

First Hollow Stem Identification and Dual-Purpose Wheat Varieties

Jourdan M. Bell, Carla Naylor, Preston Sirmon, and Kevin Heflin

Dual-purpose winter wheat is planted for grazing and grain production across the Texas High Plains. March 15 is the deadline for removing cattle from insured dual-purpose wheat pastures, but depending on the planted variety and environmental conditions, it is often advised to remove cattle sooner if a producer also hopes to maximize grain production. This is an economic decision that is based on annual grain and cattle prices, and to optimize profitability in both markets, pull-off timing is critical.

To maximize forage grazing and grain profitability, it is advised to remove cattle when the wheat reaches the first hollow stem (FHS) stage. At FHS, wheat has switched from a vegetative to a reproductive stage, but the first node or joint is still below the soil surface. This stage occurs before jointing (Feekes 6.0) when the leaf sheaths become erect. If the pull-off date is delayed until the jointing stage, the developing wheat head will have moved above the soil surface and be susceptible to grazing injury. Previous research demonstrated that every day wheat is grazed past FHS reduces grain yields (Redmon et al., 1996), and grain losses can reach 10% when grazing 10 days past FHS (Fiester et al., 2006).

Predicting First Hollow

The wheat variety as well as planting date, temperature, water stress, day length, and grazing pressure affect the rate of development. The maturity classes for wheat (early, medium, late, and very late) will provide the producer an indication of the occurrence of FHS. The maturity of the planted wheat variety is regulated by the vernalization requirement and photoperiodism (sensitivity to day length), which influence the rate of development, occurrence of FHS, and ultimately the duration of grazing.

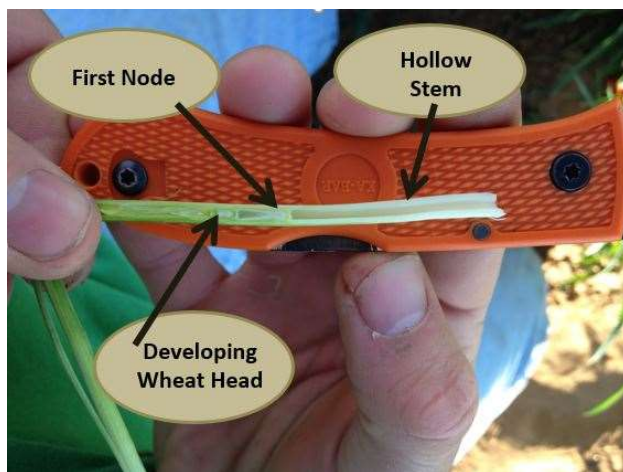


Image 1. Identification of an elongated hollow stem, first node, and developing head (Photo credit J. Bell).

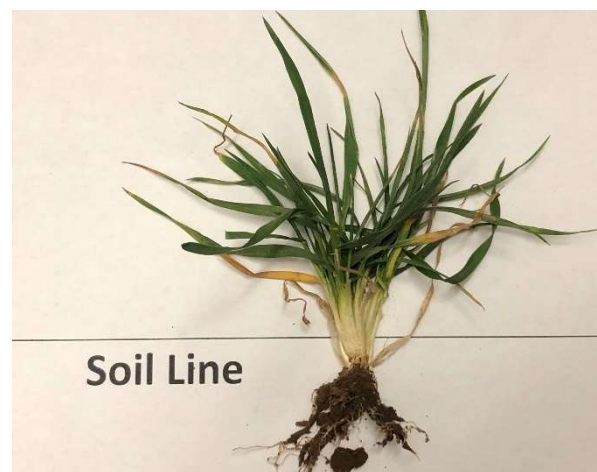


Image 2. Identification of the crown below the soil line (Photo credit J. Bell).

For dual-purpose grazing, it is recommended that later maturing varieties be used to extend the grazing period before FHS, but stocking density will impact the rate of development. Heavily stocked fields will mature at a slower rate than fields stocked at a lower density.

Planting date also impacts the FHS date. Earlier planted wheat accumulates more heat or growing degree days (GDDs) earlier in the season resulting in a quicker onset of FHS than later planted wheat. While many growers plant wheat for dual purpose production in late summer to optimize fall forage production and winter grazing, this can result in an earlier FHS date because the amount of heat accumulated by the plant in the fall influences plant development in the spring. It has been suggested that in-season GDD accumulation can be used to predict FHS, but examination of dryland wheat in the Texas Panhandle suggests that using GDD accumulation to identify the anticipated FHS date may be inaccurate due to year-to-year variability and the influence of the planted varieties maturity (Table 1). Accumulated GDDs to FHS ranged from 1,974 to 2,786 from 2014-2020. In-season soil moisture stress during tillering stages will delay wheat development and the onset of FHS regardless of accumulated GDDs. When calculating wheat GDDs, the base temperature (the lower threshold temperature) is 39.2° F (Undersander and Christiansen, 1986), and the upper threshold temperature is 86° F. The base temperature is the temperature below which the plant stops developing, and the upper threshold is the temperature where heat is no longer beneficial for plant development. Temperatures above the threshold temperature can result in plant stress and developmental delays. Daylength also affects development. The transition from vegetative to reproductive development is accelerated as day length increases (Ghiglione et al., 2008).

These factors can move FHS and jointing forward or backward by as much as 7 to 14 days, so physical examination of the wheat rather than relying on a calendar date or GDD accumulation is a more accurate determination of the growth stage. Since grazing delays wheat development, determinations of wheat growth stages should be made in non-grazed areas. Cut the selected wheat plant off at the base of the crown below the soil surface and look for the main stem. The smaller shoots are tillers and will not be indicative of the actual growth stage because maturity is slightly delayed for tillers. After separating the main stem from the tillers, slice the main stem open lengthwise from the base, in equal halves. Look for the hollow stem below the spear shaped wheat head in the cut stem slice (Image 1). Jointing occurs when the first node emerges above the soil line (Image 2).

Evaluation of First Hollow Stem in Texas A&M Wheat Varieties

The days to FHS and growing degree day (GDD) accumulation of common dual-purpose varieties in the Texas Panhandle was evaluated from 2015-2020 for ungrazed dryland wheat at the Texas A&M AgriLife Research Farm at Bushland, Texas (Table 1). Evaluation of select varieties shows differences in maturity between years and varieties. The average date to FHS for the evaluated varieties in the dryland Bushland variety trials was March 18, but the average annual FHS date ranged from March 7 in 2016 to March 29 in 2019. The later FHS date in 2019

was a function of a later planting date and low spring temperatures as indicated by lower seasonal GDDs. Across evaluated varieties, the average FHS date ranged from March 15 for TAM 112 to March 23 for TAM 205. TAM 112 is known to have a slightly earlier FHS date than other dual-purpose varieties, while TAM 205 has a later FHS date for a longer grazing window. Based on evaluations from two or more years, data confirmed that the FHS date was up to 8 days later for evaluated varieties than TAM 112, which remains a top variety for dryland dual-purpose systems (Table 2).

To maximize grain yields in dual-purpose systems, it is strongly recommended that producers consider the maturity class of their selected variety but evaluate wheat plants from each ungrazed portions of grazed field every year regardless of variety rather than relying on a calendar date.

Table 2. Number of days from March 15 to FHS for evaluated wheat varieties based on evaluations for two or more years at Bushland, Texas.

Variety	Days to FHS from March 15
TAM 111	3
TAM 112	0
TAM 113	3
TAM 114	4
TAM 115	6
TAM 204	4
TAM 205	8
TAM 304	0
TAM 401	0
Iba	7
T158	4
LCS Mint	7
Winterhawk	6

References:

Fieser, B.G., G.W. Horn, J.T. Edwards, and E.G. Krenzer. 2006. Timing of Grazing Termination in Dual-Purpose Winter Wheat Enterprises. *The Professional Animal Scientist*. 22(3)210-216. doi.org/10.15232/S1080-7446(15)31096-2.

Ghiglione, H.O., F.G. Gonzalez, R. Serrago, S.B. Maldonado, C. Chilcott, J.A. Curá, D.J. Miralles, T. Zhu, and J.J. Casal. 2008. Autophagy regulated by day length determines the number of fertile florets in wheat. *The Plant Journal*, 55(6):1010-1024.

Redmon, L.R., E.G. Krenzer Jr., D.J. Bernardo, and G.W. Horn. 1996. Effect of Wheat Morphological Stage at Grazing Termination on Economic Return. *Agro. Journal* doi.org/10.2134/agronj1996.00021962008800010020x

Undersander, D.J. and S. Christiansen. 1986. Interactions of water variables and growing degree days on heading phase of winter wheat. *Agricultural and Forest Meteorology*. 38: 169-180 doi.org/10.1016/0168-1923(86)90056-0.

Table 1. Date of the First Hollow Stem (FHS) measurement reaching 0.6 inches or 15.2 mm from the crown, days to FHS, and cumulative GDDs for select wheat varieties under dryland conditions at Bushland, Texas. A hollow stem height of 0.6 inches (15.2 mm) makes the growing point susceptible to grazing injury.

Varieties Evaluated	2014-2015 Planted 10/1/2014		2015-2016 Crop Planted 10/14/2015			2016-2017 Crop Planted 10/17/2016			2017-2018 Crop Planted 10/11/2017			2018-2019 Crop Planted 10/30/2018			2019-2020 Crop Planted 10/14/2019			Average	
	Date of FHS 2015	Days to FHS	Date of FHS 2016	Days to FHS	GDD Base 32	Date of FHS 2017	Days to FHS	GDD Base 32	Date of FHS 2018	Days to FHS	GDD Base 32	Date of FHS 2019	Days to FHS	GDD Base 32	Date of FHS 2020	Days to FHS	GDD Base 32	Avg. Date of FHS	Days to FHS
TAM 111	18-Mar	168	7-Mar	145	2323	18-Mar	152	2695	24-Mar	164	2854	27-Mar	148	1920	14-Mar	152	2089	18-Mar	155
TAM 112	16-Mar	166	2-Mar	140	2206	17-Mar	151	2664	13-Mar	153	2597	29-Mar	150	1983	15-Mar	153	2098	15-Mar	152
TAM 113	20-Mar	170	3-Mar	141	2223	21-Mar	155	2794	23-Mar	163	2827	28-Mar	149	1956	14-Mar	152	2089	18-Mar	155
TAM 114	20-Mar	170	7-Mar	145	2323	22-Mar	156	2817	24-Mar	164	2854	27-Mar	148	1920	14-Mar	152	2089	19-Mar	156
TAM 115	---- [†]	----	----	----	----	----	----	----	----	----	----	29-Mar	150	1983	12-Mar	150	2054	21-Mar	150
TAM 204	21-Mar	171	9-Mar	147	2359	19-Mar	153	2731	24-Mar	164	2498	29-Mar	150	1983	14-Mar	152	2089	19-Mar	156
TAM 205	----	----	----	----	----	----	----	----	----	----	----	29-Mar	150	1983	16-Mar	154	2121	23-Mar	152
TAM 304	21-Mar	171	8-Mar	146	2341	17-Mar	151	2664	----	----	----	----	----	----	----	----	----	15-Mar	156
TAM 401	21-Mar	171	12-Mar	150	2420	17-Mar	151	2438	----	----	----	----	----	----	----	----	----	15-Mar	157
TX14A001035	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15-Mar	153	2098	15-Mar	153
TX14M7061	----	----	----	----	----	----	----	----	----	----	----	----	----	----	14-Mar	152	2089	14-Mar	152
TX14V70214	----	----	----	----	----	----	----	----	----	----	----	----	----	----	14-Mar	152	2089	14-Mar	152
Iba	28-Mar	178	8-Mar	146	2341	20-Mar	154	2767	26-Mar	166	2917	2-Apr	154	2016	15-Mar	153	2098	22-Mar	159
T158	----	----	9-Mar	147	2341	17-Mar	151	2664	25-Mar	165	2888	30-Mar	151	1991	15-Mar	153	2098	19-Mar	153
LCS Mint	----	----	----	----	----	----	----	----	----	----	----	30-Mar	151	1991	14-Mar	152	2089	22-Mar	152
Winterhawk	22-Mar	172	14-Mar	152	2472	18-Mar	152	2695	24-Mar	164	2854	29-Mar	150	1983	17-Mar	155	2141	21-Mar	158
Yearly Average	20-Mar	171	7-Mar	146	2472	18-Mar	153	2472	22-Mar	163	2786	29-Mar	150	1974	14-Mar	153	2095	18-Mar	154

[†] variety not evaluated