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# Agronomic Management to Optimize Texas High Plains Grain Sorghum Production

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Grain sorghum provides Texas High Plains producers with a reduced-risk cropping option because of inherent heat and drought tolerance. Financial inputs are generally lower than other warm-season crops because of lower seed costs and improved water use efficiency. Specifically, grain sorghum can produce its first bushel of grain per acre on about 2 to 3 inches less water than corn. This improved water use efficiency is especially important in dry conditions and increases the probability that sorghum reaches reproductive maturity and delivers a harvestable yield. However, the adoption of key agronomic practices is essential to further enhance and stabilize yield potential. To optimize production, consider these four foundational factors:

### 1. Hybrid Selection and Maturity

Selecting a hybrid with a maturity rating suited for your specific environment and water availability is a first step toward success. Match maturity to your regional frost dates and predicted water windows to ensure the crop has ample time to reach physiological maturity (Table 1). Because the actual maturation rate is a function of accumulated heat units, planting dates and year-year environmental variability will result in slight variations in the days to half-bloom.

| Maturity | Days to Half Bloom | Total Water Requirement (in.) |
|---|---|---|
| Early | 50-59 | 10-14 |
| Medium-Early | 60-65 | 14-16 |
| Medium | 66-69 | 16-18 |
| Medium-Long | 70+ | 18-20 |

**Table 1.** Average days to half-bloom and total water requirement for marketed maturity classes commonly grown on the Texas High

**Figure 1.** Well managed dryland grain sorghum field in the Texas Panhandle (Photo Credit: Jourdan Bell)

## 2. Planting Date and Heat Stress

Planting dates for sorghum in the Texas High Plains vary considerably. In dryland systems, planting must coincide with timely rainfall to ensure uniform germination and crop establishment. While there is a common perception that early planting increases productivity, research conducted in the region shows no distinct advantage to early planting (Jenkins, 2022). A benefit to delaying planting from early May to late May or even early- to mid-June (or slightly later in the South Plains) is shifting the flowering time window. Sorghum planted in early May often flowers in July, typically hottest month in the region. High temperatures during the reproductive phase are a significant contributor to yield loss. Research indicates that the 10-day window from boot through flowering is the most critical. Heat stress during this period can reduce grain yield by 54% to 87%, even when moisture is adequate (Prasad et al., 2008; Crauford and Peacock, 1993). Specifically, sorghum pollen begins to sustain damage at temperatures exceeding ~97°F, leading to poor seed set (Djanaguiraman et al., 2018). The interaction of heat with limited soil moisture further compounds yield losses. Sorghum flowers over a 5- to-8- day window from the top of the panicle down (Vanderlip, 1993). This staggered progression provides sorghum an opportunity to escape brief, acute periods of heat stress during the reproductive phase that might result in near-total floret sterility. Consequently, producers must identify the specific timing of peak heat in their region and then match the maturity of the hybrids they will plant with a planting date that avoids the highest temperatures at flowering.

**Figure 2.** Examples of varying pollination because of heat stress in the Texas A&M AgriLife 2020 forage sorghum trial. All plots were evaluated for pollination with scores from 1 to 3 as represented by images from left to right. 1: ≥90% pollination (Good), 2: 50-90% pollination (Fair), 3: ≤90% pollination (Poor). (Photo credit: Jourdan Bell)

### 3. Fertility Management

While soil analysis is the gold standard for efficiency, the general "Rules of Thumb" (ROT) for sorghum nutrient requirements are:

- Nitrogen (N): 1.2 lbs/bushel (2.0 lbs N per 100 lbs grain)
- Phosphorus ($P_2O_5$): 0.4 lbs/bushel (0.17 lbs P/bushel or 0.3 lbs P per 100 lbs grain)
- Potassium ($K_2O$): 0.3 lbs/bushel (0.25 lbs K/bushel or 0.4 lbs K per 100 lbs grain)

Nutrient applications should always be balanced with a recent soil test. Early-season pre-plant soil testing ensures adequate nutrients are available during the critical stages of germination and stand establishment.

### 4. Herbicide Management and Differentiation

Timing is everything with post-emergence herbicides. Many labels specify that drop nozzles must be used after the 7- to10-leaf stage or approximately 30 to 40 days after emergence for early- to medium-long maturity hybrids. Some labels use plant height (example, 12 to 15 inches) which loosely corresponds with this growth stage. Plant height is a function of genetics and environment, so it is important to verify the physiological stage. This is a physiological mandate, not just a suggestion.

**Figure 3.** Growing point differentiation in sorghum (Photo Credit: Ronnie Schnell).

At this stage, sorghum enters growing point differentiation (GPD). During GPD, the growing point moves above the soil surface, and rapid cell division occurs as the plant transitions from vegetative to reproductive growth. This is when the spikelet number and potential number of seeds per spikelet is being determined. Direct herbicide contact down the whorl may be absorbed by the growing point and negatively impact panicle development. This leads to "blasted" heads and reduced grain set.

Some labels set requirements based on crop height, so it is important to check the label. Examples of post-emergent restrictions for common sorghum herbicides per herbicide labels:

**2,4-D LV6 and Amine:** Only make a post-emergent application when plants are 5 to 15 inches tall but use a drop nozzle when plants are greater than 8 inches tall. Do not spray plants less than 5 inches tall. Applying after 8-inches will result in crop injury (Figure 4).

**Dicamba:** Only make a post-emergent application after all sorghum has emerged and before sorghum is 15 inches tall. Use a drop nozzle when plants are greater than 8 inches tall.

**Huskie (Pyrasulfotole + Bromoxynil):** Can generally be applied up to 30 inches tall or prior to flag leaf emergence in both grain and forage sorghum, but application timing and coverage are critical to avoid transitory leaf burn.

**Figure 4.** Characteristic 2,4-D injury in sorghum a) stalk lodging, b) buggy-whipping leaves, and c) brace root fusion and deformation following a post-emergent 2,4-D application using flat-fan nozzles when sorghum was 10 to 12 inches tall. (Photo Credits: Jourdan Bell).

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