7 Ways Wheat Can Boost Crop Rotation

This article was written by Gil Gullickson and printed in 2015 but the facts and figures still hold true today. Although the growing conditions may be different, wheat in the rotation still provides important advantages to crops and soils.

What you need to know

- * Small grains almost always yield better following another crop than when following other small grains.
- * Rotations can control or reduce disease, insect and weed pressure.
 - * Rotations can improve soil fertility and soil structure.
 - * Rotations help manage available soil moisture.
- * Diversity in crops grown can spread out fieldwork and harvest time, as well as reduce risk.

1. Wheat can better yields of your other crops.

Data from a 2013 Dakota Lakes Research Farm rotational study at Pierre, South Dakota, showed the impact rotational diversity has on corn yields.

- * Continuous corn: 203 bushel per acre.
- * Corn-soybean: 217 bushels per acre.
- * Corn-corn-soybean-wheat-soybean: 235 bushels per acre.

A 12-year University of Illinois (U of I) study found adding wheat to a corn-soybean rotation boosted corn yields by about 10 bushels per acre and soybean yields by 3 to 5 bushels per acre, says Emerson Nafziger a U of I Extension agronomist.

Bottom-line benefit: Including wheat in a rotation can spark single-digit per acre yield increases in soybeans and double-digit increases in corn.

2. Including wheat in a corn-soybean mix can lower costs.

When Dwayne Beck managed the now defunct James Valley Research Center near Redfield, South Dakota, he helped northeastern South Dakota farmers develop diverse corn-soybean-wheat-cover crop rotations.

"Basically, the production costs for these are 50% of what a corn and soybean rotation would be," says Beck, who now manages the Dakota Lakes Research Farm." So essentially, they can grow wheat for free."

Bottom-line benefit: Diversifying a corn-soybean rotation with wheat can slice rotational production costs by one half.

3. Wheat can spark profitability . . . but not across the board.

In 2011, Thomas Zimmerman, a North Dakota State University graduate student, analyzed 16 rotations at the Conservation Cropping Systems Project (CCSP) near Foreman, North Dakota.

The winner? A spring wheat/winter wheat/corn/soybean/corn/soybean rotation. Its net return blitzed that of a corn-soybean rotation by \$20.20 per acre.

That's not the case all over, though. On prime farmland, the yield boost incurred by including wheat in a rotation doesn't cover the loss incurred by forgoing a row crop, says Nafziger.

"Unless wheat is double-cropped or if additional income is derived from straw (on high-yield farmland), wheat doesn't compete well as a cash crop with corn and soybean," says Nafziger.

Bottom-line benefit: Yield increases can spark profitability in some areas. That may not be the case, though, in prime farmland areas like central Illinois.

4. Wheat can make your corn-soybean soil healthier.

The platy soil structure incurred by a corn-soybean rotation slices soil water infiltration and strangles root uptake of nutrients and water, says Jason Miller, an NRCS agronomist based in Pierre, South Dakota.

A field in a rotational study at the Dakota Lakes Research Farm had been rotated between corn and soybeans for 20 years. After wheat followed by a cover crop cracked the rotation, irregular soil blocks replaced the soil plates. This switch increased water infiltration and enabled roots to access more nutrients and water.

"After one year, the wheat and cover crop dramatically changed the soil structure," says Miller. "The difference was unbelievable."

Bottom-line benefit: Curbing compaction through steps like these can erase the 5% to 10% yield decrease that compaction typically inflicts, says Randall Reeder, retired Ohio State University Extension agricultural engineer.

5. A diverse rotation helps manage weeds.

"You couldn't sit at a blackboard and draw up a production system more favorable to weeds than a corn-soybean rotation," says Bob Hartzler, lowa State University (ISU) Extension weed specialist. "They are two summer crops with nearly identical planting and harvesting dates. In many cases, we use the same control tactics in both crops. It's simple for weeds to beat that system."

A multi-year ISU study examined a corn-soybean rotation and showed that inclusion of these crops with small grain and legumes in three- and four-year rotations effectively suppressed weeds.

"This was despite backing off herbicides in the threeand four-year systems," says Matt Liebman, an ISU agronomist.

Bottom-line benefit: Diverse rotations can slice weed pressure and control costs. Per acre rotational herbicide costs in the ISU study were the following:

- * Corn-soybeans: \$28.18.
- * Corn-soybean-oats/red clover: \$18.17
- * Corn-soybeans-oats/alfalfa-alfalfa: \$14.09



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> www.sdwheat.org wheatinc@midco.net





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Fusarium Research Encompasses 140 Projects

The SD Wheat Commission is a member of US Wheat Associates who supports the US Wheat & Barley Scab Initiative. Each year somewhere in South Dakota we see vomitoxin which reduces our wheat yields and prices. This research helps breeders to understand Fusarium Head Blight and work to reduce it through treatment and breeding.

The U.S. Wheat & Barley Scab Initiative (USWBSI) has submitted its fiscal year 2019 Research Plan and Budget to the USDA Agricultural Research Service, totaling \$6,091,165 in scab-related funded research projects. The total includes 140 projects in 31 states, encompassing 32 land grant universities and several USDA-ARS locations.

The pie chart depicts the percentage of recommended funding broken down by research category, plus the actual amount for each category. The dollar level recommendation and number of projects per category break down as follows:

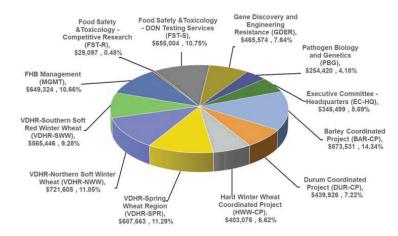
- Barley Coordinated Project \$873,531 / 14 research projects
- Durum Coordinated Project \$277,678 / nine projects
- Hard Winter Wheat Coordinated Project \$403,076 / 10 projects
- Variety Development & Host Resistance (VDHR) / Spring Wheat Region \$687,663 / 13 projects
- VDHR / Northern Winter Wheat Region \$721,605 / 24 projects (includes four multi-PI projects)
 - VDHR / Southern Winter Wheat Region \$565,446 / 12 projects
- FHB Management \$649,324 / 30 projects (includes 21 state-based integrated management trials)
 - Food Safety & Toxicology / Research \$29,097 / one project
- Food Safety & Toxicology / DON Testing Labs \$655,004 / four projects (labs)
 - Gene Discovery & Engineering Resistance \$465,574 / 13 projects
 - Pathogen Biology & Genomics \$254,420 / five projects
- Executive Committee & USWBSI Headquarters \$346,499 / five projects (includes one research project that potentially could benefit multiple CPs). Funding for USWBSI Headquarters is split into three separate projects.

Each year, the U.S. Wheat & Barley Scab Initiative is charged with developing a comprehensive research plan and budget recommendation that is aimed at achieving the Initiative's primary mission: enhancing food safety and supply by reducing the impact of Fusarium Head Blight (scab) on wheat and barley.

The process followed to develop this research plan and budget is the product of extensive deliberations overseen and approved by the USWBSI Steering Committee (SC), which is comprised of wheat and barley growers, farm organization representatives, food processors, public and private scientists and consumer groups. The USWBSI Networking and Facilitation Office

(NFO) coordinates this process in close consultation with the organization's Executive Committee (EC) and the chairs of each individual research area and coordinated project.

USWBSI'S Summary of Funding for FY2019





National Association National Association of Wheat Growers Wheat Growers Update

NAWG Submits Comments to USDA's Proposed Rule Changes to Proposed Rule on GE Plants

August 5th marked the closing of comment period for the U.S Department of Agriculture's proposed rule changes to regulations in 7 CFR part 340, "Introductions of Organisms and Products Altered or Produced Through Genetic Engineering Which are Plant Pests or Which There is Reason to Believe are Plant Pests". NAWG submitted comments to the proposed rule (Docket No. APHIS-2018-0034), and Lavon, TX wheat farmer and NAWG President Ben Scholz made the following statement:

"NAWG believes USDA APHIS is correct in its work to update and revise the current regulations and commends their effort to streamline the process. APHIS can point to its learnings from more than 20 years of documented risks to plant health within its authority related to plant pests and noxious weeds when making these rule changes.

"Modern biotechnology (transgenesis and gene editing) helps achieve an increase in food production without the need for more land area for agriculture. NAWG members believe science-based decisions should be used to develop regulatory framework, and that regulations should

not burden research investment with unnecessary costs or delays.

"In its comments, NAWG noted its highest priority concern is that any rule change contemplated by the USDA APHIS needs to consider its impact on importing countries of US produced grain. NAWG encourages USDA APHIS to develop and execute an international engagement strategy that defines USDA's rationale on pre-market regulatory approaches. All foreign customers expect the continued oversight by USDA to ensure consistent food safety, which is fundamental to their confidence in purchases of U.S. wheat.

"Further, NAWG encourages USDA APHIS to be vocal about the safety of GE technology, aiming their messaging at every opportunity to earn the trust of every U.S. consumer. Even if the technology is innovative and improves productivity, farmers will not purchase it if the marketplace will not accept it. NAWG appreciated the opportunity to provide comments on this issue of significant importance to the wheat industry."

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Education Primary Goal for SDWI

Well it rained 1 1/2 inches just before July 29th in the St. Lawrence area. That probably helped producers the time to attend the Soil Health Sit-Down at Wil-Restaurant on main street. The room was full of farmers hoping to increase their insight into profit-



able rotations which include wheat and increased organic matter. Both are a big benefit to the farm operation bottom line!

SD Wheat Inc., participated in several Soil Health Sit-Downs across the state which include Hoven, St. Lawrence and Harrisburg. Presenters such as Brian Johnson, 2019 Leopold Winner from Frankfort shared the positive outcome created by incorporating grazing of cover crops. We also heard from Jason Miller, conservation agronomist with USDA-NRCS.

Also this summer we participated with several SDSU Extension Wheat Walks/Plot Tours. Wheat breeders Karl Glover and Sunish Sehgal shared personal insight into winter and spring wheat varieties. There are some signif-

icate quality traits being demonstrated in the plots, that should be available to producers in future varieties. Jon Klienjan, SDSU Extension Crop Production Associate, hopes to be able to share the results before September.

South Dakota Wheat Incorporated makes educational opportunities a priority for its members! In addition to education at the local level, the Association provides Ag Horizons for producers. The 2019 Ag Horizons Conference will be held on December 10 & 11 at the Ramkota RiverCenter in Pierre. Six Keynote speakers and 30 plus breakout sessions offers educational opportunities for attending producers.

Ag Horizons — December 10 & 11, 2019
Pierre

Adam Varenhorst

Assistant Professor & SDSU Extension Field Crop Entomologist

Watch for True Armyworms in Wheat

Early in July we observed some true armyworm caterpillars in winter wheat fields. The caterpillars were still relatively small, which means they will continue feeding for some time. So far, the true armyworm caterpillars were still feeding on the leaves of the nearly mature wheat, but they have the potential to also clip heads off of the plants. True armyworms are migratory pests that start each season in the Southern U.S. During the northward flight, true armyworm moths are more attracted to fields that contain living ground cover (e.g., grass, weeds, early season crops). For South Dakota, the moths generally arrive during June and July. Depending on the seasonal migration and their location in South Dakota, one or two generations of true armyworms are possible.

Identification

Dark green and tan curled caterpillars with an orange stripe along their sides.

Caterpillars of the true armyworm can vary greatly in color from light brown to dark green or sometimes almost black (Figure 1). Fortunately, there are some other characteristics that can be used reliably to identify them.

True armyworm caterpillars have an orange stripe on each side of their body that runs from their head to the

end of their abdomen.

Dark green caterpillar with an orange stripe feeding on a corn leaf.

In addition, true armyworm caterpillars will have dark bands on each of their abdominal prolegs (Figure 2).

The last characteristic is the network of black lines that are present on their orange head capsule (Figure 3).

Scouting Strategy

Dark green caterpillar that has an orange head with a network of black lines.

When scouting, the entire field should be examined. If examining individual plants, the threshold is 2 caterpillars per square yard. Sometimes the caterpillars will be found at the base of the plant or on the soil near the plant.

If scouting with a sweep net, the threshold is 40 caterpillars per 30 pendulum sweeps. Remember when using a sweep net to walk in a W or Z pattern through the field.

Caterpillar feeding can reduce yields, especially if the flag leaf is removed prior to the soft dough stage.

As plants mature, fewer nutrients are available in the leaves and the caterpillars will move to the heads to either

(Continued on page 5)

(Continued from page 4)

feed on the beards (Figure 4) or cut the stem below the head.

Management Options

If thresholds of true armyworms are exceeded, please refer to the 2019 South Dakota Pest Management Guide: Wheat.

Table 1 contains a list of insecticides labeled for true armyworm management in wheat. Remember to double-check pre-harvest intervals to ensure that harvest is not greatly delayed by the insecticide being used.



Figure 1. True armyworm caterpillars can vary in color.

Courtesy: Adam Varenhorst



Figure 4. True armyworm feeding on wheat beards. Courtesy: Christopher Nelson



Figure 2. True armyworm caterpillars have an orange stripe on each side of their body and dark bands present on their abdominal prolegs. Courtesy: Adam Varenhorst



Figure 3. True armyworm caterpillars have a network of black lines present on their orange head capsule.

Courtesy: Adam Varenhorst

Additional Authors:

Amanda Bachmann, Philip Rozeboom, Patrick Wagner

rue armyworm mana	agement in wheat.*
Rate	Pre-Harvest Interval
5-18 fl oz	7 days for harvest 30 days for straw
2-20 fl oz	1 day
1.3-3.9 fl oz	14 days
1.28-4.3 fl oz	14 days
	Pate 5-18 fl oz 2-20 fl oz 1.3-3.9 fl oz

^{*}This is list is not comprehensive. Insecticides that are listed were chosen based on having pre-harvest intervals of 14 or less days.

Wheat Market Commentary

Wheat Market Overview

With the 2019 U.S. Hard Red Winter (HRW) Wheat harvest all but completed in the central and southern plains regions, the U.S. wheat market's attention turns domestically to a) 2019 Hard Red Spring (HRS) Wheat crop prospects in the northern plains states, b) U.S. Soft Red Winter (SRW) Wheat prospects in the eastern Corn Belt states, and c) White Wheat (WW) crop estimates in the Pacific Northwest and Mountain West States.

Reports from recent crop tours are for moderate-to-good yields of HRS Wheat in the Northern Plains states of North Dakota, etc. With large yields, fairly good test weights but average-to-below average protein in HRW Wheat in many western Kansas locations, it will be important to find out the protein quality of the coming 2019 HRS Wheat crop for blending and milling purposes.

Concerns have also emerged about foreign wheat production prospects among major export competitors in parts of Europe, Russia, and Australia. As a result, weekly U.S. wheat exports have been "positive" to sometimes "bullish" - especially for U.S. HRW Wheat. Also, increased feed usage of U.S. wheat is likely to occur as a result of short 2019 U.S. feed grain production - having some impact on U.S. wheat supply-demand balances (i.e., down 200+ million bushels) and prices.

Long Term HRW Wheat Futures Market Expectations in Years 2020-2022

SEPTEMBER 2019 HRW Wheat futures closed at \$4.32 compared to \$4.50 1/4 for DEC 2019 HRW Wheat. These nearer term prices compare to longer term prices of \$4.84 for "next harvest" JULY 2020 HRW Wheat, and \$5.28 1/2 - \$5.37 1/4 for JULY 2021 & JULY 2022 HRW Wheat futures. So, as of today, looking two-to-four years ahead, when the HRW Wheat market just like the Corn futures market has little to go on other than current "new crop" supply-demand and prices, HRW Wheat futures market price expectations for harvest in years 2020, 2021 and 2022 are in the range of \$0.52-\$1.05 1/4 per bushel higher than lead SEPT 2019 futures.

Compared to deferred "new crop" DEC Corn futures, on the surface these deferred "new crop" JULY HRW Wheat futures prices APPEAR to indicate market expectations of much higher prices over the next two to four years. HOWEVER, it is more likely that the accumulation of carrying charges from current to deferred futures two to four years into the future INSTEAD represent market expectations of the impact of the

Mktg Yr	World % S/U	World Crop	U.S. % S/U	U.S. S/bu	U.S. Exports
2006/07	21.6% S/U	597 mmt	22.3% S/U	\$4.87 /bu	879 mln bu
2007/08	20.9% S/U	612 mmt	13.2% S/U	\$5.70 /bu	1,291 mln bu
2008/09	26.7% S/U	685 mmt	28.7% S/U	\$7.24 /bu	1,051 mln bu
2009/10	31.4% S/U	688 mmt	48.6% S/U	\$4.87 /bu	879 mln bu
2010/11	30.4% S/U	651 mmt	36.4% S/U	\$5.70 /bu	1,291 mln bu
2011/12	28.9% S/U	699 mmt	33.4% S/U	\$7.24 /bu	1,051 mln bu
2012/13	26.1% S/U	660 mmt	29.9% S/U	\$7.77 /bu	1,012 mln bu
2013/14	28.6% S/U	717 mmt	24.2% S/U	\$6.87 /bu	1,176 mln bu
2014/15	31.8% S/U	730 mmt	37.3% S/U	\$5.99 /bu	864 mln bu
2015/16	34.3% S/U	738 mmt	50.0% S/U	\$4.89 /bu	778 mln bu
2016/17	35.7% S/U	756 mmt	53.1% S/U	\$3.89 /bu	1,051 mln bu
2017/18	37.8% S/U	762 mmt	55.5% S/U	\$4.72 /bu	906 mln bu
2018/19 ^{USD}	4 37.6% S/U	732 mmt	52.4% S/U	\$5.16/bu	936 mln bu
2019/20 ^{USD}	A 38.6% S/U	781 mmt	46.9% S/U	\$5.20 /bu	

Variable Storage Rate (VSR) mechanism upon grain futures contract prices into the future relative to the level of current lead HRW Wheat futures contracts.

In other words, it appears at this time that the price determination focus of the HRW wheat futures complex is set upon the lead SEPTEMBER 2019 HRW Wheat futures contract, with anticipated carrying charges between deferred contract s affecting relative price levels in an accumulative manner off into future months — and in this case — year's. This phenomena in HRW Wheat futures DOES present forward pricing opportunities for seller hedgers in future time periods should they choose to bear the risk and uncertainty of such deferred pricing strategies.

HRW Wheat Managed Money (Spec) & Commercial Trader Positions

The relatively more positive although still "bearish" net position of the HRW Wheat futures market is shown in futures trade positions during June-July 2019. As reported by Commodity Futures Trading Commission (CFTC) trader position data, for the week ending July 23, 2019 Managed Money (Spec) traders held an aggregate "short" or "sell" position that has declined to 345 million bushels (mb), based on 68,930 contracts @ 5,000 bu/contract. This is down from a record bearish short position since at least June 2006 on the week ending April 30, 2019 at 117,242 contracts (586 mb).

There were also "long" or "buy" positions of 240 mb from 48,086 contacts for Managed Money (Specs) for the week ending 7/23/2019. When combined, there was a "net short" managed money position of 104mb in HRW Wheat futures for the week ending July 23, 2019 — the most recent available public record of trading data. This is a more positive position in the HRW Wheat futures market than the record "net short" managed money position that occurred for the week ending May 7, 2019 with 299m in HRW Wheat futures "net short".

Also of note, as of the week ending July 23rd, Commercial Traders in HRW Wheat futures had an aggregate short or "sell" position of 98,148 contracts (491mb), combined with a long or "buy" position of 71,615 contracts (358mb). The record large short or "sell" position for HRW Wheat futures since mid-year 2006 of 172,992 contracts (865mb) occurred on the week ending July 11, 2017. The record large NET short amount of commercial positions (652mb) was recorded for the week ending July 18, 2017 - again during the later part of harvest two years ago. It appears the current HRW Wheat futures market supply-demand and price situation in "new crop" MY 2019/20 is an improvement from two years ago in MY 2017/18, with only "moderate" harvest time "bearishness" occurring compared to selected years in the past.



Dan O'Brien will be our keynote speaker on Tuesday, December 10th at 1:00 pm

Join us as we Grow Our Future!

6 South Dakota Wheat, Inc.

West River Field School was held at the West River Research Farm on July 16

The West River Research Farm is comprised of 111 acres located northwest of Sturgis. The farm was acquired by South Dakota State University in 2018. It focuses on agronomic and livestock research for conditions similar to those in western South Dakota. Researchers perform grazing, cover crop and variety trials. SDSU's statewide network of weather stations, called the Mesonet at SDSU, has a weather station located at the West River Research Farm.



7 Ways Wheat Can Boost Crop Rotation (Continued from page 1)

6. A rotation-cover crop combo can boost marginal farmland soil quality.

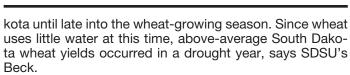
"When land rents started going up in my area, it got harder to expand," says Nigg. "I have marginal ground that is not good corn ground. I got to thinking that I could take this marginal ground and push it with wheat."

By itself, wheat can help boost yields and profits by increasing soil tilth and water infiltration. Cover crops double soil health efforts and also have perks like breaking compaction and adding soil carbon to boost organic matter. Even on sandy soils, Niggís organic matter tallies an lowa-like 5%.

Bottom-line benefit: "A 1% increase in organic matter will boost water infiltration 0.4 inches," says NRCS's Miller. "A 1% increase is a \$24-per-acre value in increased nutrients and infiltration."

7. Diversifying a rotation can reduce weather risk.

The 2012 drought didn't fully form in most of South Da-



Not so with corn. At tasseling, corn can consume up to .33 inches of rain daily. In 2012, the steadily accelerating drought hit corn during this peak time and pummeled yields.

Bottom-line benefit: Spiking a row-crop rotation with wheat can lessen weather risk of a corn-heavy rotation. Severe stress can slice corn yields 8% per day during silking and pollen shed, says Bob Nielsen, Purdue Extension agronomist.

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With six field stations and more than 17,000 acres of land across the state devoted to scientific exploration, the South Dakota Agricultural Experiment Station is the largest public and privately funded research organization in the state. Since 1887, we have used science to find solutions to pressing problems and identify new opportunities for our state.

For more information on the Agricultural Experiment Station and its research, contact us or check out SDSU's Open PRAIRIE:

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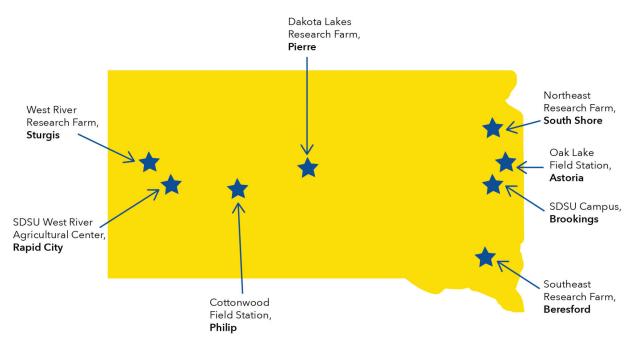
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SDSU Open PRAIRIE- Public Research Access Institutional Repository and Information Exchange

Open PRAIRIE is the South Dakota State University public access institutional repository (IR). The IR supports the strategic mission of the library, the institution, and the University's status as a land-grant institution. The repository

allows public access to information, resources, and the scholarly and creative output of the University. The repository provides permanent storage of institutional materials and a peer-reviewed publishing platform for faculty and student research.

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