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Sherman
June 14, 2023

Oregon State University

USDA

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# Map Key

- Fairgrounds building: *Registration, Welcome, Indoor Presentations, Lunch*
- Parking
- Winter Wheat Varieties
- Wheat Breeding Update
- Variable Rate Nitrogen
- Wheat Disease Updates
- Poster Session

Oregon State University

USDA

**Sherman Station**
**OSU/ARS FIELD DAY**
**Wednesday, June 14, 2023**

| Time | | Event |
|---|---|---|
| *7:30am-9:30am* | | *Inside fairgrounds building* |
| 7:30am | | Registration, Coffee & Donuts Available |
| 7:50am | | Welcome and Introductions |
| | 8:00-8:10 | Francisco Calderon, OSU station overview |
| | 8:10-8:20 | Sam Birikorang, State of ARS-USDA |
| *8:20am-9:30am* | | *Indoor presentations* |
| | 8:20-8:40 | Mineral nutrient density in Pacific Northwest wheat by Dr. Curtis Adams |
| | 8:40-9:00 | Weed Research Update by Dr. Judit Barroso, Fernando Oreja & Victor Ribeiro |
| | 9:00-9:20 | Biochar Increases Soil Organic Carbon, pH, and Wheat Yields by Dr. Stephen Machado |
| *9:30am* | | *Drive to plots* |
| | 9:40-10:10 | Winter Wheat Varieties by Dr. Ryan Graebner |
| | 10:15-10:45 | OSU Wheat Breeding Update by Dr. Bob Zemetra |
| 10:50-11:20 | | Break and poster session |
| | 11:25-11:30 | Variable Rate Nitrogen with Biofertilizers in Spring Wheat by Jacob Powell |
| | 11:35-11:55 | Wheat Disease Updates by Dr. Chris Mundt |
| *11:55am* | | *Drive back to fairgrounds* |
| 12:00pm | | Lunch – Sponsored by Mid-Columbia Producers |
| 12:40pm | | Time to thank our Field Day Sponsors |
| 1:00pm | | 2023 Field Day Completed |
| 1:30pm | | Liaison Committee Meeting Begins in County Conference Room |
| | | |

## Grain Mineral Density of Pacific Northwest Winter Wheat

Curtis B. Adams[1], Teepakorn Kongraksawech[2], Andrew Ross[2], Ryan Graebner[2], Juliet Marshall[3], Xi Liang[3], Clark Neely[4], Catherine L. Reardon[1], Dan S. Long[1]

[1]USDA-ARS, [2]Oregon State University, [3]University of Idaho, [4]Washington State University

The U.S. Pacific Northwest (PNW) region is a major exporter of cereal grains, including multiple market classes of wheat, but particularly soft white winter wheat. Much of the product is exported to Asia, including to developing nations with populations that are afflicted by mineral nutrient deficiencies. Billions of people worldwide experience mineral deficiencies, especially Zn and Fe, particularly in regions with predominantly cereal-based diets. One route to improve human nutrition is enhancing mineral density of diet staples, such as wheat. But for *winter* wheat produced in the PNW, there is hardly a baseline of knowledge on mineral density, though one report suggested that soft white *spring* wheat produced here had declined in mineral density over time (due to selection for low ash), while hard red spring wheat had not. Therefore, the objective of this study was to gain a better understanding of grain mineral density (P, K, Mg, Ca, Mn, Fe, Zn, and Cu) of PNW winter wheats, including testing for differences among N fertilizer rates and wheat varieties, and making comparisons among wheat market classes (soft white and hard red) and many production sites (in Oregon, Idaho, and Washington). To provide a broader perspective, the average mineral densities for each test site were also compared to standard densities obtained by synthesizing worldwide data reported in the scientific literature. Among agronomic factors affecting grain mineral densities, N fertilizer typically had little impact, while wheat variety and production site had greater effects. For example, in a two-year test involving four N rates, four wheat varieties, and two sites, grain Zn differed by up to 7.5%, 13%, and 27% among those factors, respectively. In comparisons of many wheat varieties at six production sites, statistical differences among varieties in mineral density were widespread. The differences were often substantial enough to provide a basis for breeding more nutritious wheat varieties, depending on specific mineral uptake heritability. In five side-by-side comparisons of soft white and hard red winter wheat variety trials, there was no evidence that these market classes systematically differed in density of any tested minerals. When mineral results for all test sites were compared to worldwide standards derived from the literature, individual minerals at individual sites differed from the standards, but there were few differences on average. The exceptions were grain P and K, which were commonly lower in grain from PNW sites than the standards. Since much of PNW wheat is processed (i.e. milled and refined) before consumption, samples from two variety trials were milled to produce straight-grade flour (the most commonly consumed flour product), enabling calculation of mineral reduction with processing. The minerals most negatively affected by processing were P, Mg, Mn, Fe, Zn, and Cu, with reductions ranging from roughly 50% to 90%. Percent reductions in individual minerals were comparable for hard red and soft white wheats. Overall, these results illustrate that the mineral density of PNW winter wheat is comparable to wheat generally, with no evidence that soft white winter wheat was less nutritious in minerals. The natural variation in grain minerals that exists among sites and wheat varieties can be utilized to customize or enhance wheat nutritional profile. Importantly, consumption of whole-grain wheat products should be expanded and promoted to preserve and utilize the inherent nutrition of wheat in relieving human mineral deficiencies.

**Resistance to Group 2 Herbicides in Downy Brome Populations collected in 2021 from Wheat Fields**

Victor Ribeiro[1], Judit Barroso[2] and Carol Mallory-Smith[1]
[1]Department of Crop and Soil Science – OSU; [2]Columbia Basin Agricultural Research Center – OSU.

The objectives of this study were to (1) conduct a survey of wheat growers to understand downy brome management in Eastern Oregon and (2) determine if 21 downy brome populations were resistant commonly used herbicides in wheat cropping systems. Survey results showed that winter wheat-summer fallow rotation (72%) was the most predominant cropping system. Only one field was tilled and none were irrigated. Pyroxasulfone + carfentrazone (10%) (Groups 15 and 14) and metribuzin (26%) (Group 5) were the most frequently used PRE and POST herbicides in winter wheat, respectively. Glyphosate (77%) was the most frequently used herbicide in fallow. Resistance screening findings indicated that all populations were susceptible to clethodim, quizalofop-P-ethyl, and glyphosate. Eighteen of 21 populations were resistant to Group 2 herbicides with different cross-resistance patterns (Table 1). Resistance to mesosulfulron-methyl (86%) and pyroxsulam (81%), were the most predominant followed by propoxycarbazone-sodium (67%), sulfosulfuron (67%), and imazamox (43%).

**Table 1.** Cross-resistance to Group 2 herbicides. Blue or yellow indicates resistant and susceptible populations, respectively. Resistance bases on 1X (>20% survival).

| Populations | Group 2 Herbicides | | | | |
|---|---|---|---|---|---|
| | Beyond | Osprey | Olympus | PowerFlex HL | Outrider |
| GIL1 | S | R | S | R | R |
| GIL2 | S | S | S | S | S |
| GIL3 | R | R | R | R | R |
| MOR1 | R | R | R | R | R |
| MOR2 | R | R | R | R | R |
| MOR3 | R | R | R | R | R |
| MOR4 | R | R | R | R | S |
| MOR5 | S | S | S | S | S |
| MOR6 | R | R | R | R | R |
| MOR7 | S | R | S | R | R |
| MOR8 | S | S | S | S | S |
| MOR9 | S | R | R | R | R |
| MOR10 | S | R | R | R | S |
| SHE1 | R | R | R | R | R |
| UMA1 | R | R | R | R | R |
| UMA2 | S | R | S | R | R |
| UMA3 | S | R | R | R | S |
| UMA4 | R | R | R | R | R |
| UMA5 | S | R | R | S | S |
| UMA6 | S | R | S | R | R |
| UMA7 | S | R | R | R | R |

**Acknowledgments:** We would like to thank the wheat growers for participating in this study, the Oregon Wheat Commission for funding this research, and County Extension agents, for their collaboration in identifying growers.

**Postharvest control of Russian thistle (*Salsola tragus*)**

Fernando Oreja[1], Judit Barroso[1], Jennifer Gourlie[1]
[1]Columbia Basin Agricultural Research Center (CBARC) – OSU

The effect of postharvest application timing and the stubble height on herbicide efficacy was evaluated at the Columbia Basin Agricultural Research Center (CBARC, Adams, OR) in two consecutive years (2020 & 2021).

**Paraquat** provided the greatest control in both years, regardless of weather conditions, with no differences in application timing or stubble height. The efficacy was 100% and 98% in 2020 and 2021, respectively.

The control with **glyphosate** and **Huskie (bromoxynil + pyrasulfutole)** was similar with both herbicides and years, but higher in 2020 compared to 2021 (89% with glyphosate and 91% with Huskie in 2020, and 75% and 69% in 2021, respectively). In 2020, a more "normal" year than 2021, there were no differences among application timings for any of these herbicides (Figure 1a). However, in 2021, a drier year than 2020, application timing affected the herbicide control efficacy. The control in both treatments was reduced when the herbicides were applied 1 WAH. For glyphosate, the control was 30% lower than in the other application timings (51% vs. 83%) and for Huskie, the control 1 WAH was only significantly lower than the application made 2 WAH (60% vs. 77%) (Figure 1b). Under this scenario, an application as soon as possible after harvest could be desirable to prevent significant water loss.

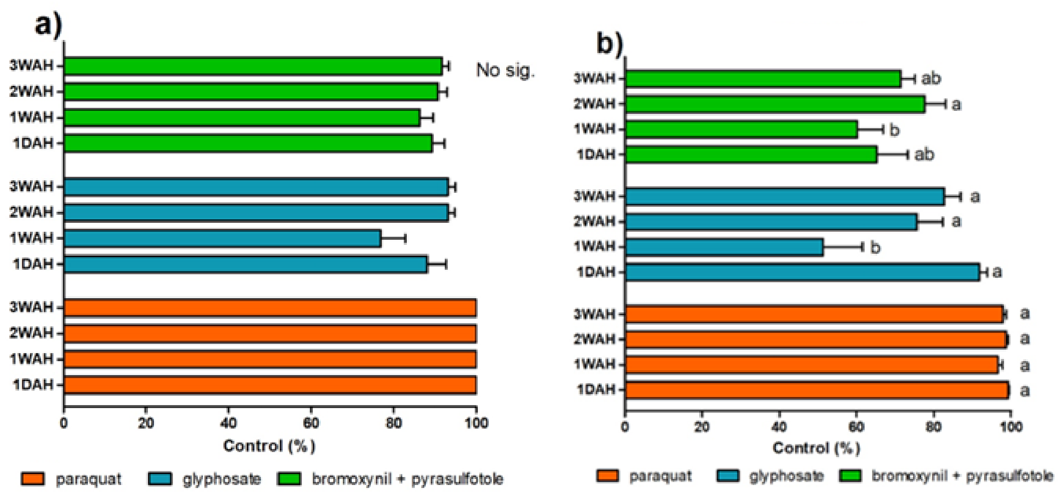



**Figure 1**. Control of Russian thistle (%) at CBARC, Adams, OR, with different herbicide treatments applied 1 day after harvest (DAH), 1, 2, and 3 weeks after harvest (WAH) in a) 2020 and b) 2021. Bars are the means and whiskers the standard error of the mean. Different letters mean differences among application timings for each herbicide, according to Tukey's multiple comparison test ($p < 0.05$).

**Acknowledgements**: This research was funded by the USDA-NIFA project titled Integrated and Cooperative Russian thistle (*Salsola tragus*) Management in the Semi-Arid Pacific Northwest (Project No. ORE00339).

**Effect of stubble height and plant size on Russian thistle dispersion**

Fernando Oreja[1], Judit Barroso[1] and Jennifer Gourlie[1]
[1]Columbia Basin Agricultural Research Center (CBARC) – OSU

An experiment was conducted in two consecutive years (2020 and 2021) at the Columbia Basin Agricultural Research Center (CBARC) (Adams, OR) and in a grower's field near Ione, OR in 2020.

At both sites, the dispersion rate increased with time. At CBARC, a higher plant dispersion was observed with plants growing in short stubble than in tall stubble. In 2020, dispersion in short stubble was 66% compared to 14% in tall stubble, and in 2021, the values were 53% in short stubble compared to 20% in tall stubble (Figure 1). Near Ione, dispersion in trampled stubble was 88% compared to 43% in standing stubble and big plants were more dispersed than small plants (86% vs. 48% respectively) (Figure 2).

For growers that struggle to control Russian thistle post-harvest, leaving the stubble tall at harvest, could reduce Russian thistle dispersion in their and neighboring fields. Preventing plants from becoming big (e.g. mowing) as part of an integrated weed management program could also reduce dispersion.

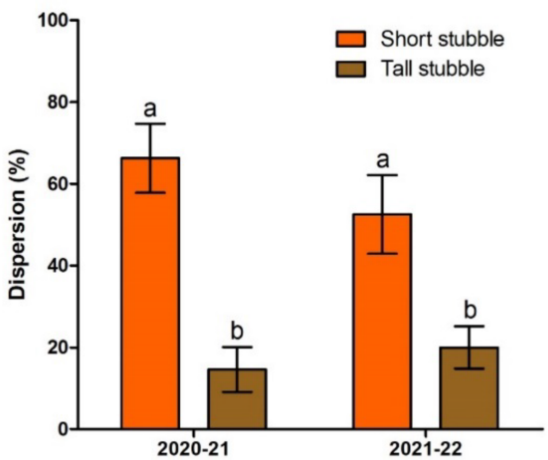



**Figure 1**. Dispersion of Russian thistle (%) at the final evaluation time (April 21 in 2021 and May 26 in 2022), at CBARC, Adams, OR, within to different stubble heights (short and tall) in 2020-21 and 2021-22. Bars indicate the means and whiskers indicate the standard error of the mean. Bars with the same letters are not significantly different according to Tukey's multiple comparison test ($p < 0.05$).

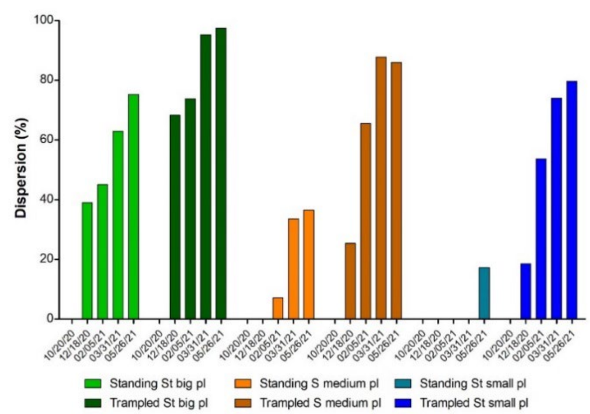



**Figure 2**. Russian thistle dispersion (%) near Ione for different plant sizes (small, medium and big) and stubble height (standing and trampled). Bars indicate the means.

**Acknowledgement:** This research was funded by the USDA-NIFA project titled Integrated and Cooperative Russian thistle (*Salsola tragus*) Management in the Semi-Arid Pacific Northwest (Project No. ORE00339).

## Study of Alternative Herbicides to Glyphosate in Fallow-Based Cropping Systems

*By Judit Barroso[1] and Jennifer Gourlie[1]*
[1]Columbia Basin Agricultural Research Center (CBARC) – OSU

Effective weed management is a key element of successful wheat production. In an effort to maintain glyphosate (group 9 herbicide, EPSP synthase inhibitor) as a viable herbicide option for as long as possible in the wheat/fallow systems of the Pacific Northwest, we conducted trials over two years in fallow, at seeding time, and post-harvest to evaluate potential good tank-mix partners and alternative herbicide options to glyphosate. The experiments were RCBD with four replications. Target weed species were primarily grasses for the fallow and seeding time trials, although broadleaf weeds were also evaluated when they were significant and uniformly distributed. Target weeds for the post-harvest trial were primarily broadleaf species like Russian thistle and lambsquarter. Studied treatments included saflufenacil (Sharpen), glufosinate (Forfeit 280), clethodim (Clethodim 2E), pyraflufen (Vida), flumioxazin+pyroxasulfone (Fierce), tiafenacil (Reviton), and combinations of some of those herbicides. Results showed no significant difference between Sharpen at the 2 fl oz/A and 4 fl oz/A rates. In the fallow trials, all treatments showed good control (75% +) of grasses, except for Vida and Reviton + Vida. In the seeding time trials, glyphosate alone and in combination with Reviton and Vida showed the best control (80% +). The post-harvest trials showed different results for 2021 and 2022. In 2022, a wet year, the control in all treatments was similar to glyphosate except for single applications of Reviton and Vita. In 2021, a dry year, only Reviton + Glyphosate and Fierce + glyphosate provided similar control than glyphosate consistently for the studied species.

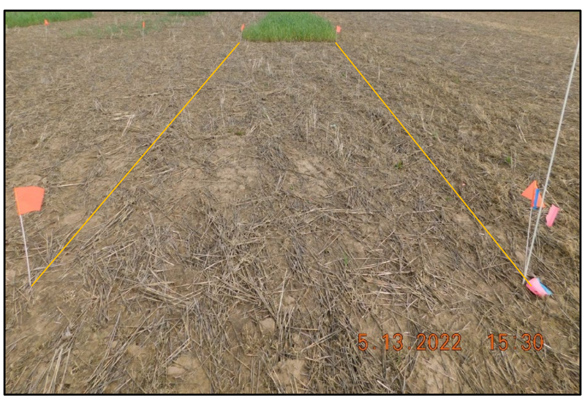



**Image 1**. Fallow trial in 2022 showing the treatment of Fierce EZ (flumioxazin+pyroxasulfone) + Clethodim 2E (clethodim).


**Image 2**. Spring wheat trial in 2022 showing the treatment Reviton (tiafenacil) + Gly Star 5 Extra (glyphosate).

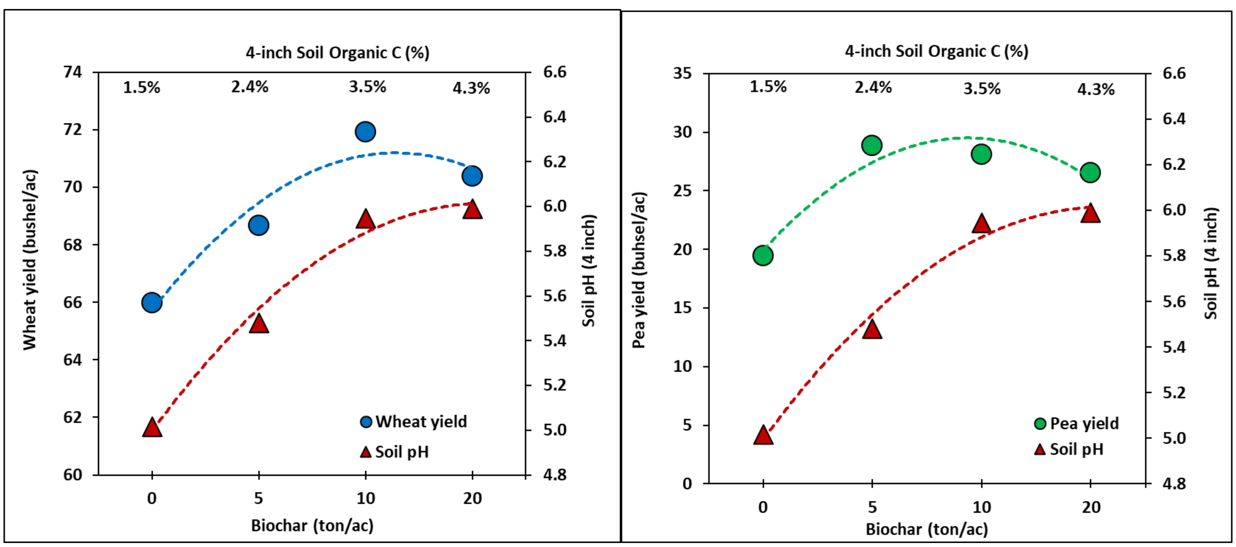
**Acknowledgments**: This research was possible thanks to the funds received from the Oregon Wheat Commission. Authors also thank Kyle Harrison and Alan Wernsing for their assistance with these trials.

**Biochar Effects on Wheat and Pea Productivity Persist**

*Stephen Machado, Larry Pritchett, Linnea Kriete*

*Oregon State University, Columbia Basin Agricultural Research Station*

Biochar, charcoal produced from pyrolysis and resistant to decomposition, can potentially improve soil health. This study evaluated the effects of biochar derived from forest wastes on crop yields, soil pH, and nutrient dynamics. Amending soil with biochar sequesters carbon (C) that would have been lost to the atmosphere as $CO_2$ through burning or natural decomposition, where it would contribute to global warming. Biochar, which contained 90% carbon (C), 0.18% nitrogen (N), C:N of 500, and a pH of 10.6, was applied only once to field plots in a winter wheat-spring pea rotation in 2013 at rates of 0, 5, 10, 20 tons per acre. Grain yields of wheat and peas were measured in 2014, 2015, 2016, 2017, and 2018 without further additions of biochar. Soil organic carbon (SOC), soil pH, $NO_3$, $NH_4$, P, K, and S were determined after harvest in 2013. Increasing biochar increased grain yield and the yield increase has persisted for 4 years even without further biochar applications. Biochar increased SOC by 115% and pH by 1.2 units (4.7-5.9) but did not influence other nutrients. Results indicated that biochar has the potential to increase grain yield of wheat and spring peas while sequestering C. Increasing pH may have increased nutrient use efficiency resulting in higher crop yields. The study continues.




Biochar effects on wheat and pea grain yields

For more information, contact Stephen Machado: stephen.machado@oregonstate.edu, 541 215 3665

**Testing for Herbicide Resistance and 'Beyond' - R.S. Zemetra**

Developing a new wheat variety occurs in several general steps; crossing of parental lines, gene segregation, selection and testing. Testing is a critical component of variety development because it determines if the breeding line has the desired traits to be a new wheat variety. In the case of herbicide resistance all lines being considered for potential release need to go through efficacy testing. This involves having paired plots of each line, one sprayed with the herbicide and one unsprayed. Such a paired test allows the breeder to determine if there was any injury at the time of herbicide application and whether the yield is the same with or without herbicide. The goal is to have minimal injury at the time of spraying and have an equivalent or higher yield in the sprayed crop. To make sure the efficacy test is working, a negative (susceptible) 'check' variety and a positive (resistant) 'check' vaariety are included in the trial. If the negative check variety shows injury and dies it indicates the herbicide application worked. If the positive check variety shows injury then the level of acceptable injury needs to be adjusted in the test for all the breeding lines. The reason injury may occur on the resistant check cultivar is that the herbicide rate applied is usually 2X the normal rate to insure partially resistant (carrying one gene instead of two for resistance) lines are observed and don't 'escape' detection. Injury on the resistant check cultivar may also indicate that there may be an application timing issue with that herbicide.

Currently the OSU breeding program is conducting efficacy trials for Clearfield and Coaxium resistant breeding lines. The Clearfield efficacy trials have been run for many years and consistently show injury and death of the negative check variety and little or no injury on the positive check variety and most of the breeding lines. To be released a breeding line must be tested in three different locations over two years (giving 6 site/years of data) for evaluation prior to release. All currently Clearfield variety have gone through and passed testing. The OSU Coaxium trials have shown more injury in the positive check variety than expected. The injury in the breeding lines have been similar to the positive check variety so the breeding lines do show resistance equivalent to the check variety. There are differences in the rate of recovery among the lines that may provide additional information for selection. The response seen in the resistant check cultivar and the breeding lines may also be due to the rate of herbicide application (2X) and/or the date of herbicide application. In 2023, Clearfield and Coaxium trials had herbicide applied one day apart at all locations but little to no linjury was observed in the Clearfield trial while injury was observed in the Coaxium trial. This may indicate that growers need to insure that herbicide application for Coaxium lines does not go on late.

But what type of additional testing is needed before a herbicide resistant line is released? 'Beyond' efficacy testing, herbicide resistant lines should be tested for agronomic performance, disease resistance, and end-use quality just like any other breeding line before they are released. This testing needs to be done over several years at different locations to insure there are no 'escapes'. To make this testing possible in Oregon the Oregon Wheat Commission funds projects for testing agronomic performance (R. Graebner – OSU), disease resistance (C. Mundt – OSU, C. Hagerty – OSU, and X. Chen – USDA-ARS), and end-use quality (A. Ross – OSU and A. Kiszonas – USDA-ARS) of OSU breeding lines and other breeding programs' lines if they are in extension testing. This insures there are no surprises for wheat growers when they plant new OSU varieties. Without this level of multi-year testing by independent researchers, wheat producers growing an untested cultivar are basically participating in a large scale field based experiment that could have either really good or really bad results.

NOTES

**Variable Rate Nitrogen with Biofertilizers in Spring Wheat**

## Introduction

In the last year the price for fertilizers has shown extreme volatility with prices significantly higher than usual, though they have recently declined. Wheat producers need additional research to help better inform their decisions on nitrogen fertilizer rates in the face of this recent volatility. In addition, there may be other alternative sources to supplement nitrogen to crops that may be more economical if fertilizer prices increase again. Bacteria and other microbes can enhance crop nutrient uptake, stimulate natural process (such as nitrogen fixation), reduce plant stress, and can improve crop quality. Microbes applied to crops are often referred to as bio stimulants or biofertilizers. In the last several years hundreds of such products have been released out of the Midwest that claim to increase crop yield and nutrient efficiency, primarily for soybeans and corn. There is a lack of research on how effective biofertilizers are on wheat, especially in the Pacific Northwest. Envita and Fresh Tracks Universal Ag Microbes are two biofertilizer products that some wheat producers in Oregon have considered using. Envita is produced by Azotic North America LTD and is formulated as a liquid that can be applied with a foliar spray or in furrow. The active ingredient in Envita is a naturally occurring nitrogen fixing bacteria, *Gluconacetobacter diazotrophicus*. Envita enables crops to fix their own nitrogen from atmospheric nitrogen. Azotic claims that Envita can maintain wheat yields when synthetic nitrogen fertilizers are reduced by a rate of 27% or can boost yields when applied with a full rate of nitrogen. Envita has been tested in several trials with corn, but only one study with spring wheat in South Dakota that increased yields by 7%. Another product is Fresh Tracks Universal Ag Microbes (FTUAM) produced by Fresh Tracks LLC as a dry powder that contains four strains of bacteria: *Bacillus subtilis, Bacillus licheniformis, Bacillus pumilus,* and *Bacillus megaterium.* These strains are reported to improve nutrient efficiency, increase microbial respiration, and increase the amount of nitrogen and phosphorus available for crop use. It can be applied as a foliar spray or in furrow. This product has not yet been tested in wheat, but has been used in other crops.

## Objectives

The objective of this study is to determine the impact of applying two different biofertilizer products (Envita and Fresh Tracks Universal Ag Microbes) under six different nitrogen fertilizer rates on the following variables in spring wheat:

- grain yield
- nitrogen tissue levels and total nitrogen uptake
- grain protein
- grain test weight

## Methods

This study is being completed at the Sherman Experiment Station in Moro, OR in a 10-12 inch annual precipitation zone. Trials were seeded on March 22, 2023 at a seeding rate of 100 lbs per acre with the spring wheat variety Ryan using a 12 ft wide AgPro no till drill. Soil tests taken in March 2023 indicated 70 lbs per acre of residual nitrogen. The recommended fertilizer rate is 2.4 lbs of nitrogen per acre per expected bushel of wheat yield (assuming 55 bushels of yield potential = 130 lbs of N are needed to meet crop demand). Granular urea was applied in furrow, along with ammonium phosphate (16-20-0) starter fertilizer. The goal was to vary nitrogen rates by 100%, 75%, 50%, 25%, and 0% of the recommended rate, along with a treatment without starter fertilizer.

Actual applied nitrogen rates including both urea and starter fertilizer in lbs per acre were: 58.5 (98% of the recommended nitrogen to add), 46.5 (78%), 34 (57%), 20 (34%), 9.5 (16%), and 0 (0%) (slightly above desired levels due additional nitrogen in the 16-20-0 starter fertilizer). Each nitrogen treatment was replicated four times with and without the addition of Envita or FTUAM. FTUAM was added to plots through three foliar applications at the labeled rate of 30 grams per acre in April through early May – once before emergence and twice after wheat had emerged (1 leaf and 4 leaf crop stages). One foliar application of Envita was applied on May 10th when wheat was at the 4th leaf stage at the labeled rate of 3.2 oz/acre. Wheat samples will be taken prior to harvest in early July to determine plant nitrogen levels and total nitrogen uptake. Plots will be harvested in July with a plot combine to determine yield, protein, and test weight.

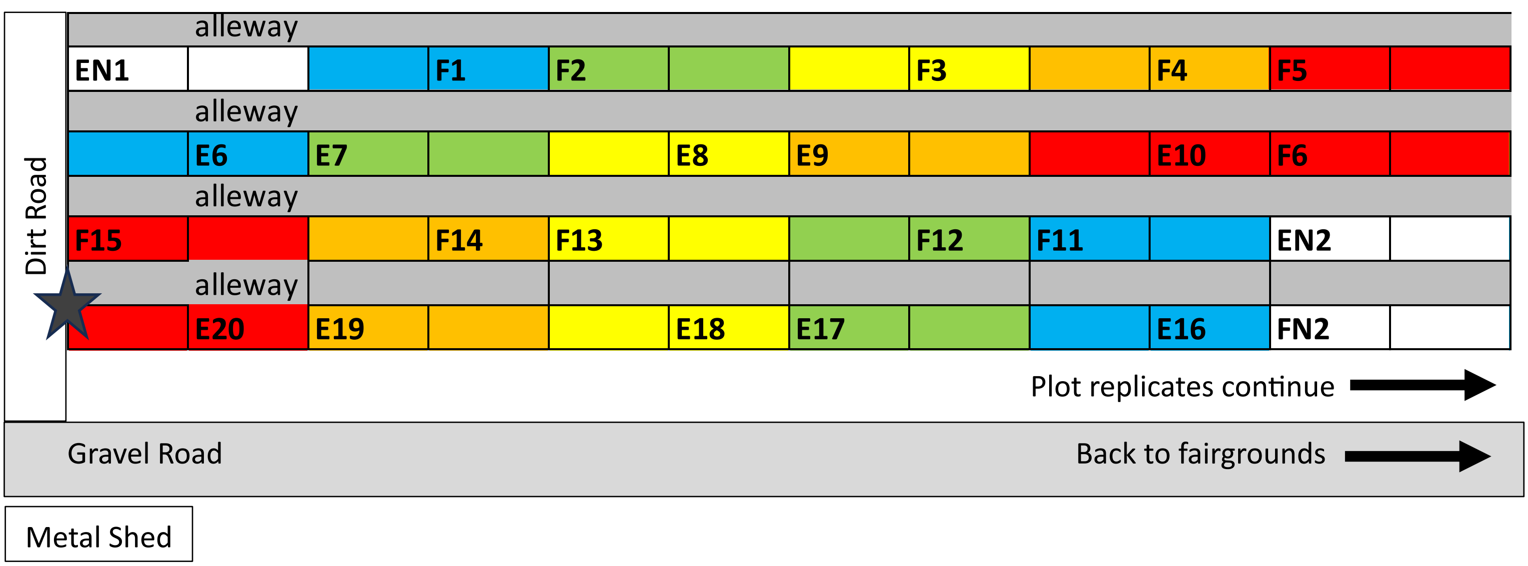
**Results so far**

Initial observations have not yet revealed any large differences between treatments, though in some plots Envita has slightly increased wheat height. Plots that did not receive any additional nitrogen appear to be showing signs of nutrient deficiency.

**Acknowledgments**

This research is being supported by the Oregon Wheat Commission and Fresh Tracks LLC, along with Wasco / Sherman County OSU Extension. This project would not be possible without the assistance of the Sherman Station Farm Manager Kyle Bender.

**Plot Map at the Sherman Station**




**Legend**

| F = FTUAM, E = Envita, flag in plot = treated | | | | | | |
|---|---|---|---|---|---|---|
| % of nitrogen added | 100 | 75 | 50 | 25 | 0 | no starter fertilizer |
| lbs of nitrogen added | 58.6 | 46.6 | 34.1 | 20.1 | 9.6 | 0 |
| Total nitrogen | 128.6 | 116.6 | 104.1 | 90.1 | 79.6 | 70 |
| flag colors at plot corners | Red | Orange | Yellow | Pink | Blue | White |
| *Double white flags indicate plot split, double pink indicates start of new fertilizer treatment | | | | | | |

# Resilient Dryland Farming Alliance

Pressing the boundaries of the dryland winter wheat production system to support family farm profitability and production resilience.

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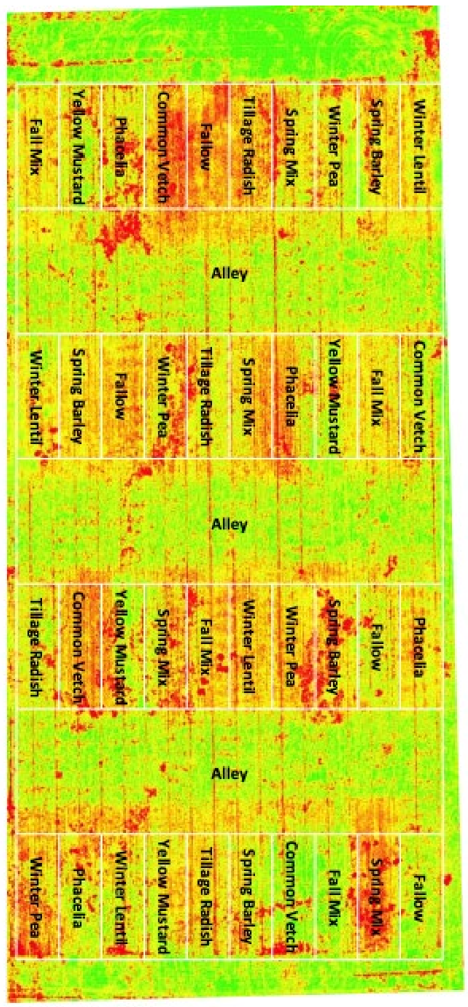
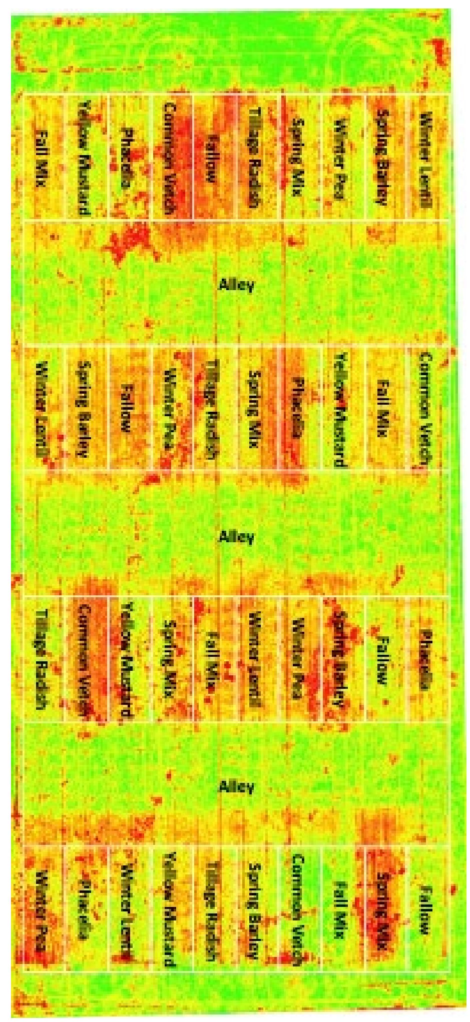
RGB




NDVI



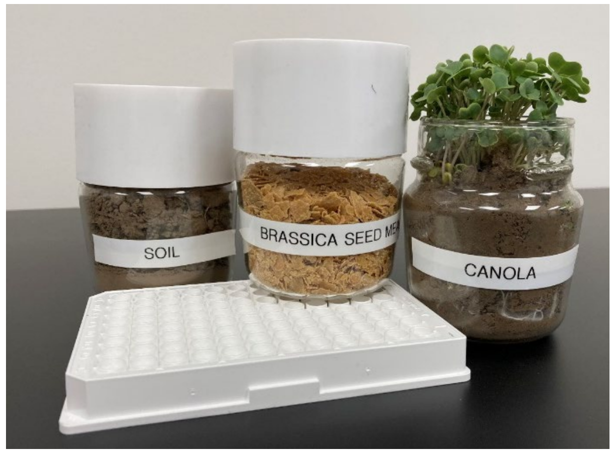

NDRE

UAS technology can assist in identifying signatures of cash crop performance following cover crop treatments

THANKS to Drew Leggett of BMCC for image collection!

**SaxAPIL: A novel biosensor for the detection of isothiocyanates in soils and plants**

Kate Reardon[1†], Kristin Trippe[2], Viola Manning[2]
[1]USDA-ARS Pendleton Oregon, [2]USDA-ARS Corvallis Oregon
[†]Catherine.Reardon@usda.gov



*The biosensor can detect ITCs in seedlings, seed meals, and soil with recently incorporated brassica cover crops. Shown is the microplate used for the bioassay.*

Isothiocyanates (ITCs) are natural, biotoxic compounds produced by cruciferous plants. These compounds are formed by an enzymatic reaction between plant glucosinolates and the enzyme myrosinase. ITCs are biologically active against microbes (antimicrobial) and nematodes (antinematicidal) and have been shown to reduce weed seed germination (2, 3, 5). Farming practices such as green manuring or biofumigation with brassica seed meals (or plant residues) exploit the formation and bioactive properties of ITCs. In fact, biofumigation with certain brassica seed meals has been shown to not only reduce the soil pathogens currently present in soil but also promote soil biology capable of suppressing newly introduced pathogens (6). Although several benefits are attributed with these cropping practices, ITCs can also have negative impacts on crops by inhibiting seed germination and root growth (1, 5). Several factors influence the amount and persistence of ITCs in the soil including the composition and concentration of the glucosinolates, the plant developmental stage, and environmental conditions. Current methods to determine the amount of ITC in the soil include chemical extractions and expensive scientific equipment. Recently, USDA-ARS scientists at Pendleton Oregon and Corvallis Oregon developed a biosensor to detect ITCs (4). The biosensor is a genetically modified microbe that emits photons (light) when exposed to different types of ITCs. Currently, the biosensor construct requires scientific equipment (luminometer) to measure the emission of light (luminescence), but there are opportunities increase the amount of the light production. The biosensor can detect concentrations of the ITC sulforaphane as low as 1-2 µM in addition to naturally-formed ITCs in seedling extracts of daikon, broccoli, radish, and kale. For soil amendments, mustard plant residues added as either seed meals or incorporated cover crop produce measurable ITC levels. This tool can be advantageous in determining plant-back dates where the question of soil ITC concentration is whether it is *too hot or not.*

**References**

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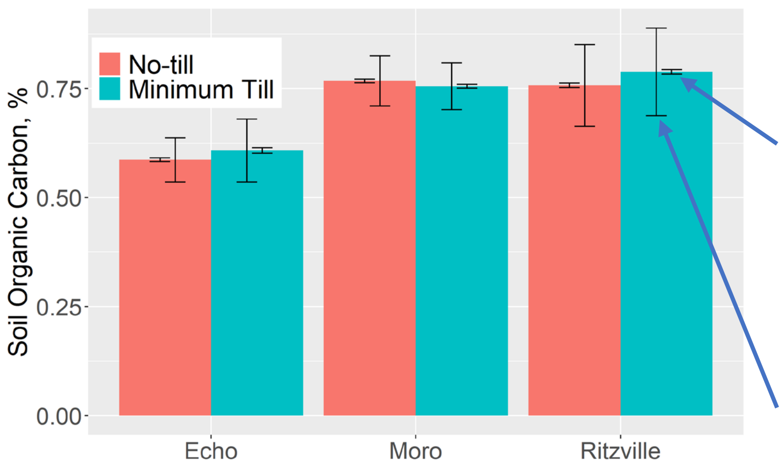
# Will no-till increase soil carbon compared to minimum tillage in low rainfall winter wheat—fallow?

**Stewart Wuest USDA-ARS, Pendleton Oregon**

Monthly soil samples (0 to 8 inches) for three years at three long-term replicated experiments.




**Standard error of the mean**: Confidence level given the large number of samples that went into this average value. (We took *lots* of samples spread over three years.)

**Standard deviation**: The average amount each measurement differed from the mean. (A big problem for accuracy).

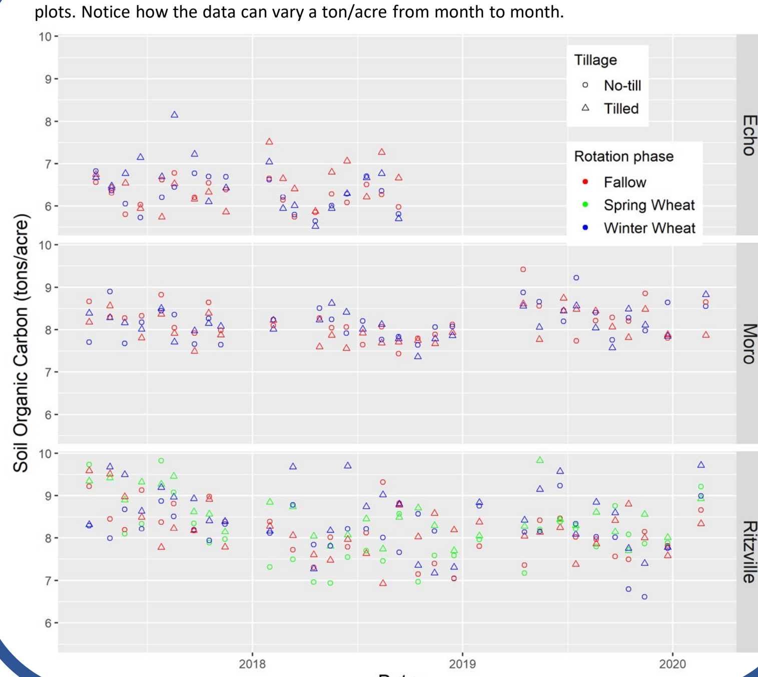
Minimum Tillage: Undercutter sweep at the Echo, OR site.

### Take home message:

- Soil carbon measurements were highly variable by season and year.
- Effects of tillage on soil carbon were very small with an average 2.45% (relative) more carbon in the tilled treatments.
- Judicious tillage can help us combat herbicide resistance without substantial effects on soil carbon in low rainfall areas.

**Messy Data**

This is what went into the bar chart. Each symbol is the average from three or four replicate plots. Notice how the data can vary a ton/acre from month to month.

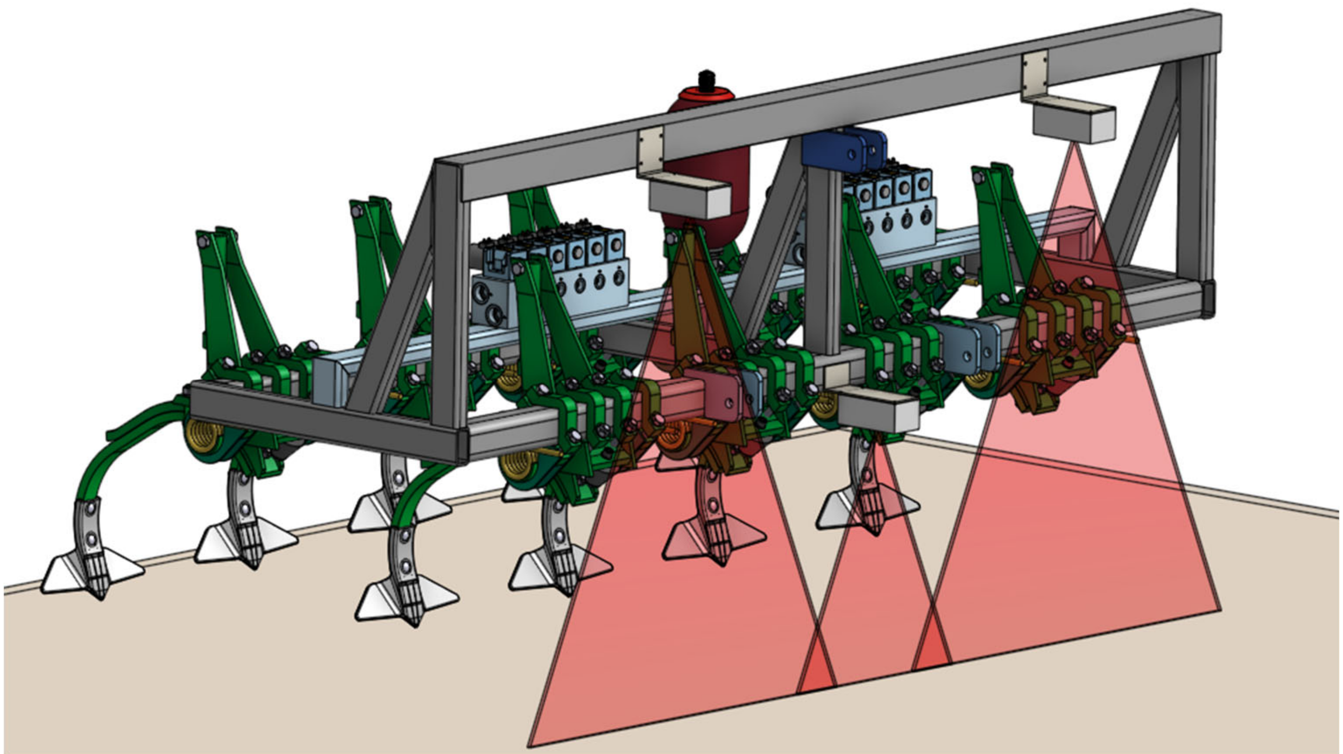



For details or a copy of the paper contact Stewart.Wuest@usda.gov

Wuest, S. B., Schillinger, W. F., & Machado, S. (2023). Variation in soil organic carbon over time in no-till versus minimum tillage dryland wheat-fallow. *Soil and Tillage Research*, *229*, 105677. https://doi.org/10.1016/j.still.2023.105677

Coming soon…

# Plot-Scale WeedChipper



The “WeedChipper” has been developed (by the Centre for Engineering Innovation: Agriculture & Ecological Restoration, The University Western Australia) as a targeted tillage implement capable of delivering site-specific mechanical control of fallow weeds. As it is based on, mostly existing cultivator mechanism and weed detection technologies, the “WeedChipper development represents a cost-effective approach for alternative weed control technologies in large-scale cropping systems.

The three-point linkage mounted rig comprises hydraulically driven rapid response tines, pressure accumulator and solenoids and fitted with WeedIT sensors capable for the detection and control of small (2cm = 25/32 in) to large (80cm = 31.5in) diameter weeds occurring at low density (<1.0 plant $10m^{-2} \approx 100ft^{2}$) control in fallow scenarios at 10 km $h^{-1} \approx$ 6.2 miles $h^{-1}$.

**A demo activity will be organized post-harvest, please stay tune!**

Oregon State University
Columbia Basin Agricultural Research Center

Please see Dr. Judit Barroso with your questions or discussion.

# Thank you for joining us, we hope to see you again at next year's Field Day, Wednesday June 12, 2024!

Please take a moment to complete a short four question survey about today's event
https://oregonstate.qualtrics.com/jfe/form/SV_bQpERqSgCPHhFqe