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Cotton Insights Newsletter

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Crop Situation Update

The 2022 planting season is rapidly approaching and shortages of numerous products are plaguing the industry. Based on last week's Drought Monitor, persistent drought is increasing the stress level of all ag producers in our service region of northwest Texas and western Oklahoma. These maps were accessed on April 7, and are provided below (see page 2). We are about 3-4 weeks out from planting windows opening for this region, and substantial rainfall has yet to be received in most areas. Some recent localized small rainfall events have provided some relief, but good, soaking, region-wide rains have not yet materialized.

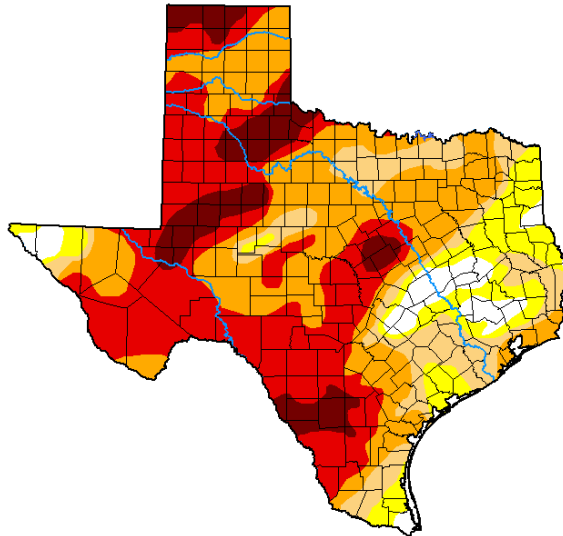
The overall calculus for the 2022 crop is in a state of flux. It is unknown at this time what conditions will be as the planting windows open for various counties. The good news is that crop insurance prices for lint coupled with the seed endorsement are around \$1.10/lb, based on my understanding. That is a much welcomed safety net for growers and will likely play a pivotal role in last minute decisions made by producers. Many irrigated growers are in the process of pre-irrigating fields. Winds have been essentially relentless, but few days have had high temperatures thus far.

Maps provided by the NOAA National Weather Service - National Climate Prediction Center are provided below (accessed April 5). The US Monthly Drought Outlook for April map (page 3) indicates persistent drought through the month of April. The Seasonal Temperature Outlook map indicates high probability of higher than normal temperatures for April, May and June. The Seasonal Precipitation Outlook for April, May and June indicates a high probability of below normal rainfall (page 4). These prognostications are shaping up for a tough 2022 growing season for producers.

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U.S. Drought Monitor Texas

April 5, 2022
(Released Thursday, Apr. 7, 2022)
Valid 8 a.m. EDT



Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

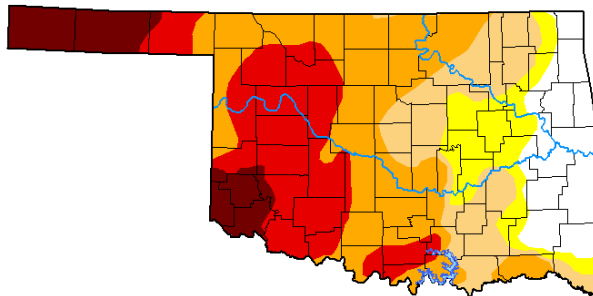
Deborah Bathke
National Drought Mitigation Center



droughtmonitor.unl.edu

U.S. Drought Monitor Oklahoma

April 5, 2022
(Released Thursday, Apr. 7, 2022)
Valid 8 a.m. EDT



Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

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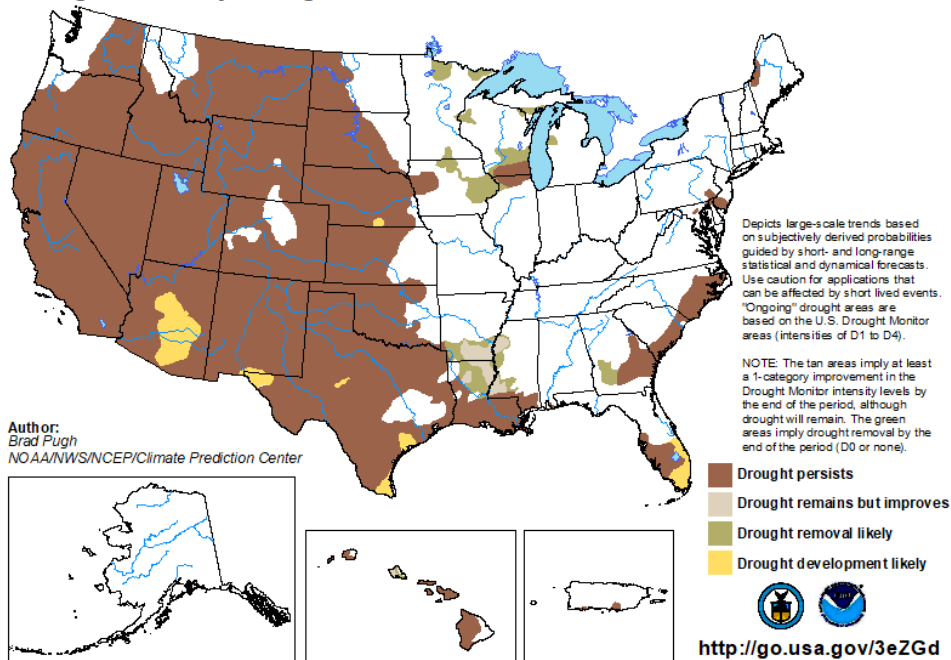


droughtmonitor.unl.edu

Source: <https://www.cpc.ncep.noaa.gov/>

U.S. Monthly Drought Outlook Drought Tendency During the Valid Period

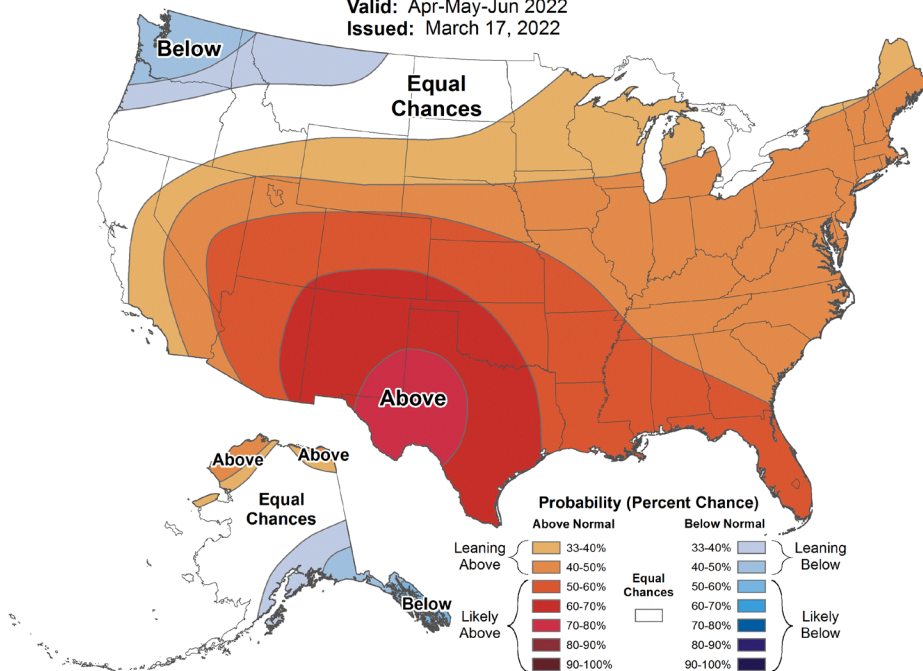
Valid for April 2022
Released March 31, 2022



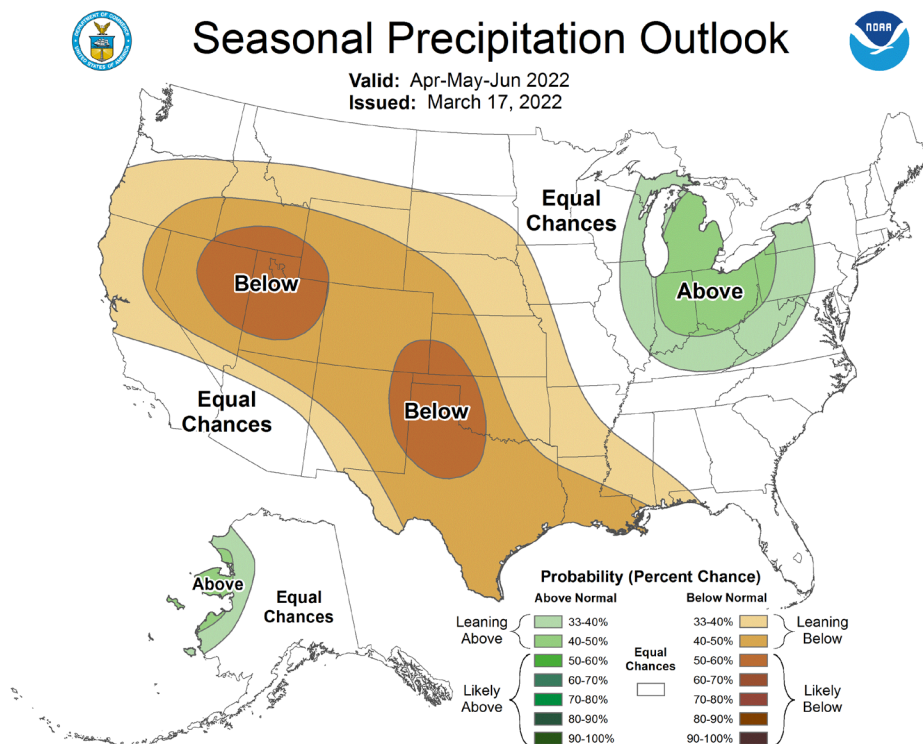
Seasonal Temperature Outlook



Valid: Apr-May-Jun 2022
Issued: March 17, 2022



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Can I replace my normal soil-applied fertility program with lower amounts of in-season foliar fertilizers?

With high fertilizer prices, essential nutrients can be a place to scrutinize for input cost reduction in a belt-tightening year. We don't want to "throw the baby out with the bath water" though. Remember that soil testing can pay. Many times, we may have had an outstanding fertilizer management program on a specific farm. Other farms may have had less than desirable soil fertility management. The best way to determine which farms require higher expenditure of fertilizer dollars is simply by checking the soil fertility status by using soil testing.

A one bale cotton crop will remove from the field about 40 lb of actual nitrogen (N) per acre in the seed cotton at harvest. However, the total above ground biomass is likely to take up about 60 lb of N/bale. The crop residue will return to the soil and recycle the remaining nutrients. This same yield will remove about 20 lb of phosphate (P_2O_5) per acre.

The table below was reproduced from a vintage Cotton Physiology Today article covering cotton plant nutrition which can be downloaded here:

<http://www.cotton.org/tech/physiology/cpt/upload/CPT-Jan91-v2-3.pdf>

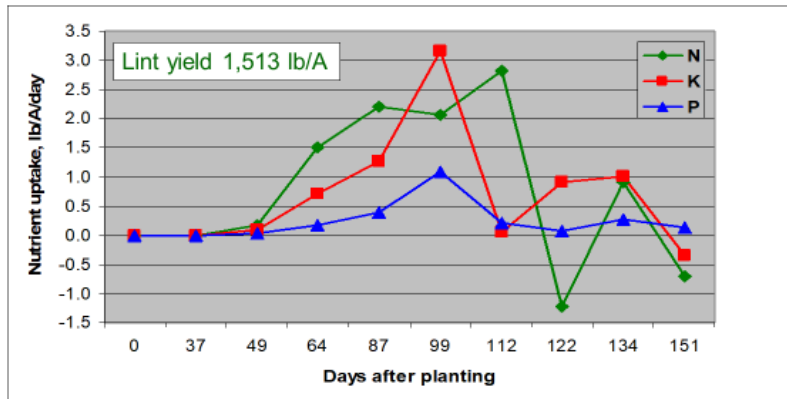
**Typical Nutrient Content
(Pounds of Nutrient Per Bale)**

Nutrient	Above ground plant (leaves, stems, fruit)	Seed cotton	Lint
Nitrogen (N)	62	35-40	1
Phosphate (P₂O₅)	22	13-20	0.3
Potash (K₂O)	61	15	3
Calcium (Ca)	27-62	1	0.2
Magnesium (Mg)	11-27	5	0.3
Sulfur (S)	8-16	1-2	trace

- Cotton is a crop with a deep tap root system, and can typically explore a large volume of soil, assuming an excellent unimpeded root system is produced and adequate soil moisture is present to allow that exploration. Cotton roots do not grow into dry soil, therefore, if moisture is limiting, nutrient uptake will also be limiting. Nutrient uptake essentially occurs simultaneously with water uptake. To be productive, the cotton plant has a physiological need for nutrients, and these nutrients have to come from somewhere if good to excellent yields are to be expected. If these good to excellent yields are obtained after cutting back on a recommended soil-applied fertilizer management program, then the producer is actually "writing checks on the checking account" in the soil. However, if no deposits are made over years, then a shortage of nutrients will ultimately occur and yield and quality will be adversely affected.
- Crop nutrients are broadly classed as macronutrients and micronutrients. Macronutrients are required in much larger amounts than micronutrients. Examples of macronutrients include nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S). Micronutrients are only required in very low amounts. For example, cotton crops normally take up 0.09 – 0.13 lb/acre of zinc (Zn). Of this, about 0.03 lb Zn/bale may be removed in seedcotton at harvest. Because of the low amount needed, timely low-rate foliar applications are indeed successfully used to treat deficiencies.
- Nutrients are also classified as mobile or immobile in the soil. Mobile nutrients include NO₃-N as well as SO₄-S. These forms are considered mobile because they are anions (negatively charged) and can be leached and move downward in the soil during extremely wet periods. Immobile nutrients include P, K, Ca, Mg, Zn, etc. P is more or less "special" because water soluble ammonium P fertilizers (such as 10-34-0, 18-46-0, 11-52-0) react with soil constituents and form insoluble P reaction products. These reaction products essentially do not move in the soil. The others on the above list are cations (positively charged). These are held by the cation exchange complex of the soil (CEC), which is based on clay mineralogy and organic residues. K is a special case and does have some level of mobility in the soil since its charge is only a +1, compared to Ca and Mg, which are both +2. Sandy soils have a low CEC, so K is more mobile there than in a clay loam soil.
- A cotton crop can "cruise on high residual soil fertility" for a period of time. That amount of time is nutrient and soil test dependent. For example, if a field has very high soil test values for nutrients, then a residual fertility drawdown occurs if nothing is added. This example field's soil could possibly sustain a cotton crop with P, K, and other nutrients for a significant time assuming nutrient concentrations are near or above the soil test critical level. A critical level is defined as the fertilizer response "breaking point" of concentration of a particular immobile soil nutrient. BELOW the critical level there is a likelihood of obtaining a fertilizer response to that nutrient. As the actual concentration nears the critical level, the likelihood of a response decreases. ABOVE the critical level the likelihood of obtaining a fertilizer response to that nutrient is LOW. **To see the P and K critical levels and Texas A&M AgriLife Extension Service recommended fertilization rates for various soil test levels, refer to the March 9 Cotton Insights Newsletter.**

- The most critical mineral nutrient is N. Since N is mobile in the soil, adequate soil concentration is based on crop removal (yield goal). A cotton crop's physiological need for N is about 40-50 lb N/bale of yield goal. It drives crop yield, as it is critical for amino acid and protein synthesis. So, although excellent soil concentrations of other nutrients are present, but N is lacking, yield and quality can suffer.
- **Producers may be tempted to cut fertilizer use by a certain percent or to use a gallon per acre of this or gallon per acre of that to replace a sound soil applied fertilizer program. Benefits of low rates of foliar fertilizers are questionable unless there is indeed a micronutrient deficiency (e.g. Zn) and the product applied contains the deficient element, and it is applied in a timely manner in the life cycle of the crop.**
- If one does the math concerning what some of the "gallon per acre" products can supply, then it is fairly easy to determine that these products will not meet the macronutrient needs of the crop. And these products could be very expensive when comparing the "program price" with how many pounds of N the same money could buy using conventional fertilizers.
- For example, assume that a foliar fertilizer has a guaranteed analysis of 5-10-5 and has a density of 11.5 lb/gallon, the labeled foliar fertilization rate is one gallon/acre and its cost is \$20/gallon. That means that 5% of that fertilizer product is elemental N, 10% is P_2O_5 , and 5% is K_2O .
- The math indicates that if one gallon per acre is applied, then a total of 11.5 lb/acre of 5-10-5 is applied so,
 - N: $11.5 \times 0.05 = 0.575$ lb actual N applied in one gallon
 - P_2O_5 : $11.5 \times 0.10 = 1.15$ lb P_2O_5 applied in one gallon
 - K_2O : $11.5 \times 0.05 = 0.575$ lb K_2O applied in one gallon.
- So, essentially one has paid around \$20/gallon for N- P_2O_5 - K_2O amounts totaling 2.3 lb/acre, which works out to about \$8.70/lb of plant nutrient.
- Let's assume the canopy has not closed between the rows and the product is broadcast applied. If we also assume that 75% of the broadcast spray pattern is being intercepted by the crop canopy, then only 75% of the applied nutrients are available for foliar absorption and uptake. So,
 - N: 0.431 lb actual N applied in one gallon is intercepted by the crop canopy
 - P_2O_5 : 0.863 lb P_2O_5 applied in one gallon is intercepted by the crop canopy
 - K_2O : 0.431 lb K_2O applied in one gallon is intercepted by the crop canopy
- Another assumption that has to be made is "how much of a specific nutrient in a fertilizer product that is deposited on a leaf is actually absorbed and becomes physiologically active?" That question may be harder to answer, as it really depends upon a lot of factors. The leaf cuticle or waxy surface is a barrier and the leaf's stomatal (structures on the leaf surface that control transpiration and gas exchange) density is also important. *Even if one assumes that the total amount that is deposited on a leaf is absorbed and becomes physiologically active, few pounds of macronutrients are delivered to the system.*
- Plant root uptake of N may reach 2-4 lb/day during boll fill. A similar uptake rate is found for K_2O (see uptake rate graphics below based on peer reviewed scientific journal articles). So, if we assume that for both N and K_2O , the uptake amounts are 3 lb/day for both during boll fill, then the amount delivered by the above example of one gallon/acre of 5-10-5 will only deliver a fractional amount of the crop's physiological needs for these nutrients. Even if multiple gallons/acre (now, it's getting very expensive at \$20/gallon) are applied using sequential applications, the total amount that this foliar fertilizer product can potentially deliver is miniscule compared to total crop need.
- The ultimate question is how much total N and K can be foliar applied and "pushed" through the leaves?

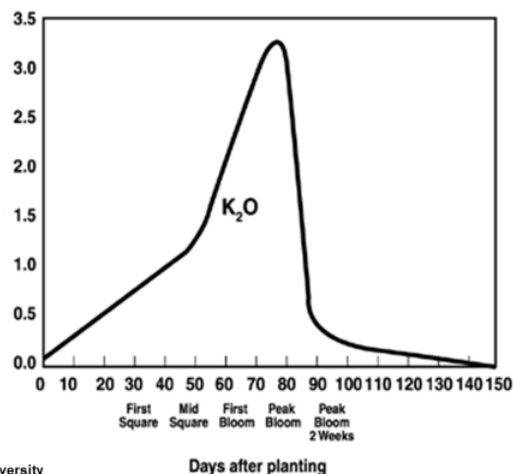
Maximum Daily Uptake of N, P, and K Occurs Near Peak Blooming



Source: Schwab et al., 2000

Source: Dr. Mike Stewart, IPNI

Rate of Cotton K₂O Uptake (lb/day)



Source: Mullins and Burmester (1990), Auburn University

- Since micronutrients are taken up in extremely low amounts, it takes a lower amount of product to be absorbed by the leaves and to then become physiologically active. A Zn deficiency, for example, if caught early enough, can be rectified by foliar fertilization in amounts as low as 0.1 - 0.3 lb Zn/acre. But, recall from comments above that total Zn uptake for a cotton crop may be around 0.1 lb/acre. Since small amounts of Zn are necessary to correct a deficiency that may exist, enough foliar fertilizer Zn can be absorbed through the leaves to correct the problem.
- In summary, micronutrient deficiencies can be corrected by proper timing of low rates of foliar fertilizers. Macronutrients such as N, P, and K by definition are physiologically required in much larger amounts, making it nearly impossible to “push” enough of those nutrients through leaves to satisfy total crop needs. This would also become expensive if performed.