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ENHANCING CROP DIVERSITY: STEVE AND BECKY CAMP

Farmer to Farmer Case Study Series

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ENHANCING CROP DIVERSITY: STEVE AND BECKY CAMP

By

Georgine Yorgey, Center for Sustaining Agriculture and Natural Resources, Washington State University. **Sylvia Kantor**, Center for Sustaining Agriculture and Natural Resources, Washington State University. **Kate Painter**, Department of Agricultural Economics & Rural Sociology, University of Idaho. **Leigh Bernacchi**, Department of Agricultural Economics and Rural Sociology, University of Idaho. **Hilary Davis**, Department of Agricultural Economics and Rural Sociology, University of Idaho. **Dennis Roe**, Department of Crop and Soil Sciences, Washington State University

Abstract

Steve and Becky Camp farm near LaCrosse, Washington, in an area receiving about 12–14 inches of annual precipitation. In this publication, the Camps discuss their strategy for diversifying and intensifying their rotations with crops including canola, camelina, spring and winter peas, and barley. Alongside direct seeding, this strategy helps them to benefit long-term soil quality.

This case study is part of the Farmer-to-Farmer Case Study project, which explores innovative approaches regional farmers are using that may increase their resilience in the face of a changing climate.

Information presented is based on growers' experiences and expertise and should not be considered as university recommendations. Mention of trade names or commercial products is solely for the purpose of providing specific information and does not imply recommendation or endorsement. Grower quotes have been edited slightly for clarity, without changing the meaning.

Readers interested in other case studies in this series can access them at on the [REACCH website](#), as well as in the WSU Extension Learning Library.

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Enhancing Crop Diversity: Steve and Becky Camp



Photo: Sylvia Kantor

Location: Lacrosse, WA

Average Annual Precipitation: 12–14 inches

Cropping System: Diversified 3- to 5-year rotation that includes winter and spring wheat and barley, winter pea, and spring camelina or canola

Watch the companion video, [Enhancing Crop Diversity: Farmer-to-Farmer Case Study Series](#), introducing Steve and Becky Camp and their diversified cropping rotations.



Map: Kaelin Hamel-Rieken, Washington State University

Introduction

Steve and Becky Camp, fifth generation farmers, are well known for pushing the limits of what is possible for dryland production in the intermediate precipitation zone. Their attitude is summed up by Steve: “If it’s impossible, what can we do to make it possible?”

Their experimentation is guided by holistic thinking, with an eye for increasing diversity, building soil quality, and enhancing ecological resiliency. Their goals are informed by a deep commitment to acting as stewards of their land for future generations. As Becky says, “We didn’t do anything to deserve [the soil we’re farming on], or to earn it, you know. We ‘get to’ farm.”

Traveling west from the two land-grant universities in Moscow, ID, and Pullman, WA, to the Camps’ farm near Lacrosse, WA, the rolling landscape changes rather quickly from a verdant landscape of wheat, barley, chickpeas, peas, lentils, and canola to a much drier farming area with nearly half the land in summer fallow. Annual precipitation near Pullman is 22 to 24 inches but drops to 12 to 14 inches 30 miles west, on the Camps’ 3,000-acre farm. Almost all farmers in the arid western dryland wheat growing area of the Palouse use a crop rotation of winter wheat–summer fallow or winter wheat–spring grain–summer fallow.

The Camps have less fallow in their rotation than many others in their area. Their rotations are flexible, diverse, and intensified. The Camps are experimenting with spring peas and Austrian winter peas in their rotation (Figure 1). They have been raising oilseeds such as canola and camelina since 2006. From the oilseeds, they make all the biodiesel they need to operate equipment and vehicles on their farm. (See the Camelina Videos sidebar for more information.)

In 2013, the Camps were recognized by Harvesting Clean Energy, a project of the non-profit National Center for Appropriate Technology, as Agricultural Innovators of the Year for growing and producing their own renewable fuels and reducing their fossil fuel use.



Figure 1. Austrian winter peas near the Camp farm contrast with a checkerboard of winter or spring wheat and fallow in the background— a more common pattern for the Camps' area. Photo: Karen Sowers.

Camelina Videos

In 2010 and 2011, Steve Camp was profiled by Washington State University News, resulting in two brief but helpful videos:

- Steve discusses the benefits of diversifying his rotation with oilseeds in [Running on Camelina: LaCrosse Farmer Sees Possibilities Firsthand.](#)
- Steve shares his process and equipment for producing the biodiesel—which he uses to run his farm equipment—in [Running on Camelina: Pressing Oil Seed to Meet Pressing Energy Needs.](#)

A Journey to Rebuild the Soil

The Camps began experimenting with direct seeding in 1989, but it wasn't until 2002 that their entire acreage was direct seeded. Becky explains their motivation for making a change.

“Our [direct seeding] journey started with an emotional response we had to an old family photo of spring runoff in the 1960s. Literally, down some of the draws, there were cascading waterfalls of chocolate syrup.”

This disturbed Steve because, as he says, “I was building a personal relationship with the soil, and I was realizing that I can't build it back as fast as it washed off.” Although Steve and Becky knew that they would not be able to rebuild the soil as quickly as it eroded, they were compelled to take action.

Cropping Diversity Builds on Direct Seed Foundation

Direct seeding is the foundation of Steve and Becky's operation. Because of its clear benefits plus ongoing innovations in equipment, herbicides, and pesticides that have made direct seed management easier, Steve thinks that “no-till should be one of the practices of every farmer out there.”

Twelve years after their transition to direct seeding, they continue to see ongoing soil quality improvements, including improved water infiltration and reduced evaporation (Figure 2).

Direct seeding has allowed them to use soil water more efficiently and crop their land more intensively than when they used conventional tillage on their farm. Previously, like most farmers in their area, they relied on a three-year rotation, with summer fallow every third year. They have lengthened the rotation to four or five years, in some cases without a fallow period. With much less land in fallow, they have increased their cropped acres and, typically, their income.

In addition, reducing the amount of fallow increases the amount of plant cover, protecting the soil and enhancing soil microbial activity. Thus, direct seeding and crop intensification work together to improve soil health and production.

Crops

Diverse crops and flexible rotations are cornerstones of the Camps' strategy. The Camps are currently growing spring canola, spring camelina, and winter barley, along with the more traditional crops of winter and spring wheat and spring barley. Steve has added new crops slowly, experimenting on a small scale before planting larger areas. This has helped them



Figure 2. By planting into the residue of the previous crop, Steve Camp aims to reduce soil erosion, conserve water, and enhance soil microbial activity. Photo: Steve Camp.

to adopt new crops while minimizing the financial risk that comes with trying something new.

Oilseeds (Figures 3 and 4), particularly camelina, accounted for about a sixth of the Camps' harvested acreage in 2012 and 2013. (See the Resources for Growing Oilseeds in the Inland Pacific Northwest sidebar for more information.) Steve first grew camelina in 2006, when he contracted to grow the crop for a grain company. After the first year, he continued to grow it because of its competitive growth habit. "It will adjust to whatever the weather conditions are, which makes it the survivor that it is.... You will almost always get a crop. You know, it's a tough little bugger!"

Oilseeds can offer both economic and agronomic benefits. Economically, growing an alternative to wheat diversifies their revenue sources, reducing long-term risk. In addition to selling the seed that they don't need for their own biodiesel (Figure 5), the Camps have developed profitable local markets for the oilseed meal, a byproduct of pressing oil from seeds that is in demand for animal feed.

Oilseeds differ biologically from cereal crops, providing agronomic benefits through diversity in the rotation. This diversity makes cereal root diseases and grassy weeds more manageable and greatly reduces their incidence when the rotation includes two or more years without cereal grains. Oilseeds can also utilize soil water and nutrients at different times and over different parts of the soil profile than cereal crops. Lastly, the Camps feel they achieve long-term benefits to soil health by fostering diverse soil biota.

Oilseeds are not the only crop the Camps grow to add diversity. While barley is not uncommon in the area, spring barley is the typical choice of farmers. But like winter wheat, winter (fall) barley has a head start on spring-planted crops.

Steve says, "It gives me a little more residue. And barley, especially fall barley, does wonders for soil tilth the year after."

The Camps are also beginning to grow limited amounts of spring and winter peas (Figure 6), and they find these have significant rotational advantages. (See the Resources for Growing Legumes in the Inland Pacific Northwest sidebar for more information.) As Steve says, "peas provide every benefit in this area that they do elsewhere."



Figure 4. Camelina at seedling stage (top) and at maturity (bottom) is a key oilseed crop that adds diversity to Camp's farm. Photos: Steve Camp (top) and Matt Haugen (bottom).



Figure 3. Camp shows canola in bloom in his fields. Photo: Kathleen Painter.



Figure 5. Camp shows tiny brown camelina seeds in his hand, and light yellow hulls. Photo: Sylvia Kantor.

Resources for Growing Oilseeds in the Inland Pacific Northwest

There is a wealth of information about oilseeds online at the [WSU Oilseed Cropping Systems website](#). This website is updated regularly with new information as it becomes available.

Together and separately, the University of Idaho, Oregon State University, and Washington State University have quite a number of Extension publications covering oilseed production. These include crop production and fertility guides as well as case studies. A sampling of publications includes:

Agronomics and Fertility

- [Oilseed Crops: Canola](#)
- [Canola Growth, Development, and Fertility](#)
- [Northern Idaho Fertility Guide: Spring Canola](#)
- [Nutrient Management Guide: Irrigated and Dryland Canola](#)
- [Camelina Production in the Dryland Pacific Northwest](#)
- [Oilseed Crops: Camelina](#)
- [Camelina: Effects of Planting Date and Method on Stand Establishment and Seed Yield](#)

Economics

- [Enterprise Budgets: Wheat & Canola Rotations in Eastern Washington Intermediate Rainfall \(12–16”\) Zone](#). Accompanying [spreadsheet](#) is available.
- [Enterprise Budgets: Wheat & Canola Rotations in Eastern Washington Low Rainfall \(<12”\) Zone](#). Accompanying [spreadsheet](#) is available.

Case Studies

- [Oilseed Production Case Studies in the Eastern Washington High Rainfall Zone](#)
- [Oilseed Production Case Studies in the Eastern Washington Low-to-Intermediate Rainfall Zone](#)
- Oilseed production case studies in the eastern Washington low rainfall zone are in progress. When completed, they will also be available as WSU Extension Manuals.

Resources for Growing Legumes in the Inland Pacific Northwest

The [USDA-ARS Grain Legume Genetics and Physiology Research Unit](#) develops improved varieties of peas, lentils, and chickpeas and conducts research on issues that affect productivity and quality in these crops.

For additional resources on growing both legumes and small grains, see the [WSU Small Grains website](#).

Crop budgets, helpful for planning for legumes and many other crops, are available through the University of Idaho Extension's [Idaho AgBiz website](#).

University of Idaho, Oregon State University, and Washington State University Extension publications on legumes include:

- [Northern Idaho Fertilizer Guide: Spring Peas](#)
- [Fertilizer Guide: Peas, Eastern Oregon—East of Cascades](#)

Peas fix nitrogen, which enhances soil nitrogen fertility and improves health for the following crop. Steve has also found that crops planted after peas do better than he would have anticipated from the nitrogen fixation benefit alone.

Steve also continues to experiment with new crops. He has participated as a cooperating farmer in WSU variety trials for over 15 years. (See the WSU Variety Trials Show Promise for Pulses in 14-inch Rainfall Zone sidebar for more information.) He is considering winter lentils, which would be an innovation for an area that normally relies on wheat and barley. However, he anticipates weed control could be a challenge due to lack of approved herbicides for this crop.

Rotations

Steve now has considerable experience with camelina and spring canola, as well as several years of experience with winter and spring peas. However, incorporating these crops into his rotations with wheat and barley remains a challenge. One sequence he is currently trying is a 4-year sequence of winter wheat, winter pea, spring camelina or canola, and spring or winter barley.



Figure 6. The Camps have experimented with both winter and spring peas. Spring peas are shown in mid-June in 2014 (left) and fully developed in July 2013 (right). Photos: Kathleen Painter (left) and Stephen Guy (right).

WSU Variety Trials Show Promise for Pulses in 14-inch Rainfall Zone

Building on a longstanding relationship with WSU Extension's Variety Testing Program, led by Stephen Guy, Steve Camp has been cooperating to test varieties of spring peas, lentils and chickpeas (as well as camelina) on his farm. Along with other growers distributed across different climatic regions in eastern Washington, Camp provides land, labor, crops, and time to help test the performance of dozens of new crop varieties (Figure 7). Steve benefits from the variety trials as he gets a first-hand look at their performance on his farm. He can then use the information for variety decision-making.

Full results can be found on the [WSU Extension Variety Testing Program website](#).



Figure 7. The 2013 spring pea variety trial at the Camp farm in early June. Photo: Stephen Guy.

In the inland Pacific Northwest, most pulse and chickpea crops are produced in the annual cropping zone, in a north-south transect including the towns of Pullman and Moscow (Figure 8). Just 3% of the lentil acreage in the Pacific Northwest was estimated to be grown in the transitional rainfall zone in 2007, and 5% of the chickpea acreage (Table 1). Dry peas were more commonly produced in the transitional rainfall zone, with an estimated 23% of the acreage in 2007. There have been small recent increases in these numbers; by 2012, the transitional zone accounted for 7%, 8%, and 26% of the lentil, chickpea, and pea acreage, respectively.

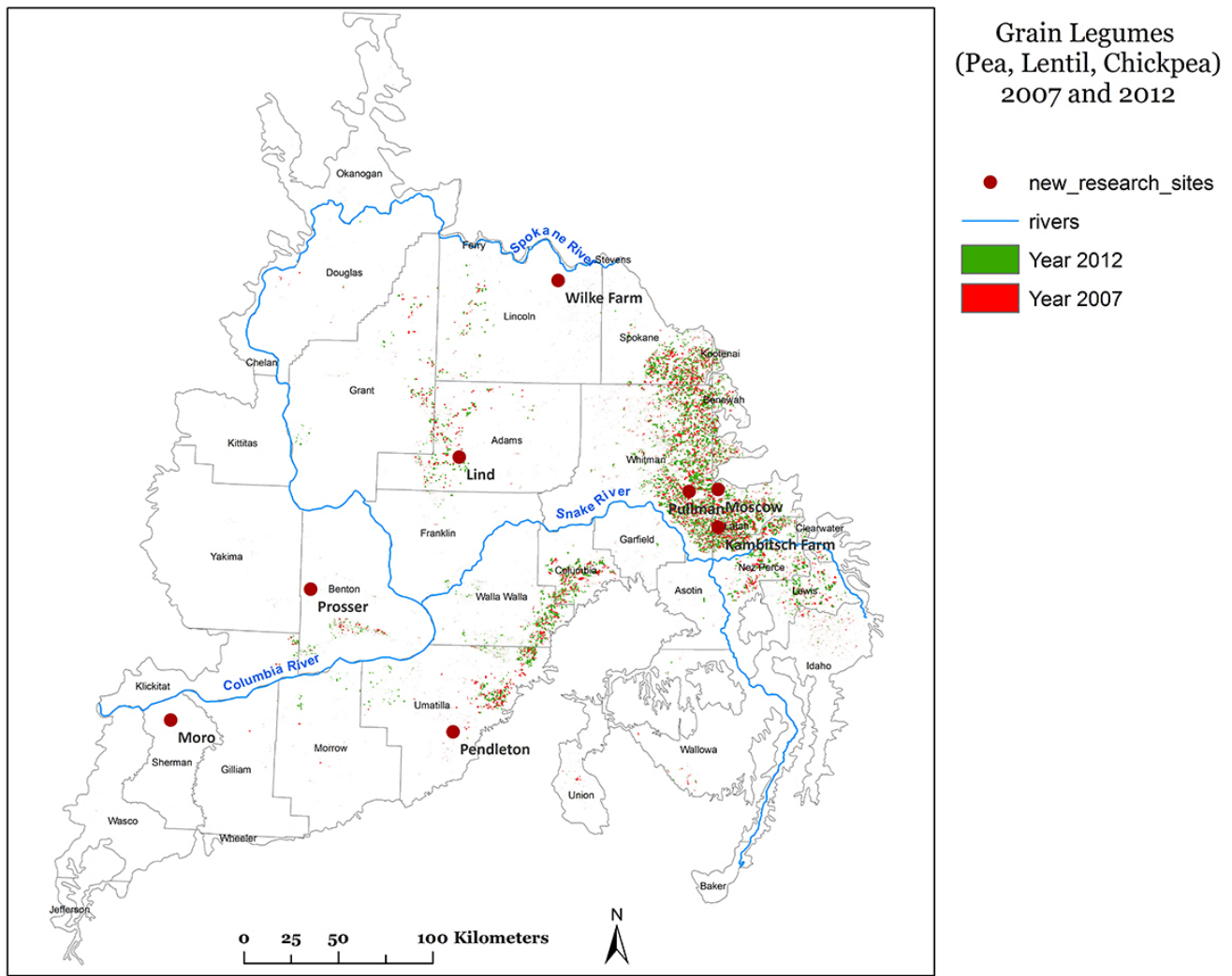


Figure 8. Grain legumes (peas, lentils, and chickpeas) acreage by year. Figure: Harsimran Kaur.

Table 1. Acreage in grain legume crops by rainfall region in 2007 and 2012.

Year	Region	Crop		
		Chickpea	Pea	Lentil
2007	Annual Cropping	84%	60%	97%
	Transition	5%	23%	3%
	Grain-Fallow	11%	17%	0%
	Total Acres	84,386	100,957	93,314
2012	Annual Cropping	84%	60%	97%
	Transition	5%	23%	3%
	Grain-Fallow	11%	17%	0%
	Total Acres	84,386	100,957	93,314

Source: Table compiled from data from the USDA National Agricultural Statistics Service Cropland Data Layer (2007 and 2012), analyzed by Huggins et al. (2014).

The WSU variety trials showed promising yield results from 2011–2013 for grain legumes (Table 2). Plot size is typically quite small (64 square feet for these trials) and intensively managed, so yields will normally be higher than an average grower’s field. For example, the average yield across all spring pea varieties for the 2013 test plots on Camp’s farm were 24% higher than his spring pea yield on a whole-field basis. And the winter wheat yields for the variety trials are about 50% higher than typical average yields for this rainfall zone.

Table 2. Results of recent WSU variety trials in Dusty, WA, 14-inch rainfall zone.

Crop	Average yield across all varieties by year			
	2013	2012	2011	Average 2011-2013
Soft white winter wheat after summer fallow, bu/ac ¹	90	94	104	97
Spring peas, lb/ac ²	2080	2390	2110	2220
Spring lentils, lb/ac ²	1780	710	1040	1260
Garbanzos, lb/ac ²	980	1550	2260	1600

¹Grower cooperater Bob Morasch

²Grower cooperater Steve Camp

Growers will need to select varieties that show promise for their region and reduce their yield expectations relative to the variety trials. From a budgeting standpoint, yield results of the variety trials should be adjusted downward to reflect realistic farm-level management.

When thinking about arranging crops into sequences, Steve emphasizes a tool belt approach (Figure 9). He likes to have options to choose from as his needs change over time in response to agronomic and market pressures. Rather than using a core rotation, he thinks about choosing sequences of crops that will generate residue to feed the soil, benefit his overall weed management, and be profitable (Figure 9). Becky notes that they usually try “something very different—that has a

different makeup, uses different nutrients from the soil, and puts different nutrients back.”

Management of Weeds and Diseases

Having a more diverse set of crops and rotations to choose from provides Steve and Becky with additional tools to break up cycles of weeds, insect pests, and diseases. Steve finds that grains following oilseeds



Figure 9. The Camps feel that benefits come from having diversity in their cropping system. Examples of this include spring wheat and spring peas grown in adjacent fields (left) and spring canola below spring wheat (right). Photos: Kathleen Painter.

are healthier, more uniform, and have better color. They also have fewer weed issues. He particularly sees these weed benefits when a field is out of winter wheat for two to three years. He finds that this greatly reduces the amount of viable seed from pervasive winter annual grasses, such as downy brome.

To maintain flexibility to plant oilseeds when he feels it could be helpful, Steve avoids using herbicides that interfere with oilseed production. (See the Herbicide Sensitivity and Plantback Restrictions for Oilseeds sidebar for more information.) To compensate for loss of weed control from not using residual herbicides, Steve uses higher seeding rates when weed pressure is high.

In the bigger picture, Steve strongly believes that direct seeding, increasing residue, and using diversified rotations will continue to provide a range of benefits, from improved growth of crops to better management of disease.

Precision Agriculture

The Camps use a number of precision agriculture tools to reduce input costs and chemical usage. They use Global Positioning System (GPS) navigation for auto-guidance on his tractor to increase accuracy and reduce overlap. Steve also has a GPS-governed variable seed rate system, which allows variable planting rates across fields. His sprayer is outfitted with auto-boom in order to reduce overlap and spraying over the edges of fields.

Learning from Others, but Finding their Own Path

Experimenting has become a way of life for the Camps. Steve says, “I’m enjoying farming more now than I ever have because I’m learning things.... Before, I farmed because that’s the way my dad did it or my grandfather or my great-grandfather.”



Figure 10. Steve Camp is the fifth generation to farm in the Lacrosse area. Photo: Sylvia Kantor.

Herbicide Sensitivity and Plantback Restrictions for Oilseeds

Ian Burke, Weed Scientist, Crops and Soils Department, Washington State University

Dennis Roe, Crops and Soils, Washington State University

Kathleen Painter, Agricultural Economics and Rural Sociology, University of Idaho

Some herbicide residues can damage oilseed crops. Before planting an oilseed crop for the first time, farmers should check the labels of all herbicides applied to the field in the previous six to ten years for tolerance to the oilseed crop to be planted in the field, with particular attention to plantback restrictions. In particular, canola is very sensitive to imidazolinone and the sulfonylurea-type herbicides, such as Glean (chlorsulfuron), Finesse (chlorsulfuron and metsulfuron), Ally (metsulfuron), Maverick (sulfosulfuron), Pursuit (imazethapyr), and others (Painter 2006).

Different herbicides and specific soil conditions will require different lengths of time between use and canola planting. Some newer varieties of canola are tolerant of certain herbicides; check with seed sources for additional information. A [report](#) summarizes field trials with Pursuit-resistant cultivars.

Anyone planning to seed an oilseed or other crop can go to the [Crop Data Management Systems website](#) to find the product labels for that crop. However, before using a product listed on CDMS, growers should find out if it is registered in their state and check the state-specific label. Information on plantback restrictions for oilseed crops can be found on the pesticide labels in the [Pacific Northwest Pest Handbook: Weeds](#).

Remember, when applying any pesticide, it is important to follow the information on the product label.

Now, with an improved understanding of the science behind the farming techniques his family developed over the generations, Steve hopes to farm more sustainably while maintaining the strong connection to the soil that he learned from his family (Figure 10).

The Camps credit a four-year holistic management program at Washington State University for shaping their attitudes towards experimentation in many important ways. (See the

Resources for Holistic Management sidebar for more information.) Among the most important activities they did as part of this program was to develop and refine a long-term goal statement for their farm:

“We will return the land to its native production capacity using sustainable methods and as little artificial inputs as necessary in order to attain a viable land base for future generations. We will strive for a quality of life that meets the spiritual, social, physical, mental, and economic needs of ourselves, family, friends, and community.”

This statement helps them focus their day-to-day efforts toward their long-term goals.

Resources for Holistic Management

Although WSU’s holistic management program is no longer active, the [Roots of Resilience](#) (previously called the Pacific Northwest Center for Holistic Management) is a regional non-profit organization based on many of these same principles. The website includes many resources for ranchers as well as other resources that may be of more general interest. According to the organization, holistic management is a decision-making framework that can be used in any aspect of life or business, and that aims to improve social, economic, and environmental balance.

They also learned two key ideas. First, they learned to “check their rearview mirror,” that is, to learn from what others have done before them, and from what they have tried in the past. Second, they do not limit themselves to proven strategies. Instead, if they think a particular strategy will help them achieve their goals, they try to figure out what they can do to make it work under their conditions.

These two ideas are evident in the Camps’ experimentation with new crops over time. When they first started growing oilseeds, little information was available for the Pacific Northwest. They relied on information about camelina from outside the area, adapting as they gained first-hand experience with the crop.

Now, with more interest in these crops in the region, they continue to learn all they can from neighbors who grow oilseeds, the [Pacific Northwest Direct Seed Association](#), universities, and conservation districts (Figure 11). Ongoing personal relationships with industry and science experts afford them access to new developments, which they adapt for their



Figure 11. Steve Camp talks with audience members after a presentation at his farm as part of the western Whitman County field tour organized by WSU Whitman County Extension in 2013. Photo: Dennis Roe.

farm, goals, and circumstances. As Steve says, “I’m relying a little more on science today because I know those people in science better and [have] built relationships with them. I know where they can help me and where they can’t.”

The Camps continually push the envelope of what is possible in their dry climate. Both consider themselves “tinkerers” who like to try new things. Steve experiments in the fields and is an advocate of evaluating a new crop, rotation, or growing practice side-by-side against an existing one. Becky uses her skills in economics and Microsoft Excel to make projections and assess the range of possible financial impacts and to evaluate the financial risk of their choices.

Benefits

Steve and Becky feel the main benefits of their system are reducing erosion and improving their soil quality. Within a few years of eliminating tillage, water in the farm’s ditches became notably clearer, and there are visible reductions of wind-blown soil during wind storms. Over the longer term, enhanced residue inputs and diversity have improved soil aggregation, structure, and tilth (Figure 12).



Figure 12. Improved soil quality benefits all their crops, including wheat. Photo: Karen Sowers.

These improvements in soil quality, in combination with crop residues that reduce evaporation, have led to soils that hold more water. And with only 12 to 14 inches of rain per year, every drop counts. Steve explains, “If we can save even a small amount of usable moisture down in this area, you’re talking about some money. Moisture has real value to us.”

Though some farmers feel that these intensified cropping systems cannot be as profitable as cereal-based rotations in the intermediate zone, the Camps have not found this to be the case. (See the Economic Comparison of a Diversified Annual Cropping System with the Traditional Cereal Rotation in the Intermediate Rainfall Area sidebar for more information.) With roughly comparable economic returns, they feel that their cropping strategy is a recipe for long-term success, even beyond their own lifetimes. As Becky says, they define success as “our needs are met... [and what] we leave behind us is going to be better.”

Challenges

Even with the improvements in soil water status that the Camps have made, water continues to be their biggest challenge. Lack of rainfall does prevent them from growing crops such as chickpeas that provide good rotational benefits in wetter annual cropping areas.

Their strategy and perspective also presents some financial challenges. The Camps have found that most bankers emphasize the ability to generate significant returns each year. The Camps’ business plan, however, emphasizes long-term goals over short-term cash flow. Cultivating a relationship and educating their banker about their approach has proven to be a successful strategy, although it has required more effort.

Last, their approach requires more intensive management than a more traditional system. As Steve says, “More planning is required...every year we adjust a little depending on our results.”

Managing Risk

In the short run, risk increases temporarily every time the Camps add a new crop, because Steve has to spend time learning how to manage the crop under a variety of conditions. Lack of insurance can also increase the risk of growing some crops. In 2013, there was no crop insurance program for camelina; though, with further testing of the crop, Steve expects this will change. However, he is not deterred by this. “I know what [camelina] will do and what it’s capable of doing...so I’ll raise it without insurance. And I look on the bright side—I don’t have an insurance premium to pay on it.”

In the longer run, the Camps view their focus on soil health as a strategy to reduce overall risk and improve the resilience of their system, both now and in the future. They also feel that diversity significantly enhances their flexibility. With more crop options, Steve can respond more easily to the combined pressures of weeds, insect pests, diseases, and ever-changing markets.

Markets are a major source of risk for most farmers, including the Camps. However, they feel that their market risk is lower than it is for many other dryland farmers because they are producing a diversified group of crops and products, including peas, barley, wheat, oilseeds, and oilseed meal (Figure 13). Their grains are sold through commodity markets, though they continue to explore alternative markets.



Figure 13. Camelina is among the diversified crops that the Camps produce. Photo: Matt Haugen, WSU News.

Economic Comparison of a Diversified Annual Cropping System with the Traditional Cereal Rotation in the Intermediate Rainfall Area

One of Steve and Becky’s goals is to keep something growing on their land as much of the time as possible. For others interested in experimenting with annual cropping in intermediate rainfall areas, Camp recommends starting small, using familiar crops. One rotation that he has found to be successful is winter wheat in Year One followed by a camelina crop in Year Two and spring peas in Year Three. In this annual rotation, Camp has achieved winter wheat yields of approximately 54 bu per acre, a 10% yield reduction relative to winter wheat planted after a fallow year, which typically yields about 60 bu per acre. In 2013, his camelina yielded 1120 lb per acre while spring peas yielded 1680 lb per acre.

In Table 3, a traditional cereal rotation for the Camps’ area is compared with his annual diversified no-till system for 2013 conditions, which could be described as not unusual but favorable, with some precipitation in June. Average revenue per acre was 15% higher for the annually cropped rotation, but production costs were also higher (Table 3). Returns over variable costs were 20% higher for the cereal rotation with fallow. However, returns over total costs were slightly higher for the annual rotation, averaging \$23 per acre over the three crops, compared to \$21 per acre averaged over the three crops in the cereal rotation. This result can be explained by the cost of summer fallow in the cereal rotation, at \$102 per acre, which is carried over to the following winter wheat crop as a fixed cost.

Overall, the economic performance of the diversified no-till rotation is very similar to the traditional, conventional tillage system, with just \$2 per acre higher returns, while reducing soil erosion, increasing soil quality, and improving overall resiliency.

Table 3. Comparison of a conventional tillage cereal rotation with fallow (fallow/winter wheat/spring wheat) to a direct-seeded annual rotation (cropped winter wheat/spring peas/camelina) in 14 to 16 inches rainfall.

By Crop:		Unit	Yield per acre	Price per unit	Revenue per acre (\$/acre)	Variable Costs (VC) (\$/acre)	Fixed Costs (FC) (\$/acre)	Total Cost (TC) of Operation (\$/acre)	PROFIT Returns over VC (\$/acre)	Returns over TC (\$/acre)
Cereal Rotation: Fallow--Winter Wheat--Spring Wheat										
Soft White Winter Wheat (SWWW)	bu	60	\$6.75	\$405	\$111	\$251	\$362	\$294	\$43	
<i>Preceding fallow year costs*</i>					\$0	\$79	\$23	\$102	-\$79	-\$102
Soft White Spring Wheat (SWSW)	bu	45	\$6.75	\$304	\$158	\$126	\$284	\$146	\$20	
Annual Rotation: Winter Wheat--Pulse--Camelina										
Soft White Winter Wheat (SWWW), no fallow	bu	54	\$6.75	\$365	\$173	\$122	\$295	\$191	\$69	
Spring Peas (SP)	b	1680	\$0.14	\$227	\$154	\$90	\$244	\$72	-\$18	
Camelina (CML)	b	1120	\$0.20	\$224	\$121	\$86	\$207	\$103	\$17	
By Rotation:					Revenue per acre (\$/acre)	Variable Costs (VC) (\$/acre)	Fixed Costs (FC) (\$/acre)	Total Cost (TC) of Operation (\$/acre)	PROFIT Returns over VC (\$/acre)	Returns over TC (\$/acre)
Cereal (F-SWWW-SWSW)		1/3 of each crop			\$236	\$90	\$126	\$215	\$147	\$21
Annual (SWWW-SP-CML)		1/3 of each crop			\$272	\$150	\$99	\$249	\$122	\$23

*Fallow costs are included as a fixed cost in the following winter wheat crop for the oilseed and grain rotations. Fallow costs are listed here for informational purposes only.

By growing multiple oilseeds and consuming a portion of their own crops in the form of biodiesel, the Camps are also, in essence, diversifying their markets (Figure 14). For example, in 2013, canola prices fell by about 50%. However, over the same time period, camelina prices were relatively stable and the price of diesel (which their biodiesel substitutes for) fell only slightly.



Figure 14. The Camps use a cold pressing process to produce biodiesel from oilseeds. Photo: Matt Haugen, WSU News.

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Advice for Others

The Camps were asked what advice they would give to other growers interested in intensifying and diversifying their cropping rotations.

Have a goal for your farm and be flexible. The Camps stress the importance of having a long-term goal and vision: “What do you want your farm to look like? Where do you want to go with it? Keep your eye on that goal.” Over time, the goal will stay the same, while changes in conditions may require flexibility in terms of strategy.

Have realistic expectations. Steve advises that people should not expect it to be easy to intensify for diversify their cropping system. “You know, most [other people] think that there’s a ‘miracle crop’ that’s going to step in. I don’t think there is such a thing.” Instead, Steve advises that it is possible to build a comprehensive strategy of practices to realize long-term goals by attempting to be as realistic as possible in terms of what any one particular crop or growing practice can do.

Learn all you can and ask a lot of questions. The Camps recommend gathering as much information as possible from trusted sources to help ease the learning curve of trying something new. They also suggest that asking questions can help you clarify and advance your own thinking.

Adapt to your farm. Steve cautions that it is important to adapt what others are doing to your specific situation, rather than trying to do exactly as others do.

Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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