EXTENSION

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Variation in heat-sensitive germination among contemporary hard winter wheat varieties, 2019–2024

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Early sowing is one of the most cost-effective ways to increase fall forage production in winter wheat. Sowing before Sep. 20 generally allows enough time for the crop to establish a canopy, produce forage and develop a strong root system before grazing begins, usually in late November. In the Southern Great Plains, dual-purpose wheat — wheat grown for both grazing and grain — is typically sown in September.

However, factors like seed dormancy, sensitivity to high soil temperatures and coleoptile length can delay germination or hinder seedling emergence when wheat is sown early into hot soils. Delayed germination shortens the growing window before winter dormancy, ultimately reducing forage production. Understanding these factors is crucial for dual-purpose wheat producers to optimize stand establishment and maximize fall forage growth.

Post-harvest dormancy

Wheat seed is considered dormant when it fails to germinate even under favorable conditions. Some level of seed dormancy is beneficial as it helps prevent premature sprouting before harvest. Dormancy is highest just before harvest and gradually decreases over time, though the rate of dormancy loss varies due to several factors.

For example, inhibitory compounds in the seed coat of hard red winter wheat varieties can extend post-harvest dormancy. Additionally, storage conditions impact dormancy loss — wheat stored at extremely hot or cold temperatures after harvest tends to germinate more readily than seed stored at ambient air temperatures. This is why placing seed samples in a refrigerator for a day or two before conducting germination tests is a common practice.

Environmental conditions during grain fill also influence seed dormancy. Cooler temperatures during this period typically result in stronger dormancy, meaning that the same wheat variety harvested from different locations within a state or region may exhibit varying germination behavior when sown early. For most hard red winter wheat varieties, post-harvest dormancy naturally dissipates by October. However, early sowing shortens the interval between harvest and planting, increasing the risk that dormancy has not fully broken, which can delay germination.

High-temperature germination sensitivity

In addition to post-harvest dormancy, some wheat varieties exhibit sensitivity to high soil temperatures, a trait commonly referred to as high-temperature germination sensitivity (Table 1). While wheat can germinate in soil temperatures ranging from 40 to 99 degrees Fahrenheit, the optimal range is 54 to 77 degrees Fahrenheit. In western Oklahoma, soil temperatures often remain above 80 to 85 degrees until mid-September and may not drop below 80 degrees until October. These elevated temperatures can extend dormancy in sensitive varieties, making them less suitable for early planting.

A practical strategy is to plant less sensitive varieties first and postpone sowing sensitive varieties until soil temperatures decrease. In most years, the combination of time after harvest and cooler soil conditions enables germination for most hard red winter wheat varieties by Sep. 15. However, high-temperature germination sensitivity does not mean the seed will not germinate at all; it simply delays germination until conditions improve, potentially limiting fall forage production.

Description of procedures

This study was conducted under controlled conditions, eliminating environmental factors, such as soil moisture variability, that are present in field conditions. This setup allowed for temperature control and enabled comparisons of the wheat varieties' sensitivity to germination in hot soils. Seeds were collected from the Stillwater demonstration plots, including harvest years from 2019 to 2024. We tested 20 seeds from each variety at three replications under two temperatures: 68 degrees (20 degrees Celsius) and 86 degrees (30 degrees Celsius). Daily germination counts were recorded for each variety, and the data was used to rank the varieties based on their sensitivity levels.

Table 1. High temperature germination sensitivity for hard red winter wheat varieties.

No sensitivity	Low sensitivity	Moderate sensitivity	Sensitive
TAM115	AP EverRock	TAM114	AG Golden
SY Wolverine	CP7017AX	WB4792	Breakthrough
Big Country	AP Prolific	LCS Chrome	Canvas
Smith's Gold	Showdown	AG Radical	Bob Dole
Paradox	Doublestop CL+	Firebox	TAM204
CP7869	Green Hammer	CP7266AX	AG Icon
WB4401	KS Ahearn	WB4632	KS Western Star
KS Dallas	AP Roadrunner	LCS Julep	WB4369
LCS Helix AX	Strad CL+	Bentley	
AP Bigfoot	Baker's Ann	KS Providence	
Duster	Crescent AX	WB4699	
TAM 112	AM Cartwright	CP7909	
High Cotton	Uncharted	Iba	
LCS Photon AX	LCS Atomic AX	Butler's Gold	
OK Corral	Gallagher		

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