



2023-2024 Texas A&M AgriLife Small Grain Silage Trial at Bushland

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Small grains have historically been an important forage source for beef and dairy producers, and because of increasing livestock numbers and associated forage requirements, the demand for ensiled small grains continues to increase across the Southern Great Plains. Ensiled forages provide livestock producers an opportunity to preserve forage quality for future consumption.

The 2023-2024 Texas A&M AgriLife small grain silage trials consisted of 40 entries including wheat (n=20), triticale (n=10), rye (n=9) and a wheat-triticale blend (n=1). Evaluated varieties were submitted by seed companies on a per fee basis. Varieties were evaluated under a lateral move irrigation system in a randomized complete block design and replicated three times. All varieties were harvested at boot and soft-dough stages. Uniform sub-samples were collected for dry matter and nutritional composition from all plots. A sub-sample of the chopped forage was dried at 221°F (105°C) to determine harvest moisture. A 600-gram sample was submitted to Cumberland Valley Analytical Services for forage nutritional analyses using near infrared reflectance spectroscopy (NIR), and forage constituents are reported on a dry matter (DM) basis (Tables 3 and 4).

Yield responses were driven by forage type and late season environmental interactions. As with summer forages, moisture (rainfall and/or irrigation) is essential to overcome heat stress. Wheat varieties reached boot and heading stages earlier than triticale varieties, and moderate temperatures (80-90 °F) coupled with timely rainfall and irrigation during the wheat heading stage (Fig. 1) benefited wheat yields at soft-dough (Fig. 2; Table 1). Conversely, temperatures were 90-100°F during the triticale heading period, and late rainfall did not provide yield benefits. Producers should consider year-to-year variability and irrigation system limitations when making forage type selections to optimize production with the selected forage type. Multi-year datasets demonstrate the value of timely irrigation and/or precipitation, which explain yield inconsistencies between forage types.

Agronomics

Planted 10/22/2023

Seeding Rate: Wheat and Triticale 1.2 M seeds/acre, Rye 0.8 M seeds/acre

Fertilizer 80 lbs. N and 35 lbs. P

Herbicides: Prowl H20 3/5/2024

Fungicides: Prosaro 4/19/2024

Irrigation: 9.5 inches to Boot and 12 inches to Soft-Dough

Precipitation: 6.8 inches (planting - 6/11/2024)

Crop water use is an important consideration for Southern Great Plains producers, and to answer producer questions about differences in water use between forage types, seasonal crop water use was determined for three varieties representing wheat, rye, and triticale (Table 4). Data confirmed significant differences in total crop water use between forage types, but producers should consider 1) greater water use is a function of a longer growing season and 2) greater water use efficiencies are a function of greater yields within the respective forage type. To minimize yield losses and overcome potential heat stress, irrigation capacity is an important agronomic consideration.

Forage Nutritive Analyses Defined:

CP: Crude Protein

ADF: Acid Detergent Fiber; a fraction of the cell wall includes cellulose and lignin.

NDF: Neutral Detergent Fiber; cell wall fraction of the forage.

NDFD30: NDF digestibility; estimated fiber digestibility after 30 hours.

Lignin: A structural material for cell walls and thus important for plant standability. Lignin is almost completely indigestible.

Starch: A carbohydrate primarily located in the grain. Starch availability is a function of harvest timing and berry processing.

WSC: A measurement of simple sugars (glucose, fructose, and sucrose) and fructans. WSCs accumulate in the stalk until anthesis. After anthesis, they remobilize to the grain. WSCs are important for fermentation as they are used during the development of lactic acid.

TDN: % Total Digestible Nutrients representing digestible protein, digestible crude fiber, digestible nitrogen free extract, and digestible fat.

tons TDN produced per acre: Represents the energy production under the evaluated management and environmental conditions. Calculated as $\% \text{ TDN} \times \text{forage yield (tons/acre; DM basis)} = \text{tons of TDN produced per acre}$

Milk/ton: An index based on several variables that influence intake and nutritive value. These are applied to a standard dairy cow to project milk produced per ton of forage. Calculated using Milk 2006.

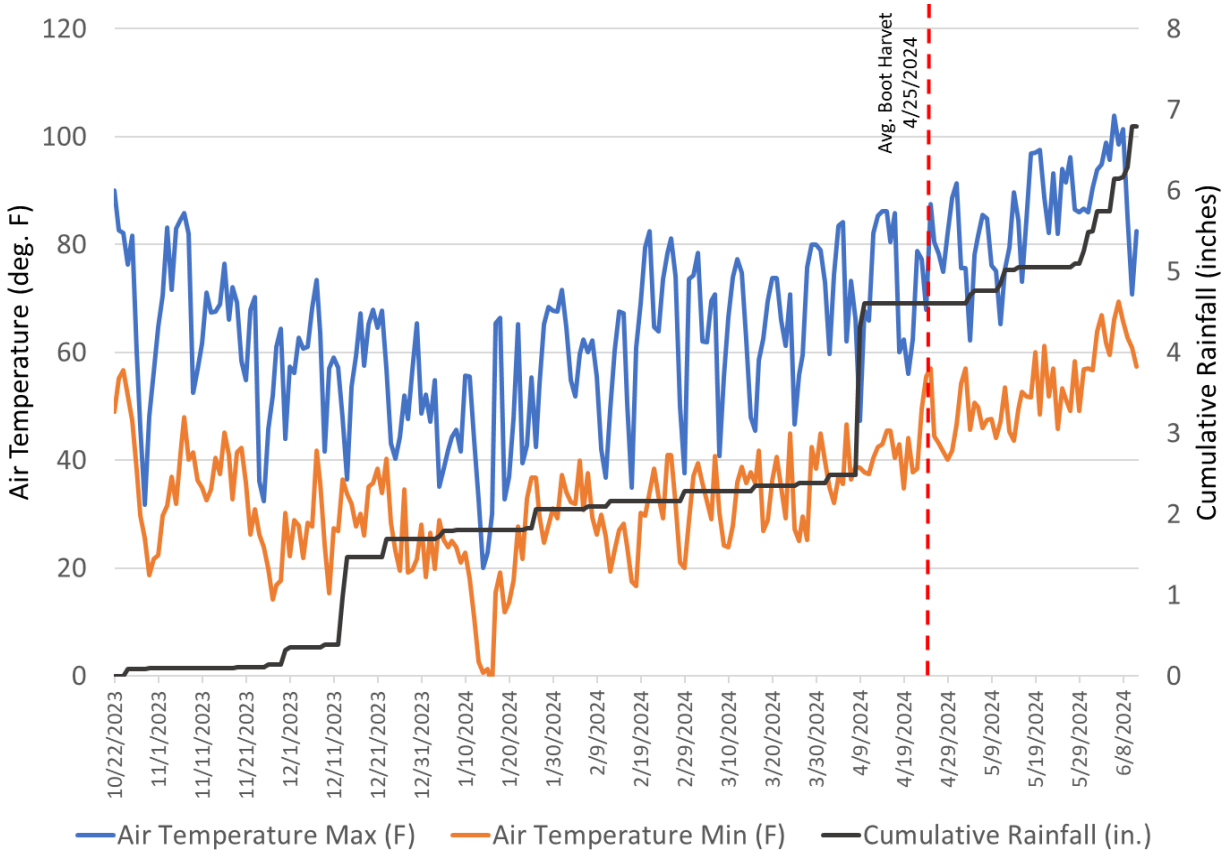


Figure 1. Daily temperature and precipitation during the 2023-2024 production season in Bushland, Texas.

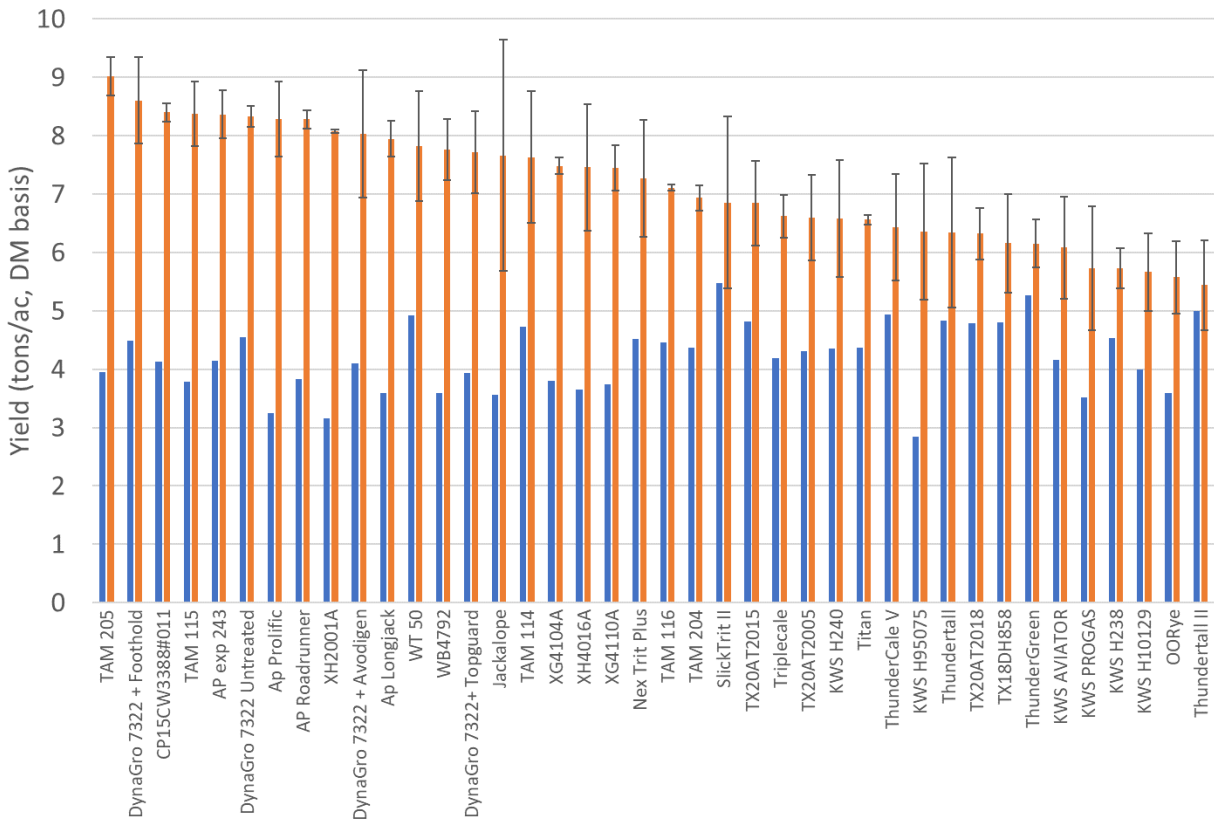


Figure 2. Yield distribution (DM basis) at boot and soft-dough for the varieties evaluated in the 2023-2024 Texas A&M AgriLife Small Grain Variety Trial.

Table 1. Yield data at boot and soft-dough stages at the reported harvest dates. Emergence and winter vigor rating scale: 0=no stand, 1=poor, 3=good, 4=very good, 5=excellent. The spring development rate is represented by the feekes stages on March 12 and March 27, 2024. Feekes scale: 3=tillering, 4=leaf sheaths lengthening, 5=leaf sheaths erect, 6=first node, and 7=second node.

| Entry | Variety | Company/Developer | Type | 11/8/2023 | 2/8/2024 | 3/12/2024 | 3/27/2024 | Boot (Feekes 10) | | | Soft-Dough | | |
|-------|-------------------------|--------------------------------|-------------|--------------|---------------------|--------------|--------------|----------------------|----------|-----------------------------|----------------------|----------|-----------------------------|
| | | | | Emer. Rating | Winter Vigor Rating | Feekes Stage | Feekes Stage | Harvest Date | Ht (in.) | Yield (lbs/ac) DM Basis* | Harvest Date | Ht (in.) | Yield (lbs/ac) DM Basis* |
| 1 | AP exp 243 | AgriPro/Syngenta | HRWW | 4.0 | 3.7 | 5.5 | 7.0 | 4/26/2024 | 32 | 8,287 | 6/3/2024 | 35 | 16,732 |
| 2 | Ap Longjack | AgriPro/Syngenta | HRWW | 4.7 | 4.0 | 5.0 | 6.5 | 4/26/2024 | 30 | 7,199 | 6/4/2024 | 36 | 15,899 |
| 3 | Ap Prolific | AgriPro/Syngenta | HRWW | 3.0 | 2.8 | 6.0 | 7.0 | 4/26/2024 | 32 | 6,488 | 6/4/2024 | 34 | 16,575 |
| 4 | AP Roadrunner | AgriPro/Syngenta | HRWW | 3.7 | 3.7 | 5.5 | 6.8 | 4/24/2024 | 29 | 7,657 | 6/4/2024 | 35 | 16,560 |
| 5 | CP15CW3388#011 | AgriPro/Syngenta | HRWW | 3.7 | 3.7 | 6.0 | 6.5 | 4/26/2024 | 29 | 8,273 | 6/4/2024 | 33 | 16,799 |
| 6 | DynaGro 7322 + Foothold | Nutrien/Texas A&M AgriLife | HRWW | 4.0 | 3.7 | 5.5 | 5.5 | 4/26/2024 | 29 | 8,985 | 6/5/2024 | 35 | 17,210 |
| 7 | DynaGro 7322 + Avodigen | Nutrien/Texas A&M AgriLife | HRWW | 4.3 | 3.7 | 5.5 | 6.0 | 4/26/2024 | 30 | 8,200 | 6/4/2024 | 35 | 16,062 |
| 8 | DynaGro 7322+ Topguard | Nutrien/Texas A&M AgriLife | HRWW | 4.3 | 3.0 | 5.5 | 6.0 | 4/26/2024 | 30 | 7,878 | 6/4/2024 | 34 | 15,437 |
| 9 | DynaGro 7322 Untreated | Nutrien/Texas A&M AgriLife | HRWW | 4.7 | 3.7 | 5.5 | 6.0 | 4/26/2024 | 30 | 9,103 | 6/6/2024 | 35 | 16,662 |
| 10 | TAM 114 | Texas A&M AgriLife | HRWW | 3.3 | 3.3 | 6.0 | 6.5 | 4/26/2024 | 31 | 9,454 | 6/3/2024 | 34 | 15,267 |
| 11 | TAM 115 | Watley/Texas A&M AgriLife | HRWW | 4.0 | 3.7 | 6.5 | 7.0 | 4/26/2024 | 30 | 7,565 | 6/4/2024 | 38 | 16,753 |
| 12 | TAM 116 | Warner/Texas A&M AgriLife | HRWW | 4.0 | 3.7 | 5.5 | 6.5 | 4/26/2024 | 29 | 8,905 | 6/4/2024 | 34 | 14,218 |
| 13 | TAM 204 | Watley/Texas A&M AgriLife | HRWW | 3.7 | 3.5 | 5.5 | 6.5 | 4/26/2024 | 31 | 8,731 | 6/3/2024 | 35 | 13,875 |
| 14 | TAM 205 | Warner/Texas A&M AgriLife | HRWW | 4.0 | 3.7 | 5.3 | 6.8 | 4/26/2024 | 33 | 7,912 | 6/4/2024 | 37 | 18,050 |
| 15 | TX18DH858 | Texas A&M AgriLife | HRWW | 3.7 | 4.3 | 6.0 | 6.5 | 4/22/2024 | 32 | 9,615 | 6/3/2024 | 38 | 12,315 |
| 16 | WB4792 | WestBred/Bayer | HRWW | 3.0 | 3.0 | 6.0 | 7.0 | 4/26/2024 | 30 | 7,175 | 6/5/2024 | 36 | 15,526 |
| 17 | XH2001A | WestBred/Bayer | HRWW | 3.0 | 2.3 | 4.5 | 6.5 | 4/26/2024 | 31 | 6,326 | 6/5/2024 | 36 | 16,157 |
| 18 | XG4110A | WestBred/Bayer | HRWW | 4.0 | 3.7 | 6.5 | 7.0 | 4/18/2024 | 28 | 7,469 | 6/3/2024 | 37 | 14,899 |
| 19 | XG4104A | WestBred/Bayer | HRWW | 3.7 | 3.3 | 6.5 | 6.5 | 4/26/2024 | 29 | 7,615 | 6/4/2024 | 35 | 14,970 |
| 20 | XH4016A | WestBred/Bayer | HRWW | 3.3 | 4.0 | 6.0 | 7.0 | 4/26/2024 | 31 | 7,303 | 6/4/2024 | 36 | 14,914 |
| 21 | Jackalope | Ehmke | Rye | 1.3 | 2.8 | 4.0 | 6.0 | 4/18/2024 | 33 | 7,132 | 6/4/2024 | 44 | 15,326 |
| 22 | OORye | Ehmke | Rye | 3.0 | 4.2 | 5.0 | 6.0 | 4/12/2024 | 36 | 7,195 | 6/3/2024 | 49 | 11,147 |
| 23 | ThunderGreen | Ehmke | Rye | 1.0 | 2.3 | 4.0 | 6.0 | 4/26/2024 | 38 | 10,522 | 6/5/2024 | 43 | 12,303 |
| 24 | KWS AVIATOR | KWS | Rye | 2.0 | 3.5 | 4.0 | 6.5 | 4/26/2024 | 41 | 8,307 | 6/4/2024 | 45 | 12,174 |
| 25 | KWS PROGAS | KWS | Rye | 2.0 | 4.0 | 5.0 | 6.0 | 4/26/2024 | 37 | 7,039 | 6/4/2024 | 44 | 11,465 |
| 26 | KWS H10129 | KWS | Rye | 2.3 | 3.7 | 4.0 | 6.0 | 4/24/2024 | 37 | 7,993 | 6/4/2024 | 44 | 11,327 |
| 27 | KWS H240 | KWS | Rye | 2.0 | 4.2 | 4.5 | 7.0 | 4/23/2024 | 37 | 8,715 | 6/4/2024 | 44 | 13,166 |
| 28 | KWS H95075 | KWS | Rye | 1.7 | 4.0 | 6.0 | 8.0 | 4/8/2024 | 30 | 5,677 | 6/4/2024 | 43 | 12,708 |
| 29 | KWS-H238 | KWS | Rye | 2.7 | 4.5 | 4.5 | 6.0 | 4/23/2024 | 37 | 9,060 | 6/5/2024 | 41 | 11,464 |
| 30 | ThunderCale V | Ehmke | Triticale | 3.7 | 4.0 | 4.5 | 6.0 | 4/26/2024 | 36 | 9,888 | 6/11/2024 | 44 | 12,861 |
| 31 | Thundertall | Ehmke | Triticale | 2.3 | 2.5 | 4.0 | 5.5 | 5/3/2024 | 38 | 9,658 | 6/11/2024 | 53 | 12,679 |
| 32 | Thundertall II | Ehmke | Triticale | 4.0 | 3.8 | 4.5 | 6.0 | 5/3/2024 | 46 | 10,007 | 6/11/2024 | 51 | 10,870 |
| 33 | TX20AT2005 | Texas A&M AgriLife | Triticale | 3.7 | 3.8 | 4.5 | 6.5 | 4/26/2024 | 42 | 8,619 | 6/11/2024 | 52 | 13,194 |
| 34 | TX20AT2015 | Texas A&M AgriLife | Triticale | 3.3 | 3.7 | 4.3 | 6.3 | 4/26/2024 | 44 | 9,639 | 6/11/2024 | 52 | 13,689 |
| 35 | TX20AT2018 | Texas A&M AgriLife | Triticale | 3.7 | 3.7 | 4.5 | 6.5 | 4/26/2024 | 45 | 9,586 | 6/11/2024 | 49 | 12,646 |
| 36 | Triplecale | Warner Seed | Triticale | 4.3 | 4.5 | 4.5 | 6.0 | 4/26/2024 | 43 | 8,367 | 6/11/2024 | 49 | 13,243 |
| 37 | SlickTrit II | Watley Seed | Triticale | 4.0 | 3.2 | 4.0 | 5.0 | 5/4/2024 | 46 | 10,944 | 6/11/2024 | 52 | 13,708 |
| 38 | Titan | Watley Seed/Texas A&M AgriLife | Triticale | 4.7 | 4.3 | 5.0 | 6.0 | 4/23/2024 | 37 | 8,740 | 6/11/2024 | 50 | 13,122 |
| 39 | Nex Trit Plus | West Gaines Seed | Triticale | 3.7 | 4.2 | 4.5 | 6.0 | 4/26/2024 | 42 | 9,046 | 6/11/2024 | 53 | 14,539 |
| 40 | WT 50 | Warner Seed | Wheat-Trit. | 4.2 | 4.0 | 5.0 | 5.0 | 4/29/2024 | 45 | 9,855 | 6/11/2024 | 52 | 15,654 |
| | | | | | | | | Trial Average | 35 | 8,403 | Trial Average | 42 | 14,304 |
| | | | | | | | | p-value | <0.0001 | <0.0001 | p-value | <0.0001 | 0.0004 |
| | | | | | | | | CV | 7.8 | 9.8 | CV | 5.3 | 11.8 |
| | | | | | | | | LSD | 4.4 | 1,342 | LSD | 3.6 | 3,141 |

* Yellow highlighted values are not significantly different at the respective physiological growth stage.

Table 2. Nutrient composition of small grain varieties evaluated in the 2023-2024 small grain variety trial at Bushland harvested at the boot stage sorted by maximum tons TDN/ac.

| Entry | Variety | Type | Nutrient Composition at Boot (DM Basis) | | | | | | | | | | |
|----------------------|-------------------------|-----------------|---|---------|---------|---------|----------|----------|---------|----------|---------|----------|-------------|
| | | | Harvest Date | % CP | % ADF | % NDF | % Lignin | % NDFD30 | % WSC | % Starch | % TDN | Milk/Ton | Tons TDN/ac |
| 23 | ThunderGreen | Rye | 4/26/2024 | 16 | 33 | 57 | 4 | 37 | 10 | 0.3 | 62 | 3057 | 3.3 |
| 37 | SlickTrit II | Triticale | 5/4/2024 | 13 | 37 | 61 | 5 | 37 | 9 | 0.5 | 58 | 2723 | 3.2 |
| 15 | TX18DH858 | HRWW | 4/22/2024 | 14 | 31 | 52 | 4 | 34 | 16 | 1.0 | 63 | 3166 | 3.0 |
| 40 | WT 50 | Wheat-Triticale | 4/29/2024 | 13 | 34 | 58 | 4 | 37 | 11 | 0.8 | 61 | 2953 | 3.0 |
| 30 | ThunderCale V | Triticale | 4/26/2024 | 15 | 35 | 58 | 4 | 38 | 9 | 1.0 | 60 | 2909 | 3.0 |
| 32 | Thundertall II | Triticale | 5/3/2024 | 13 | 36 | 59 | 4 | 36 | 9 | 0.4 | 59 | 2805 | 3.0 |
| 10 | TAM 114 | HRWW | 4/26/2024 | 14 | 33 | 56 | 4 | 36 | 12 | 0.9 | 61 | 2981 | 2.9 |
| 31 | Thundertall | Triticale | 5/3/2024 | 14 | 35 | 59 | 4 | 36 | 9 | 0.6 | 60 | 2775 | 2.9 |
| 9 | DynaGro 7322 Untreated | HRWW | 4/26/2024 | 15 | 31 | 54 | 4 | 36 | 14 | 1.1 | 63 | 3194 | 2.9 |
| 29 | KWS-H238 | Rye | 4/23/2024 | 15 | 31 | 55 | 3 | 37 | 11 | 0.6 | 63 | 3168 | 2.9 |
| 34 | TX20AT2015 | Triticale | 4/26/2024 | 14 | 37 | 61 | 4 | 38 | 9 | 0.6 | 59 | 2772 | 2.8 |
| 6 | DynaGro 7322 + Foothold | HRWW | 4/26/2024 | 14 | 32 | 55 | 4 | 36 | 15 | 1.3 | 62 | 3085 | 2.8 |
| 12 | TAM 116 | HRWW | 4/26/2024 | 13 | 33 | 56 | 4 | 37 | 14 | 1.3 | 63 | 3103 | 2.8 |
| 27 | KWS H240 | Rye | 4/23/2024 | 15 | 31 | 55 | 4 | 37 | 12 | 0.4 | 64 | 3190 | 2.8 |
| 35 | TX20AT2018 | Triticale | 4/26/2024 | 14 | 38 | 61 | 5 | 38 | 8 | 0.3 | 57 | 2654 | 2.7 |
| 38 | Titan | Triticale | 4/23/2024 | 14 | 33 | 56 | 4 | 38 | 12 | 0.8 | 62 | 3117 | 2.7 |
| 13 | TAM 204 | HRWW | 4/26/2024 | 14 | 32 | 55 | 4 | 35 | 16 | 1.2 | 62 | 3073 | 2.7 |
| 39 | Nex Trit Plus | Triticale | 4/26/2024 | 14 | 35 | 60 | 4 | 40 | 9 | 0.7 | 60 | 2890 | 2.7 |
| 33 | TX20AT2005 | Triticale | 4/26/2024 | 15 | 32 | 56 | 4 | 36 | 13 | 0.3 | 62 | 3037 | 2.7 |
| 7 | DynaGro 7322 + Avodigen | HRWW | 4/26/2024 | 14 | 30 | 53 | 3 | 36 | 16 | 1.2 | 64 | 3246 | 2.6 |
| 24 | KWS AVIATOR | Rye | 4/26/2024 | 16 | 33 | 58 | 4 | 38 | 10 | 0.5 | 62 | 3068 | 2.6 |
| 5 | CP15CW3388#011 | HRWW | 4/26/2024 | 14 | 32 | 55 | 4 | 36 | 15 | 1.2 | 62 | 3042 | 2.6 |
| 1 | AP exp 243 | HRWW | 4/26/2024 | 13 | 33 | 56 | 4 | 36 | 15 | 1.4 | 62 | 3007 | 2.6 |
| 36 | Triplecale | Triticale | 4/26/2024 | 15 | 35 | 58 | 4 | 37 | 10 | 0.5 | 60 | 2853 | 2.5 |
| 26 | KWS H10129 | Rye | 4/24/2024 | 16 | 32 | 56 | 4 | 38 | 10 | 0.2 | 63 | 3118 | 2.5 |
| 8 | DynaGro 7322+ Topguard | HRWW | 4/26/2024 | 15 | 30 | 53 | 3 | 36 | 16 | 1.4 | 63 | 3193 | 2.5 |
| 14 | TAM 205 | HRWW | 4/26/2024 | 13 | 32 | 55 | 4 | 36 | 14 | 1.1 | 63 | 3109 | 2.5 |
| 4 | AP Roadrunner | HRWW | 4/24/2024 | 15 | 32 | 54 | 4 | 37 | 14 | 1.0 | 62 | 3125 | 2.4 |
| 11 | TAM 115 | HRWW | 4/26/2024 | 15 | 31 | 55 | 4 | 36 | 14 | 0.9 | 63 | 3126 | 2.4 |
| 19 | XG4104A | HRWW | 4/26/2024 | 14 | 32 | 55 | 4 | 35 | 15 | 1.1 | 62 | 3064 | 2.4 |
| 18 | XG4110A | HRWW | 4/18/2024 | 15 | 31 | 53 | 4 | 36 | 15 | 0.9 | 63 | 3231 | 2.4 |
| 22 | OORye | Rye | 4/12/2024 | 20 | 28 | 51 | 3 | 37 | 11 | 0.6 | 65 | 3357 | 2.3 |
| 21 | Jackalope | Rye | 4/18/2024 | 19 | 29 | 53 | 3 | 38 | 11 | 0.3 | 64 | 3321 | 2.3 |
| 20 | XH4016A | HRWW | 4/26/2024 | 15 | 32 | 55 | 4 | 34 | 14 | 0.9 | 62 | 2984 | 2.2 |
| 16 | WB4792 | HRWW | 4/26/2024 | 14 | 33 | 56 | 4 | 36 | 14 | 0.9 | 62 | 3015 | 2.2 |
| 2 | Ap Longjack | HRWW | 4/26/2024 | 14 | 33 | 56 | 4 | 36 | 14 | 1.3 | 61 | 3010 | 2.2 |
| 25 | KWS PROGAS | Rye | 4/26/2024 | 15 | 34 | 59 | 4 | 36 | 8 | 0.5 | 60 | 2812 | 2.1 |
| 3 | Ap Prolific | HRWW | 4/26/2024 | 13 | 33 | 57 | 4 | 36 | 14 | 1.3 | 62 | 3053 | 2.0 |
| 17 | XH2001A | HRWW | 4/26/2024 | 16 | 31 | 54 | 3 | 36 | 14 | 0.9 | 63 | 3121 | 2.0 |
| 28 | KWS H95075 | Rye | 4/8/2024 | 19 | 30 | 53 | 3 | 36 | 11 | 0.5 | 64 | 3215 | 1.8 |
| Trial Average | | | | 15 | 33 | 56 | 4 | 36 | 12 | 0.8 | 62 | 3043 | 2.6 |
| CV (%) | | | | 12 | 8 | 5 | 11.2 | 5 | 24 | 47.8 | 3 | 6 | 15.4 |
| p-value | | | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| LSD | | | | 1.2 | 1.9 | 2.4 | 0.4 | 1.8 | 2.1 | 0.3 | 1.9 | 160.2 | 0.3 |

Table 3. Nutrient composition of small grain varieties evaluated in the 2023-2024 small grain variety trial at Bushland harvested at the soft-dough stage sorted by maximum tons TDN/ac.

| Entry | Variety | Type | Nutrient Composition at late Soft Dough (DM Basis) | | | | | | | | | | |
|----------------------|-------------------------|-----------------|--|--------|---------|---------|----------|----------|---------|----------|---------|-----------|-------------|
| | | | Harvest Date | % CP | % ADF | % NDF | % Lignin | % NDFD30 | % WSC | % Starch | % TDN | Milk/ Ton | Tons TDN/ac |
| 14 | TAM 205 | HRWW | 6/4/2024 | 10 | 33 | 51 | 5 | 20 | 11 | 18.8 | 60 | 2499 | 5.4 |
| 5 | CP15CW3388#011 | HRWW | 6/4/2024 | 11 | 29 | 45 | 5 | 15 | 11 | 24.7 | 62 | 2602 | 5.2 |
| 6 | DynaGro 7322 + Foothold | HRWW | 6/5/2024 | 11 | 32 | 49 | 5 | 17 | 10 | 22.5 | 60 | 2463 | 5.1 |
| 11 | TAM 115 | HRWW | 6/4/2024 | 10 | 33 | 51 | 5 | 20 | 10 | 19.7 | 60 | 2522 | 5.0 |
| 9 | DynaGro 7322 Untreated | HRWW | 6/6/2024 | 12 | 31 | 48 | 5 | 18 | 11 | 21.8 | 60 | 2585 | 5.0 |
| 3 | Ap Prolific | HRWW | 6/4/2024 | 10 | 32 | 48 | 6 | 16 | 12 | 21.2 | 60 | 2483 | 5.0 |
| 4 | AP Roadrunner | HRWW | 6/4/2024 | 11 | 32 | 49 | 5 | 19 | 10 | 20.3 | 60 | 2536 | 4.9 |
| 1 | AP exp 243 | HRWW | 6/3/2024 | 10 | 33 | 51 | 5 | 19 | 11 | 19.0 | 59 | 2428 | 4.9 |
| 7 | DynaGro 7322 + Avodigen | HRWW | 6/4/2024 | 11 | 31 | 48 | 5 | 18 | 10 | 22.3 | 61 | 2601 | 4.9 |
| 2 | Ap Longjack | HRWW | 6/4/2024 | 11 | 32 | 47 | 5 | 18 | 10 | 22.0 | 60 | 2585 | 4.8 |
| 17 | XH2001A | HRWW | 6/5/2024 | 10 | 34 | 52 | 6 | 18 | 12 | 17.5 | 58 | 2330 | 4.7 |
| 21 | Jackalope | Rye | 6/4/2024 | 10 | 33 | 53 | 6 | 22 | 11 | 14.2 | 61 | 2641 | 4.6 |
| 16 | WB4792 | HRWW | 6/5/2024 | 10 | 35 | 53 | 6 | 20 | 10 | 18.1 | 59 | 2399 | 4.6 |
| 10 | TAM 114 | HRWW | 6/3/2024 | 11 | 33 | 51 | 5 | 20 | 10 | 17.7 | 59 | 2511 | 4.5 |
| 19 | XG4104A | HRWW | 6/4/2024 | 11 | 31 | 48 | 5 | 17 | 11 | 22.2 | 60 | 2530 | 4.5 |
| 8 | DynaGro 7322+ Topguard | HRWW | 6/4/2024 | 11 | 34 | 52 | 6 | 20 | 10 | 18.7 | 58 | 2399 | 4.5 |
| 12 | TAM 116 | HRWW | 6/4/2024 | 11 | 29 | 45 | 5 | 17 | 11 | 25.1 | 63 | 2788 | 4.5 |
| 20 | XH4016A | HRWW | 6/4/2024 | 10 | 34 | 50 | 6 | 17 | 10 | 20.3 | 58 | 2352 | 4.3 |
| 40 | WT 50 | Wheat-Triticale | 6/11/2024 | 8 | 40 | 60 | 7 | 20 | 8 | 14.5 | 55 | 1988 | 4.3 |
| 18 | XG4110A | HRWW | 6/3/2024 | 10 | 35 | 53 | 6 | 19 | 13 | 14.1 | 57 | 2304 | 4.3 |
| 13 | TAM 204 | HRWW | 6/3/2024 | 11 | 31 | 49 | 5 | 18 | 11 | 21.7 | 61 | 2572 | 4.2 |
| 39 | Nex Trit Plus | Triticale | 6/11/2024 | 9 | 39 | 59 | 6 | 19 | 8 | 15.2 | 55 | 1935 | 4.0 |
| 34 | TX20AT2015 | Triticale | 6/11/2024 | 10 | 36 | 55 | 6 | 18 | 10 | 18.0 | 57 | 2136 | 3.9 |
| 28 | KWS H95075 | Rye | 6/4/2024 | 10 | 32 | 51 | 6 | 18 | 10 | 19.5 | 61 | 2540 | 3.9 |
| 27 | KWS H240 | Rye | 6/4/2024 | 10 | 34 | 53 | 6 | 19 | 11 | 15.7 | 60 | 2471 | 3.8 |
| 30 | ThunderCale V | Triticale | 6/11/2024 | 10 | 35 | 53 | 5 | 20 | 9 | 19.2 | 58 | 2361 | 3.8 |
| 37 | SlickTrit II | Triticale | 6/11/2024 | 9 | 42 | 63 | 7 | 22 | 7 | 10.8 | 54 | 1896 | 3.7 |
| 36 | Triplecale | Triticale | 6/11/2024 | 10 | 39 | 58 | 6 | 20 | 8 | 15.2 | 55 | 2035 | 3.7 |
| 15 | TX18DH858 | HRWW | 6/3/2024 | 11 | 33 | 49 | 5 | 18 | 10 | 21.5 | 59 | 2452 | 3.6 |
| 38 | Titan | Triticale | 6/11/2024 | 9 | 39 | 59 | 6 | 20 | 10 | 12.0 | 55 | 2014 | 3.6 |
| 23 | ThunderGreen | Rye | 6/5/2024 | 9 | 37 | 58 | 6 | 22 | 10 | 12.9 | 58 | 2374 | 3.6 |
| 24 | KWS AVIATOR | Rye | 6/4/2024 | 9 | 37 | 58 | 6 | 22 | 10 | 11.9 | 58 | 2378 | 3.5 |
| 33 | TX20AT2005 | Triticale | 6/11/2024 | 9 | 41 | 61 | 7 | 22 | 9 | 11.2 | 54 | 1919 | 3.5 |
| 31 | Thundertall | Triticale | 6/11/2024 | 9 | 39 | 60 | 6 | 19 | 8 | 13.3 | 54 | 1853 | 3.4 |
| 25 | KWS PROGAS | Rye | 6/4/2024 | 10 | 34 | 54 | 5 | 22 | 10 | 16.2 | 60 | 2518 | 3.4 |
| 26 | KWS H10129 | Rye | 6/4/2024 | 9 | 35 | 56 | 6 | 22 | 10 | 12.7 | 59 | 2447 | 3.4 |
| 29 | KWS-H238 | Rye | 6/5/2024 | 10 | 35 | 56 | 6 | 21 | 10 | 13.8 | 58 | 2368 | 3.3 |
| 35 | TX20AT2018 | Triticale | 6/11/2024 | 9 | 42 | 62 | 7 | 17 | 9 | 12.3 | 52 | 1647 | 3.3 |
| 22 | OORye | Rye | 6/3/2024 | 10 | 37 | 57 | 7 | 18 | 10 | 11.1 | 57 | 2168 | 3.2 |
| 32 | Thundertall II | Triticale | 6/11/2024 | 10 | 40 | 62 | 7 | 19 | 9 | 9.7 | 53 | 1826 | 2.9 |
| Trial Average | | | | 10 | 35 | 53 | 6 | 19 | 10 | 17.2 | 58 | 2336 | 4.2 |
| CV (%) | | | | 12 | 8 | 5 | 11.2 | 5 | 24 | 47.8 | 3 | 6 | 15.4 |
| p-value | | | | 0.0050 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| LSD | | | | 1.2 | 1.9 | 2.4 | 0.4 | 1.8 | 2.1 | 0.3 | 1.9 | 160.2 | 0.3 |

Table 4. Crop water use to boot and soft-dough harvest stages. Total crop water use represents the combined soil water, precipitation, and irrigation from planting to the reported harvest date. The water use efficiency represents the pounds of forage (DM basis) per inch of total water.

| Variety | Forage Type | Boot | | | | | | Soft-Dough | | | | | | | |
|----------------|-------------|--------------|---------------------|-------------|------------|----------------------|---------------|----------------|---------------------|-------------|------------|----------------------|---------------|--------|--------|
| | | Harvest Date | Soil Water Use (in) | Precip (in) | Irrig (in) | Total Water Use (in) | WUE (lbs/in.) | Harvest Date | Soil Water Use (in) | Precip (in) | Irrig (in) | Total Water Use (in) | WUE (lbs/in.) | | |
| TAM 114 | Wheat | 4/26/2024 | 2.5 | 4.6 | 9.5 | 16.6 b | 571 | 6/3/2024 | 6.4 | 5.7 | 12 | 24.2 b | 621 | | |
| Aviator | Rye | 4/26/2024 | 1.9 | 4.6 | 9.5 | 16.0 c | 520 | 6/4/2024 | 5.3 | 6.3 | 12 | 23.6 c | 527 | | |
| Slick Trit II | Triticale | 5/4/2024 | 3.4 | 4.6 | 9.5 | 17.5 a | 623 | 6/11/2024 | 6.7 | 6.3 | 12 | 25.0 a | 538 | | |
| Average | | | | | | 16.7 | 571 | Average | | | | | | 24.3 | 562 |
| CV (%) | | | | | | 4 | 11 | CV (%) | | | | | | 3 | 12 |
| p-value | | | | | | <0.0001 | 0.0326 | p-value | | | | | | 0.0073 | 0.4157 |
| LSD | | | | | | 0.2 | 75 | LSD | | | | | | 0.5 | 117 |