Spring Triticale Forage Yield and Nutritive Value as Affected by Location and Maturity in Wisconsin

Newman, Y.[*†]; Jarek, K.[†]; Holman, P.[†]; Akins, M.,[†]; Schriefer, E.[**]; Zogbaum, R.[†]
* University of Wisconsin-River Falls; † University of Wisconsin-Madison Extension; ** USDA Farm Service Agency

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Abstract. Spring triticale (*X Triticosecale* Wittm.) has a nutritional value that is like other spring cereal grain forages and presents a wide range in value and potential for ruminant feed (Emile et al. 2007). As varieties are improved, they may compete with oats as a spring forage source. A multi-location evaluation was conducted during 2021 in Wisconsin (Spooner, Marshfield and Lancaster) to evaluate spring triticale varieties harvested at two maturities (boot and mature stage) for yield and nutritive value. Treatments included six spring triticale varieties (AR-1, AR-2, AR-3, AR-4 and a local oat (WI-O) and triticale (WI-T) variety. Response variables measured included DM yield, and nutritive value constituents [crude protein (CP), digestibility (IVDMD, NDFD), carbohydrates (WSC, fructans, starch), fiber components (NDF, ADF, lignin) and minerals (P, K, Ca)]. Yield and nutritive value variables had interactions with locations ($P < 0.01$). Yield for all treatments were higher at mid and south locations compared to the northern Spooner location ($P < 0.01$). This work presents baseline information and discusses the trade off between yield and quality at the northern-most location with lower precipitation and growing degree days (GDD), leading to lower yield but higher nutritive value, as compared to mid and southern-most locations. The increasing extremes observed in weather patterns, in terms of precipitation and temperature, warrants future evaluations.

Introduction

Wisconsin is one of the states in the USA that leads in overall total forage production. While alfalfa and corn silage remain the two most significant sources of high yielding and high quality forage for Wisconsin farm operations, difficult growing seasons in 2018, 2019, and 2020 contributed to the lowest on-farm hay stocks in recorded history (U.S. National Agricultural Statistics Service, NASS, 2022). A shortage of high quality forages can have a significant impact on the financial well-being of any farm (Tilth Agronomy, personal communication). As a result, many farms are incorporating spring and/or winter cereal forages into their cropping rotation as a feed source that can supplement the existing ration needs for both lactating and non-lactating animals. Spring triticale is one of the emergency forages farmers utilize and increased adaptability of varieties is ensured by their cold and drought resistance (Chernobai et al. 2019). Spring triticale has a nutritional value that is like other spring cereal grain forages and presents a wide range in value and potential for ruminant feed (Emile et al. 2007). When selecting a forage crop species for production, dry matter (DM) yield is often the single most important characteristic farmers and crop consultants identify. Spring triticale has shown great forage accumulation relative to other grain cover crops (Holman et al. 2021). When evaluating a forage crop's suitability for rations, nutritionists generally evaluate at least three characteristics to make a quick determination about its usefulness; dry matter yield (DM), crude protein (CP), and neutral detergent fiber digestibility (NDFD-30 hr). As varieties are improved, they may compete with oats as a spring forage source. A study was conducted in Wisconsin to evaluate spring triticale varieties harvested at two maturities (boot and mature stages) for yield and nutritive value.

Methods

A multi-location evaluation was conducted during 2021 in Wisconsin. Sites included Spooner, Marshfield and Lancaster. The Spooner location is in the northern fringe of WI farm land and farm field crops including small grains are grown. The soils are sandy with low organic matter (1.2%) and mean annual precipitation is 25 inches. The Marshfield location is in the center of the state and presents very deep poorly drained soils with the highest OM of the three sites (3.6%). Mean annual precipitation is 30 inches. The Lancaster site is in the southwestern corner of the state on non-glacial, moderately deep silt-loam soils with mid-range OM (2.2%) levels. Mean annual precipitation is 36 inches. Actual 2021 monthly precipitation data show the contrasting amounts among locations (Fig. 1). Treatments included six spring triticale experimental varieties, one local

oat variety and one local triticale variety; evaluated at two maturities (boot and mature stages). Seeding dates were April 22, May 1 and April 16 2021 for Spooner, Marshfield and Lancaster, respectively. Measured response variables included DM yield, and nutritive value constituents [CP, digestibility (IVDMD, NDFD), carbohydrates (WSC, fructans, starch), fiber components (NDF, ADF, lignin) and minerals (P, K, Ca). Only yield, CP and NDFD-30 hr are discussed here.

Results and Discussion

Yield was clearly affected by maturity. This confirms earlier reports where the yield of spring triticale was largely determined by timing (Muratov and Niskii, 2008). Dry matter yield was approximately doubled at each location when harvest was delayed from the boot to the mature stage. When looking at yield, Spooner had lower overall yields, at either stage, compared to Marshfield and Lancaster, likely associated with the Spooner site's lower GDD. The nutritive value constituents followed a trend opposite to that observed for DM yield.

***Weather*:**

Precipitation varied widely from northern-most Spooner to southern-most Lancaster (Fig. 1-A). Likewise monthly GDD was consistently higher at the southern-most Lancaster site (Fig. 1-B).

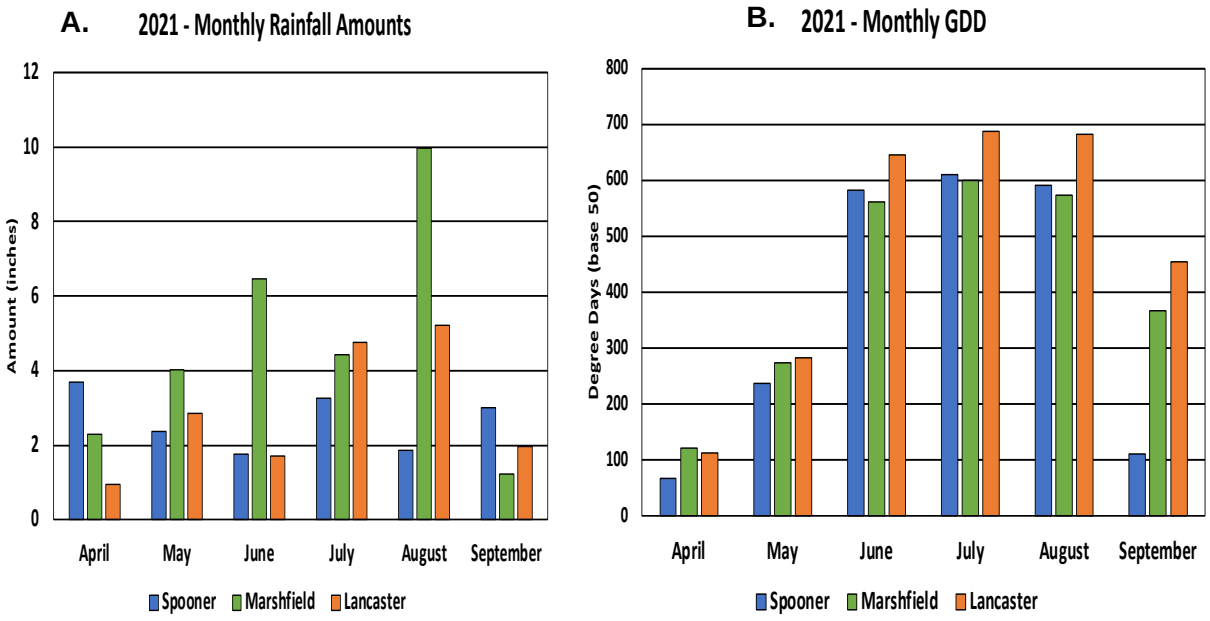

Fig. 1. A. 2021 monthly precipitation by location (Spooner, Marshfield, and Lancaster). B. 2021 monthly Growing Degree Days (GDD) by location (Spooner, Marshfield, and Lancaster).

DM Yield:

There were interactions with location ($P < 0.05$), thus the data were further analyzed by location. When we look at the boot stage yield, the northern-most Spooner and Marshfield locations presented no significant differences ($P > 0.05$). At the mature stage (Fig. 2) the local varieties (WI-O and WI-T) were among the highest yielding. The northern Spooner location yield was approximately half that of mid and southern locations.

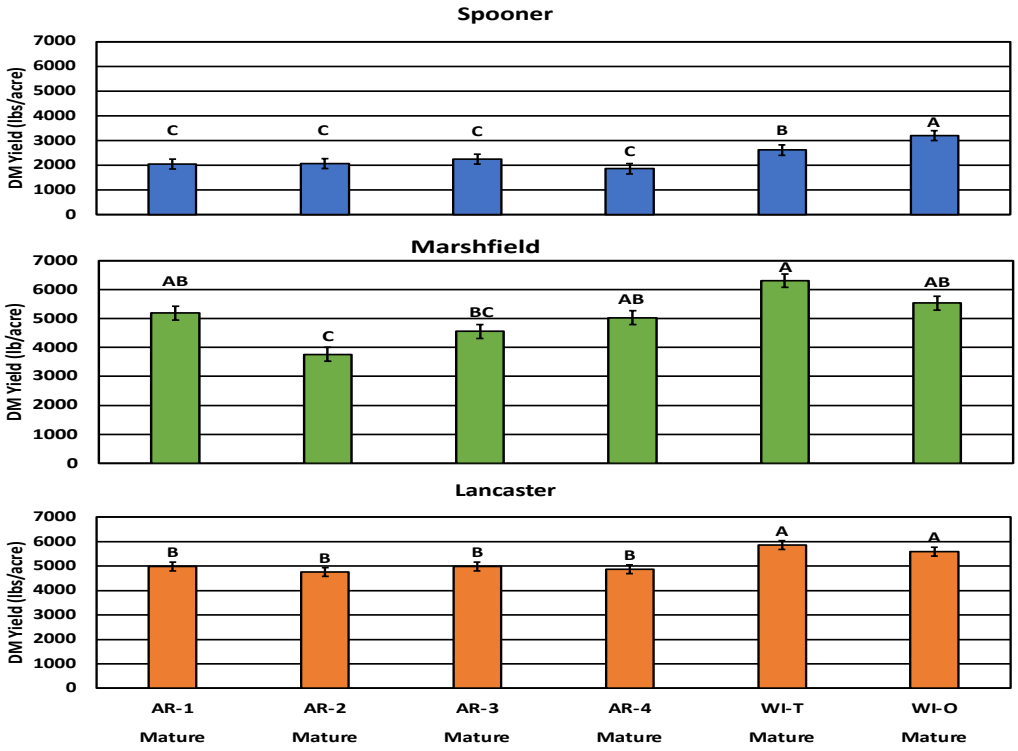

Fig. 2. Yield at the mature stage, by location (Spooner, Marshfield, and Lancaster). The effect of treatment (varieties) was significant if letters are different ($P < 0.05$). The highest value is marked with an A.

Crude Protein:

Crude protein values at the mature stage, for lower latitudes (Marshfield and Lancaster), were similar but lower than those at Spooner. This is likely associated with DM dilution when we look at the associated yield values.

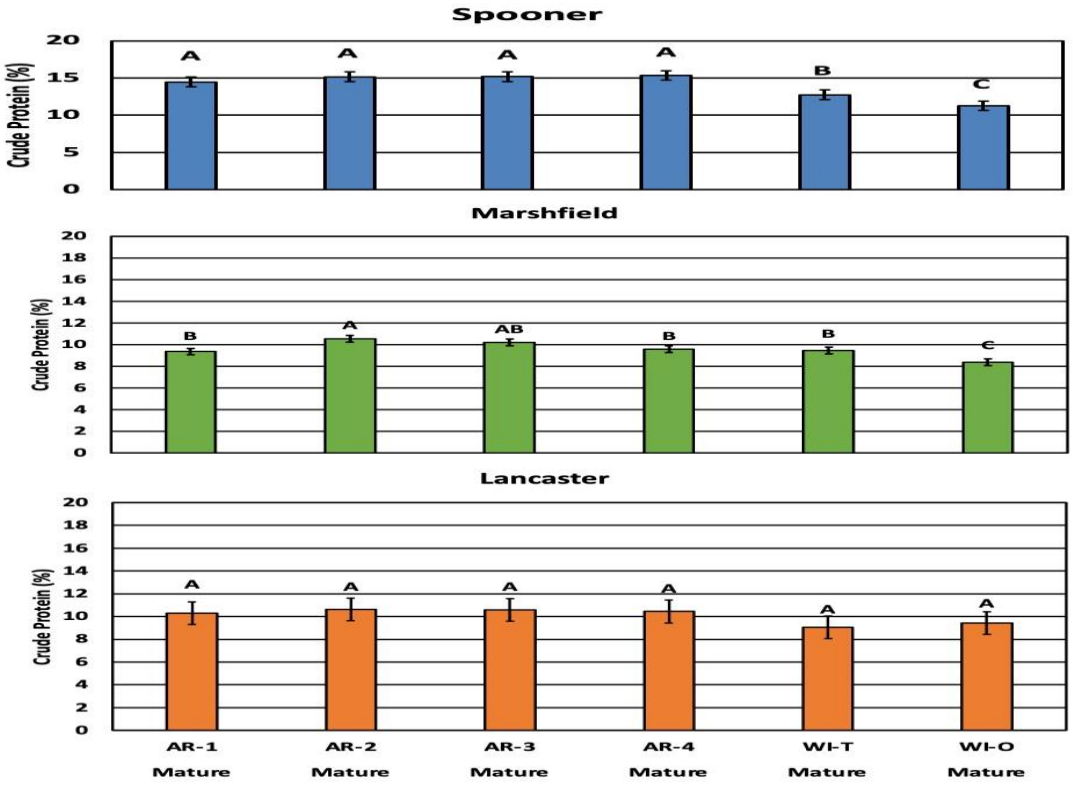

Fig. 3. Crude protein (CP) at the mature stage, by location (Spooner, Marshfield, and Lancaster). The effect of treatment was significant if letters are different ($P < 0.05$). The highest value is marked with an A.

NDFD-30 Hour:

Digestible NDFD (30-hour) at the mature stage followed a trend similar to that found for CP.

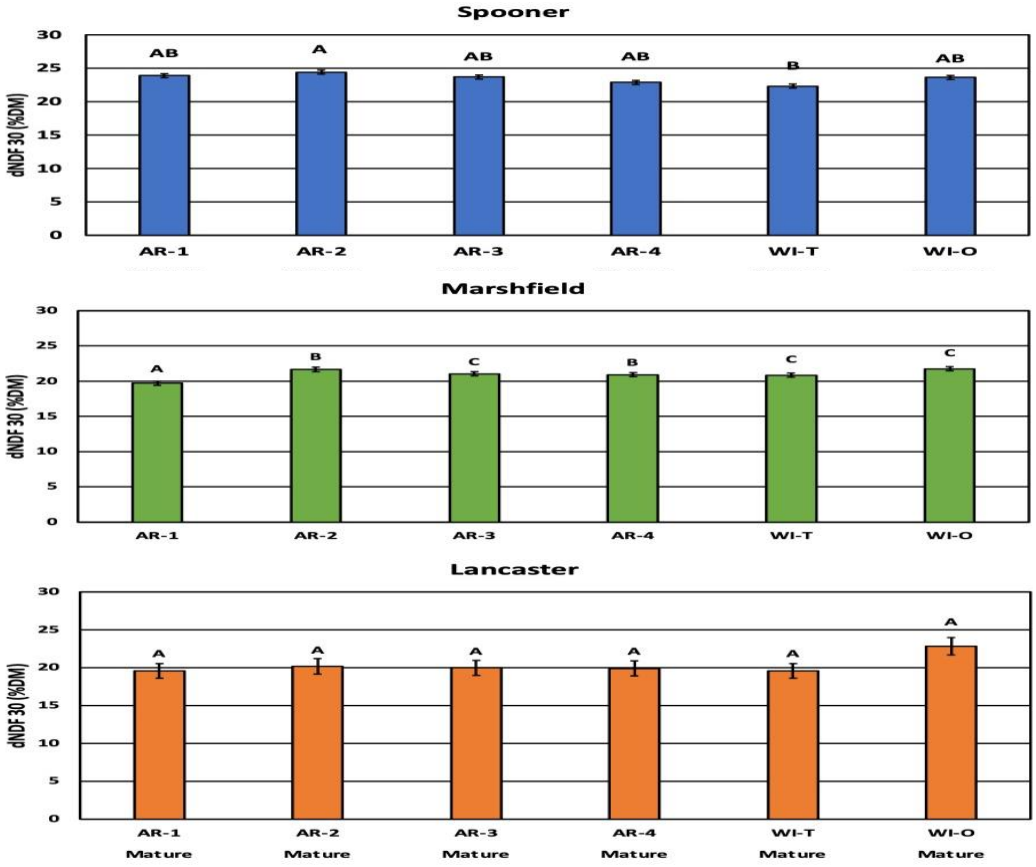

Fig. 4. Neutral detergent fiber digestibility at 30-hours (NDFD-30hr) at the mature stage, by location (Spooner, Marshfield, and Lancaster). Effect of treatment was significant if letters are different ($P < 0.05$). The highest value is marked with an A.

Conclusions and/or Implications

Latitude GDD and precipitation influenced DM yield of all species/varieties significantly. As expected, mature cereal harvest gave a greater yield than boot stage harvest. Latitude and reduced moisture affected yield negatively at the northern-most location. The trade off in reduced yield was offset with higher CP and digestibility, which would be a plus given the intended forage use. The increasing extremes observed in weather patterns, in terms of precipitation and temperature, warrants future evaluations.

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