**2025 DURUM FIELD DAY NOTES**

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- Dr. Linda Dykes, USDA-ARS, Fargo, ND
- Montana Wheat and Barley Committee Support – Sam Anderson / Lori Wickett/ Kent
- Montana State Foundation Seed Program – Doug Holen / BranDee Johnston

**MSU durum breeding is:**

- Testing 19 advanced selections against currently grown varieties.
- Working with MSU Foundation Seed to promote our releases.
    - **MT Raska** is high yielding, semi-dwarf, early flowering, very high test weight, low sawfly cutting, low lipoxygenase for semolina and pasta color retention, resistant to fungal leaf spot
    - **MT Blackbeard** is highest yielding, standard height and flowering time, very high pasta quality, low cadmium, tolerant to fungal leaf spot
    - **WB8148** is a high yielding semi-dwarf, early flowering, high yielding, low sawfly cutting, high pasta quality.
    - **Lustre** is high yielding, standard height, good pasta quality and protein content, low cadmium.
    - **MTD19011-** High yield potential across locations, large seeds, good test weight, good quality traits, low cadmium uptake.
    - **MTD19241** – Solid Stem, good yield potential in saw fly prone environments, good test weight, low cadmium uptake
- **The MSU durum breeding team thanks MT producers and MSU Research Center faculty and personnel for their support.**

**MSU durum line Lustre (MTD16005) was released January 2020. MT Raska (MTD18313) and MT Blackbeard (MTD18348) were released January 2022. WB8148 was released in January 2023 and licensed by WestBred.**

**MT Raska** pedigree: Alkabo/Brigade//Alzada/Strongfield
**MT Blackbeard** pedigree: Alzada/Strongfield//Brigade/Carpio
**WB8148** pedigree Joppa/Alzada
**MTD19011** pedigree Alkabo/Brigade(F1)//Durafield
**MTD19241** pedigree MTD16002/Fortitude

**Yield Data**

| | **2021** | | **2022** | | **2023** | | **2024** | |
|---|---|---|---|---|---|---|---|---|
| **Cultivar** | **Triangle[a*]** | **Eastern MT[b]** | **Triangle[a]** | **Eastern MT[b]** | **Triangle[a]** | **Eastern MT[b*]** | **Triangle[a]** | **Eastern MT[b*]** |
| **MT Blackbeard** | 28.9 | **35** | **31.7** | **41.2** | 42.4 | 48.4 | **38.5** | 47.9 |
| **MT Raska** | 26.6 | 30.6 | **31.2** | **39** | **44.2** | 52.3 | **37.8** | 44.5 |
| **WB8148** | 25.6 | **35** | **32.2** | **40** | 42.7 | 49.3 | **40.9** | 47.9 |
| **ND Riveland** | 28 | **33.1** | **30.2** | 36.1 | 39.4 | 46.3 | 34.2 | 45.8 |
| **Alzada** | / | / | **31.4** | **38.8** | **47.7** | 48.2 | **39.4** | 47.4 |
| **Joppa** | 24.4 | 28.5 | 27.5 | **38.2** | 41.7 | 48.3 | 35.9 | 45.8 |
| **Mountrail** | 25.6 | 29.6 | **30.8** | **41** | 40.4 | 50.7 | **38.6** | 49.0 |
| **Divide** | 25 | 29.9 | 29.4 | **39.5** | 38.3 | 49.8 | 37.0 | 47.8 |
| **Carpio** | 27.6 | 27.9 | 28.3 | 36.8 | 38.8 | 48.1 | 34.3 | 47.7 |
| **Lustre** | 23.8 | 27.1 | **29.8** | 36.9 | 35.7 | 50.4 | **38.2** | 49.2 |
| ANOVA p | 0.113 | <0.001 | 0.002 | 0.04 | <0.001 | 0.26 | 0.005 | 0.318 |
| LSD (0.05) | | 3.71 | 2.15 | 3.51 | 3.87 | | 3.5 | |
| No. Tests | 6 | 2 | 6 | 4 | 6 | 4 | 6 | 5 |

[a] Test locations included EARC dryland, Sheridan Co, Roosevelt Co, Valley Co, McCone Co.

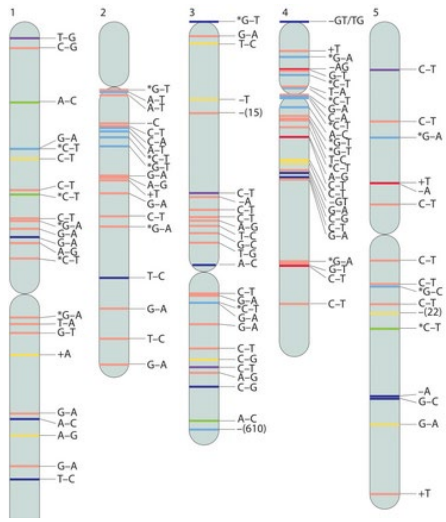
[b] Test locations included WTARC, NARC, CARC, Conrad, Ft. Benton. 2023 NARC and 2024 CARC were not included.

# IMPROVING WHEAT WITH TARGETED GENE EDITING

**Brandon Tillett**

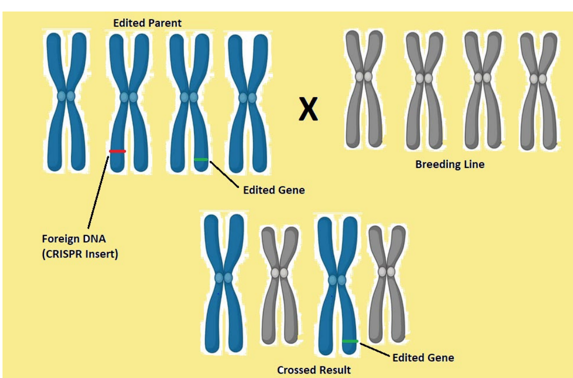
## EMS – The Old Way

- Many random mutations
- Time consuming to find the right mutation
- Unavoidable linkage drag



## CRISPR – The New Way

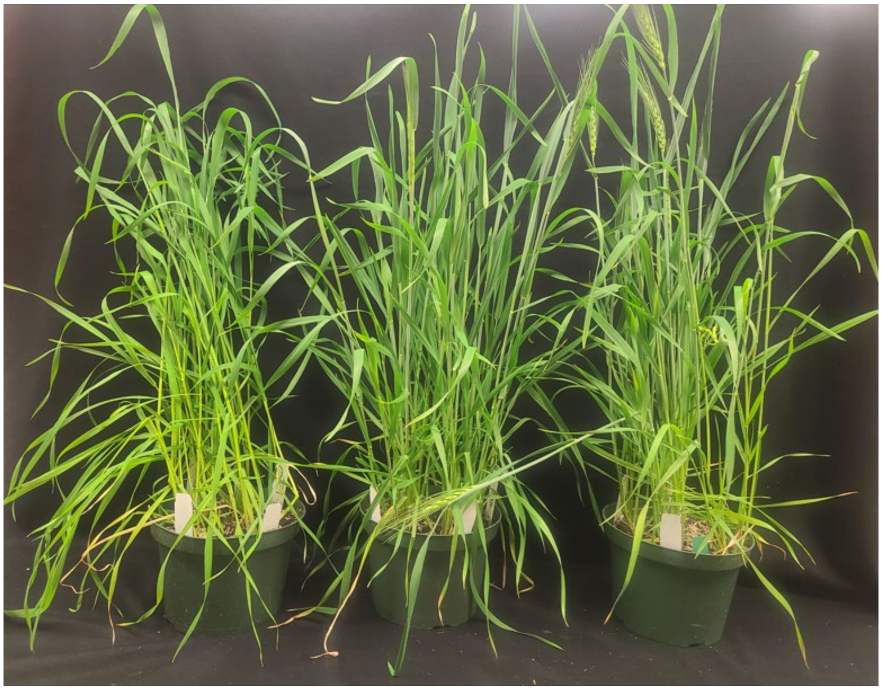
- Precise guided edits
- Can be much faster than EMS
- Significantly less linkage drag than EMS



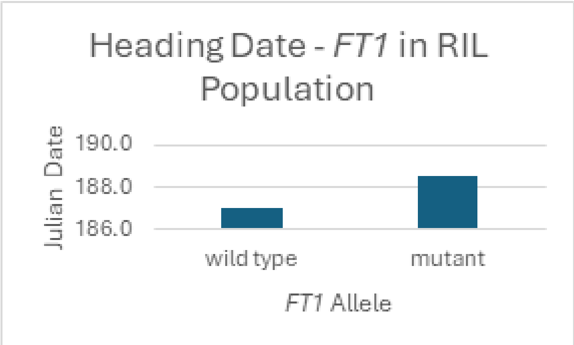

**CRISPR insert is separated from edited gene through crossing.**

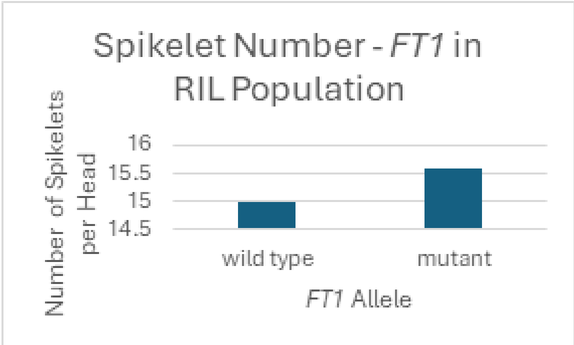
**Result = No foreign DNA & a useful new allele**

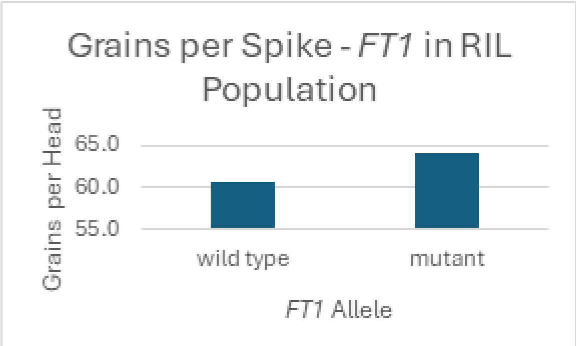
## GENE EDITING TARGETS



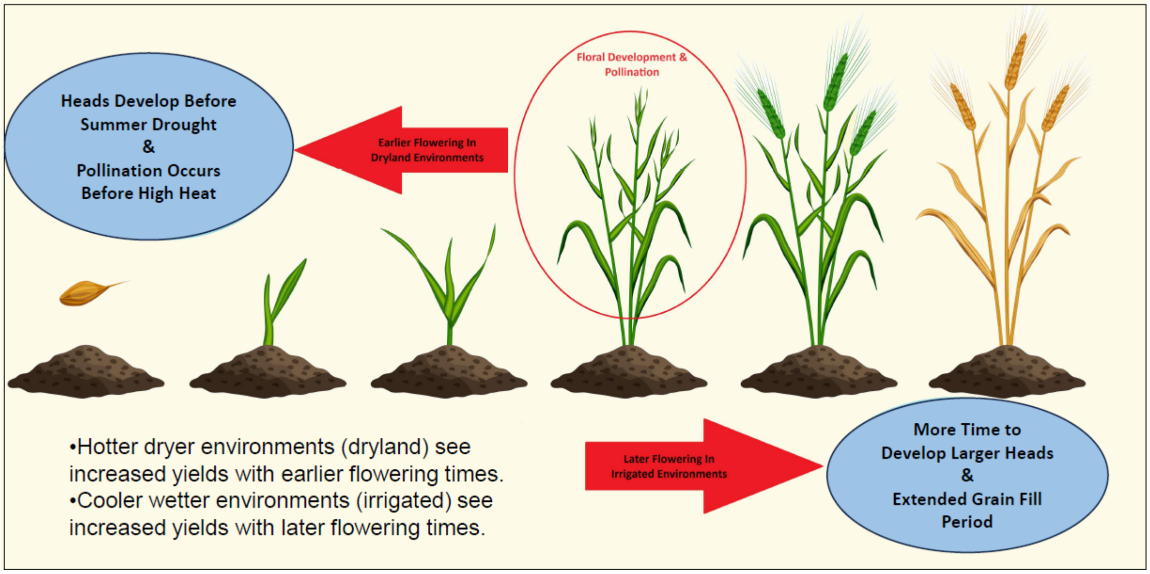
Spring Wheat – MT Carlson varying for flowering time caused by direct edits to flowering genes. The timing of floral development has significant impacts on yield based on environment. Different flowering times will be evaluated for yield stability in the different environmental regions around the state.



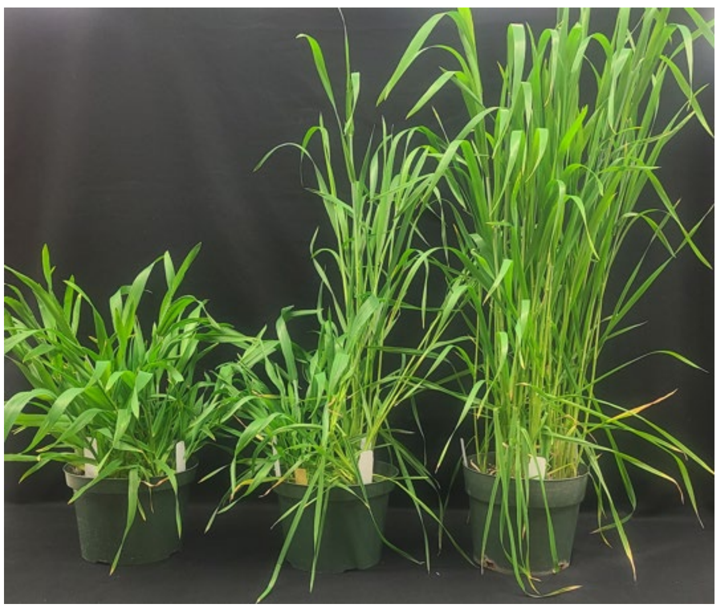




The mutant allele of *FT1* delays flowering by 1.5 days, allowing for longer head development which results in on an average of 0.6 more spikelets per spike and 4 grains per spike in a recombinant inbreed spring wheat population. In Bozeman 2024 the later flowering allele yielded 7% more than the normal allele.




**Other Editing Successes**



Tall durum wheat was edited to make semi-dwarf durum wheat. While semi-dwarf wheat already exists, the hope is the gene edited allele that is causing the dwarfing condition will be more agronomically valuable than the current natural allele being utilized in all semi-dwarf durum lines.

Additional editing projects are underway to pulse crops to increase branching and rooting.

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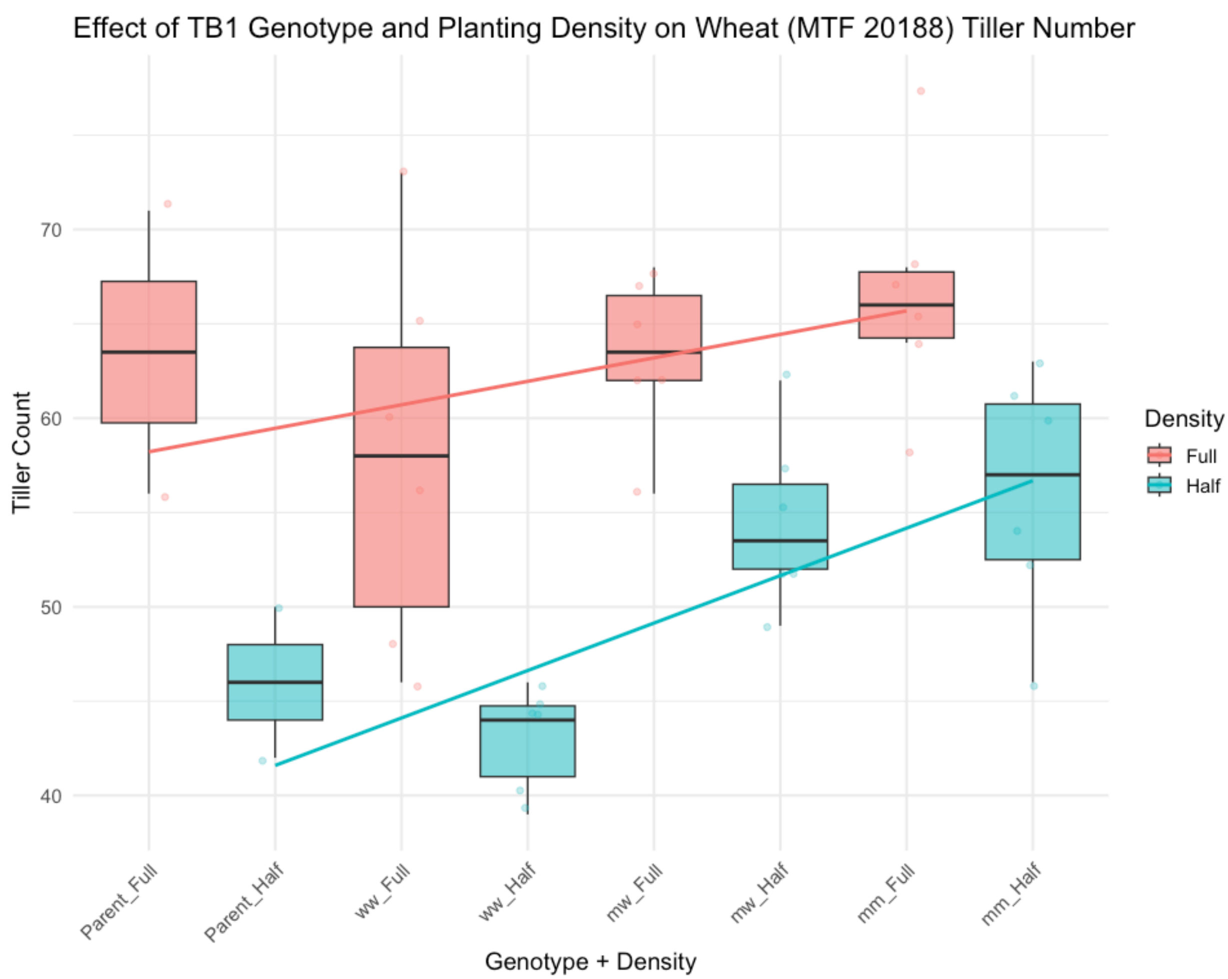
**_Teosinte Branched1_ mutations on Tillering for Winter Wheat Dual Purpose**

**Sergei O'Sullivan**

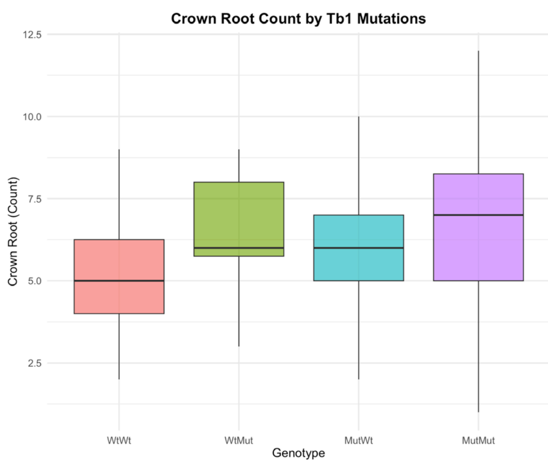
This figure shows how changes to a single gene, Teosinte Branched1 (TB1), affect tiller production in winter wheat grown under two different seeding rates. Each group represents a set of genetically similar lines (composite near-isogenic lines) with specific TB1 mutations, tested in both full and half seeding rate conditions. The boxplots show the number of tillers per plant, while the trend lines highlight a clear pattern: plants with more TB1 mutations tended to produce more tillers, especially at the lower seeding rate. For farmers, this trait could be valuable—extra tillers may help compensate for thin stands caused by winterkill or reduced seeding rates, offering potential for more resilient forage or dual-purpose wheat in challenging conditions.

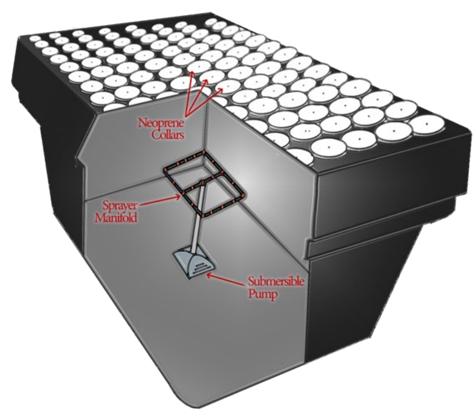


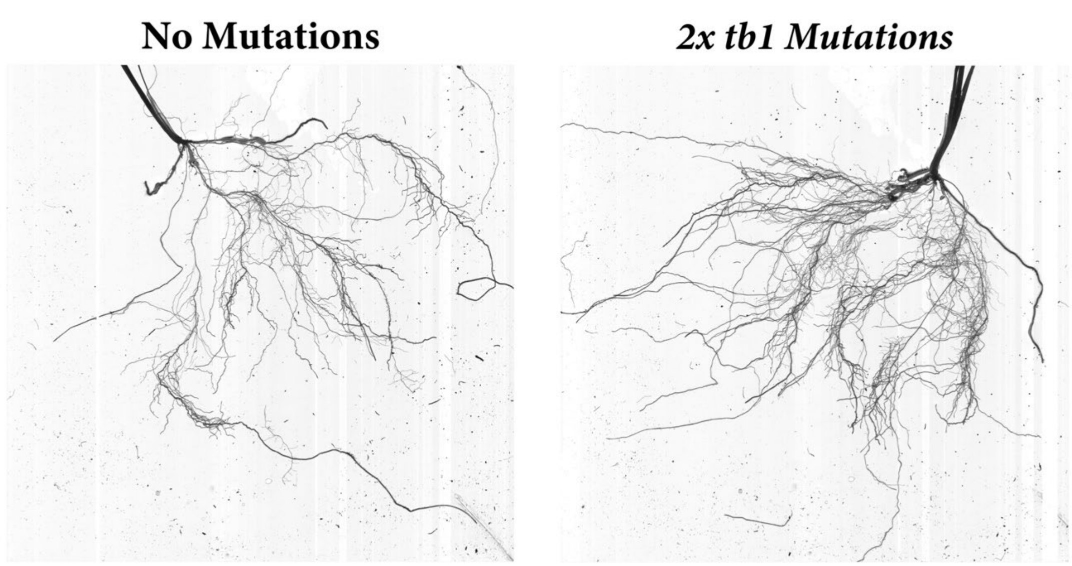
## *Teosinte Branched1* for Durum Wheat Rooting

This figure shows how changes to a single gene, *Teosinte Branched1 (TB1)*, can affect the way wheat roots develop. Plants with more TB1 mutations tend to produce more crown roots, as shown in both the boxplot (top left) and the root images (bottom). These plants were grown in a soil-free system (top right) that allows us breeders to clearly observe root development over time. The roots of plants with two TB1 mutations are noticeably denser and more branched compared to those with no mutations. This denser, more branched root system may offer improved access to water and nutrients below ground.

Differences in root architecture like this may influence how plants interact with their environment—particularly in terms of water and nutrient uptake. By understanding the genetic factors that shape root systems, breeders can make more informed decisions when developing wheat varieties suited for diverse and challenging conditions.



# Slow-Release Hydrogen Sulfide Seed Treatments Enhances Growth in Pulse Crops

MONTANA STATE UNIVERSITY

Ethan Harbo

**Project Goal** → Develop a DBDTP seed treatment to boost plant growth and agronomic yield

Pulses treated with a DBDTP concentration curve at EARC


Chickpeas exhibiting physiological differences in greenhouse experiments.

- **DBDTP Releases $H_2S$ at a slow rate as a salt and in solution. Hydrolysis of DBDTP occurs within the plant.**
- **Exogenous applications of $H_2S$ up to a point increase drought, heat, pathogen tolerance as well as plant growth.**
- **We are evaluating efficacy of seed treatments under normal field conditions and elevated stress conditions in greenhouse settings.**

# Revolutionizing Wheat with HaHB-4 Transcription Factor for Drought Tolerance in Montana

**Luis Esquivel Cervantes**