



# Picabo Livestock, ID

## SOIL HEALTH CASE STUDY

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FARE IDAHO

Silver Creek running through the ranch

Three generations of the Purdy family—Nick (age 83), Pat (60), and Nicholas (36)—operate the 135-year-old Picabo Livestock ranch, a 700-head cow-calf operation. They also grow alfalfa hay, malt barley, mustard seed, and potatoes across 4,800 acres of heavy silt loam and rocky clay riverbed in Blaine County, Idaho. Although they’ve adopted soil health practices on their entire acreage, this study focuses on their 1,800-acre rotation that includes 2 years of barley and 4 years of alfalfa where the Purdys practice no-till, cover cropping, and nutrient management. The ranch is 100% irrigated and is protected from development by a conservation easement.

The Purdy’s initial motivation for transitioning away from conventional management, especially intensive tillage, was the severe wind erosion often experienced in this region of Idaho. Constantly dredging precious silty topsoil to maintain the world-class trout stream that the ranch abuts was incredibly expensive, and seeing how much topsoil had run off the fields was “heartbreaking.” In 2014, they began their no-till journey on both barley and alfalfa, then expanding across all their acreage as they acquired the necessary equipment, a process which took about four years.

Prior to their adoption of cover crops in 2015, the ranch’s fields would sit bare over the winter, which Pat calls “the kiss of death for soil health and maintaining topsoil.” Now, the Purdys plant a fall forage mix, which includes peas, lentils, vetch, turnips, and a pea/vetch/lentil inoculant, on roughly half of their barley acres. This mix plus the volunteer barley growth provides excellent grazing for their cattle in the fall before it frosts over the winter.

Around the same time that the ranch began no-tilling, the Purdys began reworking their nutrient management program, which they continue to refine every year. In general, on alfalfa fields, they switched from dry then liquid synthetic fertilizer to custom-applied 100% manure compost; and on barley fields, they transitioned from a single application of a dry blend to a split application of a liquid blend. They also began to adopt different soil sampling methods, moving away from relying exclusively on traditional chemical extraction tests. They’ve added the Haney, soil organic matter, Solvita Labile Amino-Nitrogen, and Volumetric Aggregate Stability tests and limit fall soil sampling to one sample per select fields instead of every field.

### Soil Health, Economic, Water Quality, and Climate Benefits

Partial budgeting analysis was used to estimate the marginal benefits and costs of no-till, cover-cropping, and nutrient management soil health practices at Picabo Livestock. The study was limited to only those income and cost variables affected by the adoption of these practices. The table on page 2 presents a summary of these economic effects revealing that, due to the three soil health practices, Picabo Livestock’s net income increased by \$65/ac/yr, or by \$117,137/yr, on the 1,800-acre study area, achieving a 136% return on investment.

The largest per-acre increase in net income is attributed to the forage value of their cover crops, estimated to be \$74/ac/yr. This cover crop benefit outweighs the \$69/ac/yr cost of cover crop seed and planting.

The second largest per acre increase in net income is due to barley and alfalfa average yield increases of 5 bu/ac and 0.5 ton/ac, respectively, that the Purdys attribute to their soils’ higher organic matter (SOM) content as a result of soil health practice adoption, providing an additional \$71/ac/yr. On average, the Study Area fields have seen an increase in SOM from 2.4% before 2015 to 3% after 2015, with some soil samples showing SOM as high as 5.8%.



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Nicholas and Nick Purdy; Pat Purdy

### Farm at a Glance

**COUNTY:** Blaine, ID

**WATERSHED:** Silver Creek & Big Wood River

**CROPS:** Alfalfa hay & malt barley

**FARM SIZE:** 4,800 acres (1,800-acre study area)

**SOILS:** Heavy silt loam to heavy clay to rocky riverbed on 0–2% slopes

**SOIL HEALTH PRACTICES:** No-till, cover crops, nutrient management



Multispecies cover crop mix



The Purdys have experienced two decreases in cost. First, by switching to no-till, they eliminated two tillage passes for barley and three passes for alfalfa, reducing their annual machinery costs by \$49/ac/yr.<sup>1</sup> Second, they've eliminated the use of insecticides on alfalfa altogether since their change in nutrient management, limiting applications of excess nitrate, which Pat calls a "bug magnet," netting the ranch a savings of \$8/ac/yr or \$9,600/yr.

Overall, the largest cost increases that Picabo Livestock has incurred are due to changes in nutrient management practices. Incorporating newer soil sampling methods is more costly, an additional \$2/ac/yr. Manure compost for alfalfa is significantly more expensive than conventional fertilizer, costing the farm an additional \$42/ac/yr. Finally, custom-hiring manure application on alfalfa and

the additional pass required for split application of liquid fertilizer on their barley accounts for an additional \$5/ac/yr. In 2021, the Purdys began doing plant sap analysis, which is dramatically changing their nutrient management. As this is a new practice, it has not been included in this analysis.

Finally, Picabo Livestock employees spend about 75 hrs/yr combined on learning activities related to their soil health practices, placing special emphasis on finding reliable mentors.

The Purdys have seen significant improvements in earthworm populations, soil tilth, and water infiltration as a result of their efforts. Says Pat, "We just don't see standing water on our soils, so my pivots don't get stuck anymore." The USDA's COMET-Planner Tool estimates that

Picabo Livestock's soil health practices resulted in a reduction of 302 metric tons of CO<sub>2</sub>-equivalent/yr, corresponding to taking 67 cars off the road for one year.

## Closing Thoughts

The Purdys credit the success of their soil health journey to starting small, experimenting where they could afford to fail, and acknowledging that mistakes are part of the process. For them, the biggest challenge has been changing their mindset. This has meant going from viewing their soil as dirt to respecting it as a living, biological organism of which they are stewards. Says Pat, "If you view your soil as a living biological system, it really does challenge you ethically to change your behavior."

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## ECONOMIC EFFECTS OF SOIL HEALTH PRACTICE ON PICABO LIVESTOCK CO, ID (2021 PRICES)<sup>2</sup>

Increases in Net Income			
Increase in Income			
ITEM	PER ACRE	ACRES	TOTAL
Grazing cover crop benefit (+0.33 ton/ac)	\$74	300	\$22,275
Increased yields for barley (+5 bu/ac) and alfalfa (+0.5 ton/ac) due to soil health practices	\$71	1,800	\$127,050
<b>Total Increased Income</b>			<b>\$4,650</b>
Decrease in Cost			
ITEM	PER ACRE	ACRES	TOTAL
Machinery cost savings due to no-till	\$49	900	\$44,325
No longer applying insecticides to alfalfa	\$8	1,200	\$9,600
<b>Total Decreased Cost</b>			<b>\$53,925</b>
<b>Annual Total Increased Net Income</b>			<b>\$203,250</b>
<b>Total Acres in this Study Area</b>		<b>1,800</b>	
<b>Annual Per Acre Increased Net Income</b>			<b>\$113</b>

Decreases in Net Income			
Decrease in Income			
ITEM	PER ACRE	ACRES	TOTAL
None identified			\$0
<b>Total Decreased Income</b>			<b>\$0</b>
Increase in Cost			
ITEM	PER ACRE	ACRES	TOTAL
Cover crop seed and planting costs	\$69	300	\$20,580
Additional cost for new soil sampling methods	\$2	1,800	\$3,600
Alfalfa nutrient cost increase with switch to manure compost from synthetic fertilizer	\$42	1,200	\$50,880
Machinery cost increase due to changes in nutrient management	\$5	1,800	\$9,090
Combined practices learning activities			\$1,964
<b>Total Increased Cost</b>			<b>\$86,114</b>
<b>Annual Total Decreased Net Income</b>			<b>\$86,114</b>
<b>Total Acres in this Study Area</b>		<b>1,800</b>	
<b>Annual Per Acre Decreased Net Income</b>			<b>\$48</b>

<b>Annual Change in Total Net Income = \$117,137</b>
<b>Annual Change in Net Income Per Acre = \$65</b>
<b>Return on Investment = 136%</b>

<sup>1</sup>Machinery costs include the cost of custom hire, labor, depreciation, interest, insurance, housing, repairs, and fuel (Iowa State University Extension, 2022, Ag Decision Maker: Iowa Farm Custom Rate Survey; University of Illinois at Urbana-Champaign, 2021, Farm Business Management Machinery Cost Estimates: Field Operations). <sup>2</sup>Rounding of per acre values may result in minor discrepancies in totals. • This table represents estimated average costs and benefits attributed to adopting no-till, cover crops, and nutrient management over a 1,800-acre study area where barley and alfalfa are grown, as reported

by the Purdys. • All values are in 2021 dollars unless provided by the farmer. • Prices used in the analysis: Barley: \$5.15/bu, Hay: \$186/ton (Source: USDA NASS, 2021); Nitrogen: \$.72/Lb, Phosphate: \$.62/Lb, Potash: \$.56/Lb (Source: Iowa State University Extension, 2022, Ag Decision Maker: Estimated Costs of Crop Production in Iowa). • For information about (1) study methodology, see [farmland.org/soilhealthcasestudies](http://farmland.org/soilhealthcasestudies); (2) USDA's COMET-Planner Tool, see [comet-planner.com](http://comet-planner.com). • This material is based on work supported by USDA NRCS Cooperative Agreement #NR223A750010C003.

**For more information about this study or to discuss soil health practices, please contact**

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