

Resilient Dryland Farming Alliance, 2021 – 2022 annual report: Alternative crop trial

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Summary

Winter wheat-fallow (WF) systems are prevalent in the dryland region of the U.S. Pacific Northwest. A fallow period (~14 month) is included to allow soil moisture recharge between wheat crops, as average annual precipitation ranges from 8 to 16 inches. Despite reliable yields, WF systems can lead to increased soil erosion, decreased soil organic matter, and poor overall soil health. This is mainly due to low biomass production, long fallow periods, and lack of crop diversity. Therefore, diversification and intensification through integrating alternative crops into WF systems may enhance overall sustainability and soil health of these cropping systems. Under the Resilient Dryland Farming Alliance (R DFA), a grower-led initiative, an array of potential alternative crops are being evaluated for diversified and intensified wheat-based systems. These alternative systems are designed to reduce the number of fallow periods, enhance soil health, break disease cycles, decrease fertilizer requirements, and change or reduce herbicide inputs. Further details about the overall rationale, objectives, long-term vision, and funding for the R DFA can be found in “[Designing Cover and Alternative Crops for Dryland Cropping Systems in Eastern Oregon](#)” by Singh et al., 2021. This annual report presents the alternative crop yields from the third year of the alternative crop trials.

Background

An alternative crop trial was established in two rainfall zones in the inland Pacific Northwest. There were eight alternative crop treatments (Table 1) with four replications at each location planted in a randomized complete block design. The low rainfall location in Morrow County, Oregon, USA (45.59 N, -119.56 W) receives a 30-year average annual precipitation of 9 in, with 13.7 in accumulated during the crop year from September 1, 2021 – July 31, 2022. The intermediate rainfall location in Umatilla County, Oregon, USA (45.72 N, -118.62 W) receives a 30-year average annual precipitation of 16 in, with 18.3 in accumulated during the crop year from September 1, 2021 – July 31, 2022. Locations will be referred to as the Umatilla County site and the Morrow County site. The Umatilla County site soil type is Walla Walla silt loam. The Morrow County site soil type is Warden silt loam.

At the Morrow County site, the WF system was intensified with alternative crops to a 2-

crop, 3-year rotation as winter wheat-alternative crop-fallow. At the Umatilla County site, the WF rotation was intensified to an annual cropping system as a winter wheat-alternative crop rotation. Both sites were managed under no-till conditions. Both sites received above an average amount of annual precipitation during the crop year (Sept 1, 2021 to July 31, 2022). Morrow County received 13.7 in annual precipitation compared to the 30-year average of 9 in. Similarly, Umatilla County received 18.3 in precipitation compared to the 16 in average.

Fall-seeded alternative crop treatments included winter pea cvs. ‘USDA Klondike’, ‘Icicle’, Austrian peas, and winter lentil cv. ‘Morton’, and winter barley cv. ‘Lightning’ (Table 1). Plots were 14 ft × 40 ft and seeded with a Fabro no-till plot drill (Swift Current, Canada) with 12 in spaced hoe-type openers. Spring-seeded alternative crop treatments included brown mustard cv. ‘Kodiak’, safflower cv. ‘Baldy’, and flax cv. ‘Golden’. Fall-planted alternative crops were seeded on October 28, 2021 at the Morrow County site and on November 3, 2021 at the Umatilla County site. Spring-planted alternative crops were seeded on March 14, 2022 and March 29, 2022 at the Morrow and Umatilla County sites, respectively (Table 1). A chemical fallow treatment served as the experimental control. Glyphosate (Gly Star 5 Extra, 24 fl oz/ac; Albaugh LLC, MO) was applied at both sites to all plots (both spring- and fall-seeded) after fall seeding but before crop emergence. Spring plots and fallow controls received a second application of glyphosate prior to spring crop emergence. In summary, fall-seeded plots received one application of 24 fl oz/ac Gly Star 5 Extra whereas spring-seeded plots and the fallow controls received a total of 48 fl oz/ac Gly Star 5 Extra in a split application. Fall-seeded legumes received a spring application of 14 fl oz/ac of Assure II (DuPont, DE) and 15.4 fl oz/ac of Basagran 5L (BASF, NC).

Alternative crop harvest timing depended on crop maturity (see harvest dates in Table 1). The crops were harvested either by small plot combine or by hand using quadrats and clippers, depending on yield, stand establishment, and the availability of equipment (Table 1). Quadrat-sampled crops were threshed using a lab-scale thresher to isolate the seed.

Alternative crop yields: Yields for the alternative crops are shown in Table 1. Statistical analysis of the data has not been completed, so any treatment comparisons refer to trends or relative differences. Among pea varieties, yields followed the trend: Klondike pea > Icicle pea > Austrian pea at both sites. All the pea varieties and brown mustard had higher yields at the Morrow County site than Umatilla County site. Winter barley, flax, safflower, and winter lentil had higher yields at the Umatilla County site than Morrow County site. In general, winter peas, winter barley, and winter lentil were the best performing alternative crops based on yield.

Table 1. Alternative crop yield, planting date, harvest date, and harvest method in trials conducted in Umatilla and Morrow County in 2022.

Plant season	Species	Variety	Umatilla County				Morrow County			
			Yield (lbs/ac)	Planting date	Harvest date	Harvest method	Yield (lbs/ac)	planting date	Harvest date	Harvest method
Spring	Safflower	Baldy	99	29-Mar-22	19-Aug-22	Quadrat sample	BD [†]	14-Mar-22	n/a	n/a
Spring	Mustard	Kodiak	128	29-Mar-22	19-Aug-22	Quadrat sample	284	14-Mar-22	22-Jul-22	Quadrat sample
Spring	Flax	Golden	555	29-Mar-22	15-Aug-22	Plot combine	33	14-Mar-22	22-Jul-22	Quadrat sample
Winter	Pea	Austrian (VNS*)	815	3-Nov-21	23-Aug-22	Plot combine	1239	28-Oct-21	21-Jul-22	Plot combine
Winter	Lentil	Morton	843	3-Nov-21	19-Aug-22	Quadrat sample	706	28-Oct-21	21-Jul-22	Plot combine
Winter	Pea	Icicle Pea	1057	3-Nov-21	23-Aug-22	Plot combine	1279	28-Oct-21	21-Jul-22	Plot combine
Winter	Barley	Lightning	1282	3-Nov-21	19-Aug-22	Quadrat sample	1028	28-Oct-21	21-Jul-22	Plot combine
Winter	Pea	Klondike	1435	3-Nov-21	23-Aug-22	Plot combine	1544	28-Oct-21	21-Jul-22	Plot combine

[†]BD is below detection

*VNS is variety not specified

Reference:

Singh, S., J. Barroso, F.J. Calderon, C.H. Hagerty, C.L. Reardon, and S. Machado.

2021. *Designing cover and alternative crops for dryland cropping systems in eastern Oregon.*

Oregon State University Extension Service.

Available at: <https://extension.oregonstate.edu/crop-production/field-crops/designing-cover-alternative-crops-dryland-cropping-systems-eastern>