ORGANIC FARMING RESEARCH FOUNDATION

Photo credit: Oxbow Farm & Conservation Center

FARMER-LED TRIALS REPORT

OXBOW FARM AND CONSERVATION CENTER

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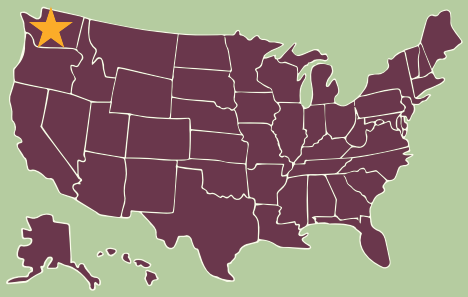
Farmer-Led Trials: Impact of Seeding Rate on Cover Crop Performance



2025

Farmer-Researcher:
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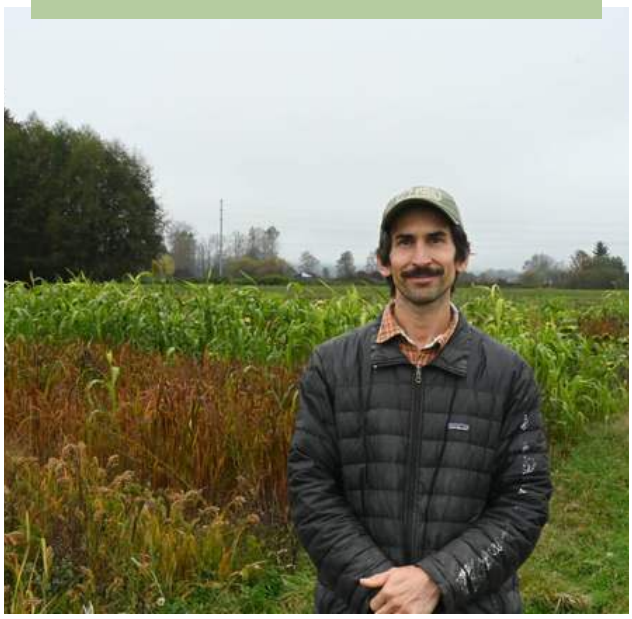
Oxbow Farm &
Conservation Center
Snoqualmie Valley, WA

IN A NUTSHELL

Oxbow Farm & Conservation Center is an 81-acre non-profit, certified organic farm that focuses on trialing climate adaptive and resilient agricultural practices.

The farm trial investigated the performance of three cover crops at two seeding rates: German Foxtail Millet, Pearl Millet, and Sudex were chosen as cover crops that would be drought tolerant and help with weed suppression, while also adding biomass. Each of these crops were seeded at 100% and 125% of the recommended seeding rate. Sudex and German Foxtail Millet performed similarly, reaching Dry Matter (DM) yields of 3.2 and 2.8 t/ha, respectively. Pearl Millet yielded significantly lower at 0.7 t/ha. Within each crop, yields increased slightly at the 125% seeding rate, but it was not statistically significant.



Anthony Reyes, in the field at Oxbow Farm

ABOUT THE FARM

Oxbow Farm & Conservation Center is a non-profit farm in the floodplains of Snoqualmie Valley, Washington. Anthony Reyes, the Agricultural Program Manager, manages 81 acres of certified organic land by experimenting and trialing climate adaptive and resilient agricultural practices. Along with his team, he works to reconcile our expanding human needs and the health of our ecosystem through sustainable agriculture, thoughtful management of our forests, ecological restoration, and education.

Oxbow's Agriculture Program strives to foster a resilient, adaptive, and sustainable food and agriculture system alongside the community and environment. They produce certified organic produce with the goal of strengthening regional food security, stewarding natural resources, and exploring ways that small farms can address environmental challenges.

Measurements were taken from a random 3×3' quadrat from each plot at Oxbow Farm & Conservation Center.

Three warm-season grasses were chosen as cover crop species for this trial. Sudex, a sorghum-sudangrass hybrid is prized for it's high biomass and drought tolerance; Pearl Millet is known for its forage quality and ability to be a prolific N scavenger, and German Foxtail Millet is a fast-growing grass under low soil moisture conditions.

WHAT WAS THE ON-FARM TRIAL ABOUT?

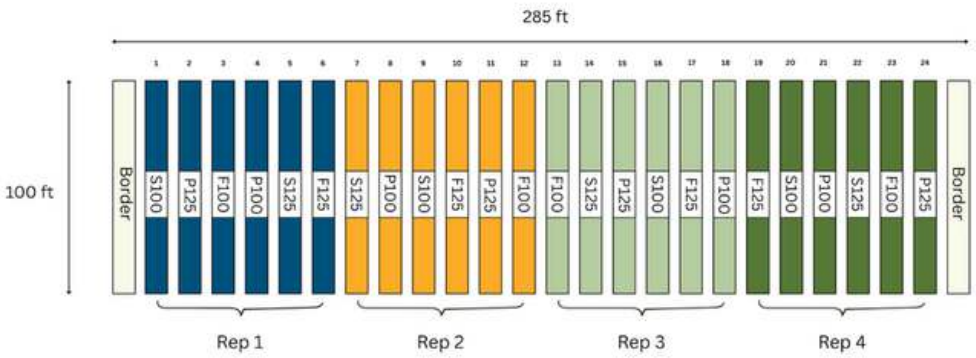
Anthony was interested in understanding how to find a cover crop that would meet the needs of the farm - managing climatic challenges, erosion, and weed pressure. Ideally, anything that would be planted would help add biomass and could withstand drought conditions. In addition to testing a few new cover crops, Anthony was interested in manipulating the seeding rate of the cover crops to achieve better soil cover, and was curious to know if the recommended seeding rate was adequate for their soil and growing conditions.

HOW WAS THE TRIAL DONE?

In this trial, Anthony investigated the impact of seeding rate on biomass and nutrient content for three cover crop species: German Foxtail Millet, Pearl Millet - specifically a tifleaf III hybrid pearl millet that was selected for drought tolerant characteristics, and Organic Blue River 225 Sudex cover crops.

The trial was arranged in a randomized complete block design, with 4 replications. Each of the 4 replications contained 6 plots (3 varieties at 2 different seeding rates), for a total of 24 plots. Plots were each 100' x 10' wide, with 1' pathways and borders on outside rows.

Aerial view of the farm, showing the field where the trial was conducted.



Treatments:
Species
S=Sudex
P=Pearl Millet
F=German Foxtail Millet

Seeding Rate
100=100% of Recommended Seeding Rate
125=125% of Recommended Seeding Rate

Figure 1. Plot map of the field trial at Oxbow Farm

Each of the cover crops were planted as a single variety at two different seeding rates: the recommended rate (100% or 20lb/ac) and 25% above the recommended rate (125%).

Once all the cover crops were established in the field, measurements were taken from a random 3x3' quadrat from each plot, including a biomass and leaf tissue sample. These samples were sent to Ward Lab for analysis of biomass, nutrient content, DM, and C:N ratio of the crop matter.

FINDINGS

Crop species had a significant effect on dry matter yield ($p<0.05$). Averaged across seeding rates, Sudex yielded the highest at 3.24 t/ac, followed closely by German Foxtail Millet at 2.83 t/ac. Pearl Millet dry matter yield was significantly less at 0.71 t/ac. Seeding rate did not significantly impact DM yield , and seeding rate x variety interaction effects were also not significant (Figure 2).

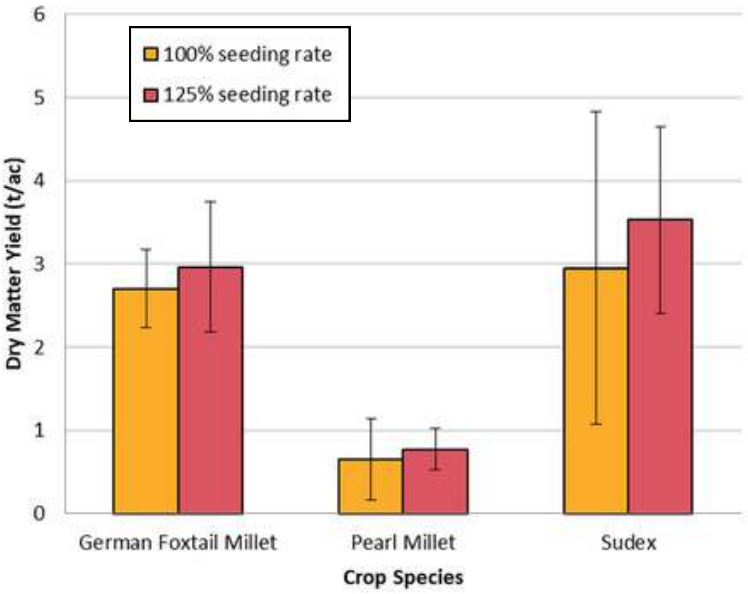
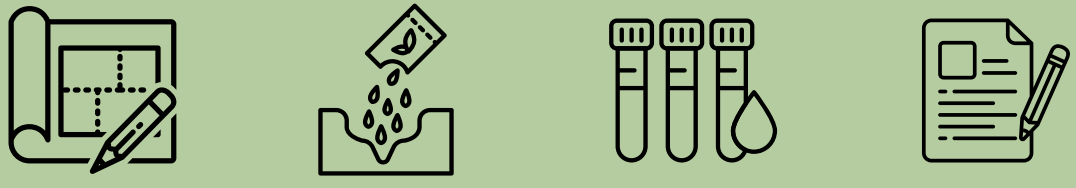


Figure 2. Dry matter yield (t/ac) of three crop species seeded at 100% and 125% of the recommended seeding rate.*
**Error bars represent standard deviation for each treatment.*



A portion of the cover cropped trial field at Oxbow Farm & Conservation Center.

"This research is critical as we face increased frequency of intense drought conditions. It is extremely important to our operation to understand what crops will perform under increasingly difficult conditions and still meet our soil health and farm management goals."

- Anthony Reyes, farmer-researcher

Tissue sampling revealed a few significant effects, mostly among crop species (Table 1). Pearl Millet was higher in P, S, and Mg than either German Foxtail Millet or Sudex.

Tissue nutrient concentrations were similar across the two seeding rates, except percent N, where N% was significantly higher at the 100% seeding rate (0.75% vs 0.59% at 125%) and C:N ratio, which was lower at the 100% seeding rate 60 vs 76 at 125%). The lower nitrogen at the 125% seeding rate may be explained by the increased plant competition for the same limited nitrogen supply, which supports Anthony's on-site observation of widespread nitrogen deficiency.

German Foxtail Millet is the most economical crop to seed, as its overall seed costs are considerably lower than Sudex (Table 2), and they yielded similarly. In terms of seeding rate, the 1x seeding rate is advantageous, as it delivers an equal yield and a higher nitrogen concentration at a reduced seed cost.

Table 1. Macronutrient tissue concentrations in the three crop species tested.*

Crop Species	N%	P%	K%	S%	Ca%	Mg%
German Foxtail Millet	0.60 a	0.15 b	1.54 ab	0.10 b	0.54 b	0.24 b
Pearl Millet	0.79 a	0.27 a	1.73 a	0.16 a	0.68 a	0.29 a
Sudex	0.64 a	0.15 b	1.35 b	0.09 b	0.66 ab	0.16 c

**Within columns, values with the same letter are not significantly different (α=0.05)*

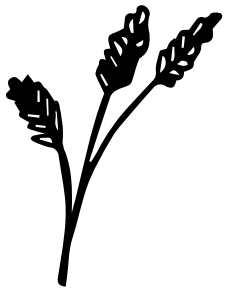


Table 2. Total cost per acre of crop species seeded at 100% (20lb/ac) and 125% (25lb/ac) of the recommended seeding rate.

Crop	Seeding Rate (lbs/ac)	Seed Cost $/50 lb	Total Cost $/acre
Sudex 'Organic Blue River 225 Brand BMR'	20	$96.00	$38.40
	25	$96.00	$48.00
German Foxtail Millet	20	$38.00	$15.20
	25	$38.00	$19.00
Pearl Millet 'Tifleaf III Hybrid'	20	$104.00	$41.60
	25	$104.00	$52.00

TAKE HOME MESSAGES

German Foxtail Millet and Sudex were identified as high yielding cover crops in this trial. There was an early season drought, which likely affected the cover crops, especially Pearl Millet. The Sudex demonstrated the most vigor and produced more tillers, while the German Foxtail Millet was shorter and more upright, and did not form a closed canopy. Under these conditions, higher seeding rates were unnecessary, as the 125% rate offered no yield benefit and diluted nitrogen concentration, making the standard 100% rate more cost-effective.

Anthony is interested in trialing these crop varieties again, in a more fertile field and ideally under typical rainfall conditions. In other areas of the farm, outside of the experimental fields, German Foxtail Millet grew taller and more densely, displaying better canopy cover despite the upright growing habit. Similarly, the Sudex outside of the trial area grew 2-3' taller and formed a full canopy.

ACKNOWLEDGEMENTS

This report is made possible by OFRF's Farmer-Led Trials program. In this program, farmers receive technical support to address their challenges through structured on-farm trials. To learn more about OFRF Farmer-Led Trials Program, visit our website page at https://ofrf.org/research/farmer-led-research-trials/

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