Recent spot fertilizer price checks across Texas for popular N fertilizers were $910-950/ton for urea (46-0-0) and $645-695/ton for liquid urea-ammonium nitrate (UAN, 32-0-0). Hence the cost of a unit of nitrogen (1.0 lb. of actual N) is $1.00 to $1.09 (100 lbs. of urea would be 46 lbs. of actual nitrogen). This is the highest we have ever seen.

AgriLife Extension economists believe fertilizer prices might moderate some as we move further into

2022 IF supply is not an issue. But prices will still be high. Growers in South and Coastal Texas, even Central Texas, may not likely see much moderation by the time they make fertilizer decisions. This is

especially true for pre-plant P & K applications. Many southerly Texas farmers appear more likely to also apply most or even all N up front. Perhaps this is a year to wait on a portion of that and split your applications in the hope the price moderates. Summer cropping for the Texas High Plains region has more time for high fertilizer prices to abate some. But that may not occur now with the Russia issue. Much nitrogen purchase and application in the High Plains does not occur until mid-May to early July.

Spoiler alert: If fertilizer N prices are high then your soil residual N down to at least 24" is also worth more than ever. How much do you have? (Hint: Soil test to find out; see below.)

4. **Projected Crop Price at Harvest vs. Contracting Now**

Grain cash prices vs. selling on contract based off Dec2022 corn futures? Cotton on Dec2022? For grains, call area elevators for current pricing and details. In the Texas High Plains currently grain sorghum is about even basis to $0.50/bu higher than for corn. Thus, grain sorghum is about $11.00-11.50/cwt. Corn in the Texas High Plains is often about +$0.50/bu above basis (Dec2022). Your Texas location will have an impact, too. A good example is grain sorghum on the Gulf Coast being most available to export meeting the high demand from China.

Again, our Extension economist colleague Dr. Mark Welch: *The risk is we get all these high-priced inputs locked in and then see output (crop) prices fall by harvest."* If you are spending money on higher cost inputs, then you may need to consider selling some crop to ensure you are better able to cover those costs. It is difficult to think about locking in a crop price and committing to deliver pounds or bushels when it is dry.

5. **Soil Testing, as Deep as You Can, for Nitrate-N Status: *Action Item!***

Soil sampling across Texas can identify subsoil nitrate-nitrogen (NO_3^--N, the form of nitrogen readily available for crop uptake). It has never been worth more! Texas A&M University research demonstrates that nitrate-N to at least 24" deep is fully available to your crop. Routine soil samples are recommended to 6" deep. Sampling deeper in the soil can pay off. We want to know what nitrate-N is below your 6" sampling depth. Then credit that deep soil N toward your plant N nutrient requirements, effectively saving you money.

For the first time in my career, I am even recommending winter 2022 *in-season* deep soil sampling for wheat in advance of topdress N decisions.

If you have already applied nutrients in South and Coastal Texas it is late to engage soil testing. For a crop that is planted young in-season soil sampling now is an option. These subsoil samples for nitrate-N only can be run inexpensively. If you are conducting regular soil sampling, we suggest get 6-18" or even 6-24" (not easy to probe).

The impetus for soil testing is greater when fertilizer—and crop commodity—prices are high. On one hand you do not want to spend unnecessarily—even if strong residual nutrient levels are high—for fertilizer. On the other hand, you want to ensure potential for higher yields to take advantage of higher crop prices and increase profitability.

Remember, though, "you can't get something from nothing" for very long if any crop has good growth potential but little nitrogen to support it. Second to available moisture, nitrogen is likely the next most important yield-yield limiting factor in Texas cropping.

More on deep soil sampling. Traditional soil test sampling and its calibration is for only a six-inch sample. **This is changing** especially for nitrogen. The potential presence of nitrate-nitrogen (NO_3^-) is the driver for deeper soil sampling. Again, in any Texas soil, for any Texas crop, Texas A&M AgriLife research suggests nitrate-N down to at least 24" is fully available to your crop. Credit **all** this N toward your fertilizer requirement. It is not uncommon for farmers to find 30 to 60 lbs. of N per acre in the top 24", often double or more what is expected. This represents a potential current fertilizer N savings of at least $30 to $60 per acre at today's fertilizer N prices. (Major agriculture states like Kansas and North Dakota now recommend 24" sampling (as one depth) for *all* nutrients. They have the calibration data for such tests whereas Texas now also has soil test calibration for N at lower soil depths.)

Regardless your production objective, remember the first units of N you apply to a field or a crop are the most valuable. The first 33% of N you apply will give a better return than the last 33%. That is, the response to nitrogen is not completely linear, especially at higher application rates. At those higher nutrient applications yield response gradually tails off. Even though fertilizer N prices are high, at least some N likely still offers a more certain net return than larger amounts. *Reducing N applications may be the right decision, but eliminating all N is not*.

6. What should N recommendations be for different Texas summer crops?

This is a simple guideline for grain sorghum, corn, and cotton. If you have questions about other crops like sesame, sunflower, summer annual forages, etc. please inquire.

Grain sorghum: Generally, the nitrogen requirement—not the fertilizer requirement—for grain sorghum is about 2 lbs. of actual N per 100 lbs. of grain yield. This is N from all sources, not just fertilizer N. With a yield goal you can calculate your estimated N requirement then reduce the amount needed by existing soil N, release from manure/compost, etc. If no soil test N data is available, you may be reduced to guesswork—and spending more money than you need to.

Corn: General N requirement for corn for yields to near 150 bu/A is about 1.0 to 1.1 lbs. of N per each bushel of yield. For higher yields the N efficiency declines somewhat, and the simple guideline moves up a bit to about 1.1 to 1.2 lbs. of N per bushel. Corn N timing is not as straightforward as grain sorghum which focuses mostly on having N applied by a singular stage of growth and development. For further information on corn N timing, especially from the Texas High Plains, consult "Getting the Most our of Your Nitrogen Fertilization in Corn" (2011), see http://agrilife.org/amarillo/files/2010/11/NitrogenFertilization.pdf

Cotton: General rule of thumb for cotton yields in Texas A&M's soil test recommendations is 50 lbs. of N per bale of yield. Recent discussion suggests this could reliably reduced to 45 lbs. of N per bale per acre. There are many Extension personnel across Texas who handle cotton inquiries (Corpus, College Station, San Angelo, Vernon, Lubbock, Amarillo). Consult the nearest resource for regional variation on suggested N fertility targets for cotton in your area.

7. Efficient Methods of Fertilizer Application

Any means you as a grower can incorporate surface-applied fertilizer or apply directly in the root zone is best. Incorporation can include spreading granular fertilizer and lightly disking it in, or it can subsurface application using knives. Soil is like a reservoir dam. It holds the N and other nutrients (and water!) until the crop needs it. In wetter areas of Texas leaching of nitrate-N below the root zone due to higher rainfall is a concern. But this is rare in the Rolling Plains, Concho Valley, and High Plains of Texas. (If you

have enough rain to leach N in these drier regions of the state, you are so happy about the rain. It is worth more than the nutrients!)

Application methods for Texas summer crops are varied. With broadcast dry N you must hope for a rain soon or use tillage to incorporate. Rain only for P & K fertilizers is not efficient. P & K don't readily dissolve in rain or irrigation. Incorporation of P & K is best if possible. And especially for P, banding is a good efficient practice for row crops. You may be able to reduce your nutrient application relative to broadcast applications.

We discourage you from broadcasting a liquid N source onto an existing crop or the soil unless you can irrigate it in immediately or a likely rain is imminent. This is not about possibly burning the leaves. Biological and environmental conditions on the leaf surface favor N loss. Foliar feeding is not occurring unless you use special formulations of N perhaps with materials to foster absorption. (**Note**: All crops have a highly specialized structure to acquire N for plant growth? Have you heard this? *It's called a root*!)

Growers in no-till systems have to think more strategically about how to best get nutrients into the root zone. Soluble fertilizers like urea work provided you get the rain. But numerous insoluble fertilizers, like many of the P containing compounds, are only slowly and sometimes only partially available. For knife and coulter rigs for application, little of the soil surface is disturbed. So, this does not violate dogmatic absolute no-till principles. Nitrogen use efficiency is lower the great amount of N applied at one time. Hence split applications, especially applying N closer to the time of crop requirement, is a good method though multiple trips across a field have added cost, too.

N efficiency is a moving target. You do your best to minimize possible N losses. Few Texas farmers who can incorporate have significant concerns about losing applied N. Surface applications that remain unincorporated could lead to N losses well above 20%. That is like wasting irrigation water. It is running the risk of wasting money and getting a poor return on expensive inputs.

8. What soil/field conditions trigger higher N losses from applied fertilizer?

Surface applications of ammonium-based fertilizers are problematic. The ammonium in urea, urea-ammonium nitrate, etc. may readily be converted to ammonia (NH_3) and lost as a gas. Do not apply ammonium-based N fertilizers on moist soil in Texas if you can avoid it. Otherwise, losses can be high. Warmer weather conditions favor N gas losses. High pH soils, which most Texas fields are west of I-35 and in the Blacklands, also foster N losses. In areas of Texas with much more moisture waterlogging can also cause 'denitrification' which converts nitrate-N to a gaseous form which is lost.

Soils in central, east, and coastal Texas that sometimes receive excessive rainfall and don't drain well can also experience N losses.

The worst conditions for N loss from urea or ammonium-based fertilizers are sandy soils, high pH, low rainfall, high winds, and time. Make sure your fertilizer does not set upon the soil surface for too long before the next rain.

9. Should you use a urease/stabilizer or nitrification inhibitor with your fertilizer application?

Urease is an enzyme that converts N to ammonia which is potentially lost to the atmosphere as ammonia gas. There are several preventive products for this (a common active ingredient is NBPT). Research conclusions on the benefit of these products is dependent on conditions tested. Technically,

they do what they say they will do. Do you have the conditions that requires them? See the table below for a simple checklist of conditions that make the product more likely beneficial. Dr. Mowrer especially notes these products may cost several dollars per acre. The benefit should outweigh the cost several fold. Research across varied field conditions is often inconclusive. Many situations don't call for a chemical additive as losses are expected to be low. You would not consider a urease/N stabilizer, for example, if you are incorporating the fertilizer.

Nitrification is the microbial conversion of in-soil nitrate to nitrogen oxides and eventually N_2 which are gassed into the air. This processed is mediated by microorganisms. This is more likely in Texas regions where wet and water-logged soils prevail. Nitrification inhibitors, too, have mixed results in their effectiveness.

	Is a Urease Inhibitor Beneficial?	
	More likely	Less Likely
Surface applied urea (46-0-0)	✓	
Surface applied UAN (32-0-0)	✓	
Dry soil, no rain projected	✓	
Moist/wet soil (avoid practice if possible)¶	✓	
Incorporate/inject N fertilizer		✓
Soil pH > 7.5	✓	
Soil pH < 7.5	✓	✓
Prolonged soil surface temp ≥ 60°F (not air temp.)	✓	
Prolonged soil surface temp < 60°F (not air temp.)		✓

¶Moist/wet soils especially when warm strongly favor volatilization of ammonium-based surface-applied N. Urease inhibitors may not be able to overcome this.

Dr. Mowrer emphasizes that Texas producers should focus on incorporation of fertilizer. Placement below the soil surface and near the upper root zone is important to protect from nutrient losses and enhance nutrient uptake. It is better to rely on incorporation than to trust a chemical to preserve your nitrogen. For no-till and strip-till farmers options are fewer but knifing/banding any fertilizer product is still feasible.