EXTENSION

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When is the best time to plant cotton in the Oklahoma panhandle?

September 2024

The interest in growing cotton in the Oklahoma Panhandle has grown in recent years. Since 2017, an average of 25,000 acres of cotton has been planted each year in the three counties that make up this region (Beaver, Texas, and Cimarron counties) (USDA NASS, 2017). This rising interest is due to decreasing groundwater resources typically utilized for corn production. Furthermore, cotton in the panhandle has been made possible by the integration of short-season cultivars. The primary limitation in this region comes from sufficient soil temperature for rapid germination, limited growing degree units (GDUs) and variable freeze dates that delay planting or stop the maturation process. While environmental conditions can vary from year to year, average GDU can be used to determine planting dates that could minimize the impacts of late spring freezes while providing time for sufficient crop development. It is also important to note that insurance cutoff dates are to be considered when deciding on planting timings. The official dates can be found through your local insurance agent.

Planting Window	Inadequate Soil Temperature[1]	Late Spring Freeze[2]	Insufficient GDU[3]
	Beaver Mesonet		
1st Week of May	70%	25%	0%
2nd Week of May	40%	0%	0%
3rd Week of May	10%	0%	0%
1st Week of June	0%	0%	5%
	Goodwell Mesonet		
1st Week of May	55%	25%	0%
2nd Week of May	30%	5%	5%
3rd Week of May	30%	0%	10%
1st Week of June	0%	0%	15%
	Boise City Mesonet		
1st Week of May	70%	50%	55%
2nd Week of May	60%	15%	55%
3rd Week of May	45%	10%	55%
1st Week of June	0%	0%	90%

[1] Inadequate soil temperatures would be below the 65 F recommendation at least 4 days prior to planting. [2] Late Freeze would be one that could affect germinating or partially germinated seed that would degrade seedling vigor or quality. [3] Insufficient GDU would be situations where the accumulation of GDU would not meet the 1800 base requirement for fully developed cotton in the Oklahoma panhandle prior to the first terminal freeze event.

Table 1. The probability of weather influencing growing degree units across 20 years of historical weather data from the Beaver, Goodwell and Boise City Mesonet stations.

Soil Temperature

Soil temperature and adequate soil moisture is crucial for rapid and even germination of cotton seed. Ideal soil temperature is above 65 F for germination with minimum air temperature above 50 F. It is recommended that this soil temperature be maintained for longer than 4 days after planting to ensure emergence. Inadequate soil temperatures can lead to poor stand, injury to seedling and increase of disease or rotting. Cotton is ideally planted 0.75 to 1 inch deep into sufficient soil moisture. When averaged across all Mesonet locations presented in Table 1, May has a 2-inch bare soil temperature of approximately 70 F. However, there is high variability in the data. Cotton planted during the first week of May would face adverse soil temperature 55% to 70% of the time based on the past 20 years of Mesonet weather records (Table 1). In contrast, if planted in the third week of May there is a 45% chance that adverse soil temperatures would occur at Boise City. At Goodwell the probability of adverse soil temperature conditions declines to 30% and at Beaver it declines to 10%. Therefore, simply using soil temperature as a guide to make planting decisions would indicate waiting until the third week of May would improve your chances of adequate cotton emergence, and waiting until the first week of June will ensure optimum soil temperature for seedling development. While Mesonet provides a great resource for approximate readings of sufficient soil temperature and soil moisture it is a best practice to monitor in field conditions for real time decision making.

Growing Degree Units

Growing degree units can be calculated as:

$$\frac{\textit{Daily Maximum Air Temperature} + \textit{Daily Minimum Air Temperature}}{2} - \textit{Crop Base Value}$$

For cotton the base value is 60 F. Any average temperature value less than 60 F would not accumulate GDUs for that day. Temperatures above 100 F prove challenging for cotton growth and is used as the maximum temperature for heat unit accumulation. Traditionally, it has been presumed that cotton needs anywhere from 2,200-2,600 GDU to become harvest ready. Unfortunately, the environment in the panhandle rarely meets that threshold in a 365-day period, much less a cotton growing season. Recent research in Texas has shown that there is potential to decrease that to an 1,800 GDU threshold in the Ogallala Aquifer region (Waddle, 1984; Howell et al., 2004). This threshold is much more feasible within a growing season in the Oklahoma Panhandle when combined with early maturing varieties. Mesonet data shows that planting date plays a critical role in achieving this base threshold of 1,800 GDU. It also shows that when cotton is planted in May near Beaver this GDU threshold should be easy to achieve and only a 5% probability of not meeting this threshold if planting is delayed until the first week of June. At Goodwell, planting the first week of May ensures accumulation of sufficient GDUs but waiting until the first week of June increases the probability of not accumulating 1,800 GDU to 15%. In contrast our analysis shows that at Boise City, cotton planted in May will have a 55% chance of not accumulating sufficient heat units, providing further evidence that cotton is not an ideal crop for the far western Panhandle.

Temperature

Within the 20 years of weather data across the three counties in the Panhandle, the latest final freeze in the spring was May 16 and the earliest first freeze in the fall was October 2. This provides a 139-day window without a freeze. From May to October there is an average accumulation of 12 heat units per day. With this freeze window and heat unit accumulation this time frame would fall short of the target 1,800 GDU. This is a short season compared to the 181-day growing season based on the average late freeze in spring (April 21) and average early freeze in the fall (October 19) in the Panhandle counties.

When planting in the first week of May in Beaver or Goodwell there is a 25% chance of a freeze event either prior to or following planting. However, this likelihood drops to 0% by the third week of May for both locations. In contrast, there is a 50% probability of adverse air temperatures the first week of May at Boise City where planting must take place the first week of June to avoid possible damaging air temperatures.

A late freeze after planting will only cause an issue if there has been enough GDU for emergence or if the seed has imbibed enough water to allow it to freeze under the surface. Checking soil temperature and monitoring daily temperatures can help to drive the decision of when to plant. If the seed is planted and sits in the soil during a night of freezing temperatures, there is a chance of cold damage or reduced seedling vigor, but the soil can maintain a sufficient temperature to keep the seedling safe in these temporary conditions. Therefore, a late freeze after planting may not catastrophically impact the crop but should be avoided, when possible, therefore it is important to monitor weather forecasts as planting is initiated.

As the season progresses it becomes important to monitor short- and long-term forecasts for declining temperatures to ensure that proper management can be applied in preparation for harvest. An extended growing season (or one that is warmer than average or extends later in the season) may allow for continued boll development that may result in increased yield, improved quality or both. This can be measured by in season conditions exceeding 1,800 GDU. These growing conditions can

contribute energy to developing later set bolls. The extended growing season may require extended irrigation to continue to supply water for developing bolls. This is especially true if irrigation was limited during the season. The chances of exceeding this minimum threshold of 1,800 GDU is more likely in the eastern portions of the panhandle but can occur more than 50% of the time in the central panhandle. Therefore, it is important to manage cotton based on the current growing season and forecasted conditions, instead of relying on calendar-based decisions.

Summary

Mesonet weather data illustrates that planting cotton in the far western Panhandle will result in low probability of accumulating sufficient GDU to develop mature and harvestable cotton as well as the greatest potential for early freezes. In contrast, data from Goodwell and Beaver suggest that planting in May can result in successful accumulation of GDUs. In fact, at Beaver, the data indicates that this can be annually achieved even when planting the third week of May when we no longer have a chance of soil temperatures below 65 F. At Goodwell, waiting until the third week of May increases the probability of not accumulating 1,800 GDU to 10%.

This data should be utilized as a guide to making cotton management decisions. However, current conditions and mid-to short-term forecasts of air temperature patterns and soil temperature should be considered as such that producers can take advantage of warm springs and/or extended growing conditions while mitigating risk associated with late freezes in the spring and fall.

The decision on when to plant is critical to take advantage of all the GDU a season offers. This is especially true in the Oklahoma panhandle. Planting early will allow higher GDU accumulation, but also increases the potential for a late spring freeze or inadequate soil temperatures to promote germination. While this may lead to increased GDUs aiding crop development and maturity of late set bolls that could positively impact yield.

While conditions are optimal with low early season risks by planting in June in the eastern Panhandle limitations with crop insurance coverage may not cover cotton planted later than June 7. It is important to assess the risks associated with these planting windows, while also consulting your local insurance agency on planting deadlines.

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