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N E W S L E T T E R

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CROP ROTATION NET RETURNS AND WATER QUALITY IN THE CHENEY LAKE WATERSHED

This article will examine the tradeoff between crop rotation net returns, downside risk, and water quality in the Cheney Lake Watershed. Improving water quality typically involves switching to crop rotations that may have a lower net return to land and management per acre or incur additional downside risk. Given these possibilities, it is important to examine the tradeoffs between net return, downside risk, and water quality. The focus of this article is on the Red Rock Creek sub-watershed (see map below).

Ten different crop rotations were examined in this study. Crop rotations examined included a continuous wheat rotation under conventional and conservation tillage production systems; a wheat/grain sorghum/soybean rotation under conventional, conservation, and no-till production systems; a wheat/wheat/grain sorghum/grain sorghum rotation under conventional and no-till production systems; a corn/soybean rotation under conventional and no-till production systems; and an alfalfa/wheat rotation under a conservation tillage production system. The wheat/wheat/grain sorghum/grain sorghum crop rotations generate four crops in three years. The other crop rotations generate one crop per year. Abbreviations for the crop rotations can be found in Table 1.

Water quality variables examined in this study included sediment yield and total phosphorus.

Sediment yield measures eroded sediment that is transported to a stream, and total phosphorus measures organic, mineral, and soluble phosphorus transported to a stream. The tillage operations along with region specific data were incorporated into the SWAT model to obtain crop yields and water quality information for each crop rotation. To facilitate comparisons among crop rotations and water quality parameters, the values of the two water quality variables were assigned a value of 1.000 for the base rotation, continuous wheat production under a conventional tillage production system. Simulation data for several soils common in the Red Rock Creek sub-watershed were generated. This article presents the results for the most common soil, Nalim loam with a 0 to 1 percent slope. Approximately 18 percent of the sub-watershed is comprised of this soil.

The yield data from the SWAT model, cost estimates, and forecasted prices were used to develop a budget for each crop and crop rotation. These budgets provided the net return to land and management data used in the risk model described below.

A risk model was developed to study the tradeoff between net return to land and management, downside risk, and water quality. This model maximizes net return per acre subject to downside risk and water quality constraints. Reductions in downside risk and improvements in water quality were examined by relaxing these constraints. Downside risk is represented by total deviations below a $60 per acre target net return.

Before examining the optimal solutions derived from the risk model, it is useful to compare net return to land and management, downside risk, and water quality results for each crop rotation. Table 2 provides this information for each crop rotation. A lower water quality index is preferred to a higher index. In other words, lowering one or more of the water quality indices represents an improvement in water quality. In general, as tillage is reduced, the net return to land and management increases, downside risk is reduced, and water quality is improved. In particular note that the W-RT, WGS-NT, WWGG-NT, CS-NT, and AW rotations have lower sediment yield and total phosphorus indices than the base rotation, W-CT. The AW rotation had the highest net return and lowest level of downside risk. However, it is important to note that alfalfa is expensive to transport, so its market is more localized. For this reason, the risk model results below exclude this crop rotation.

Table 3 presents the optimal solutions generated with the risk model. Two solutions are illustrated, a profit maximizing solution and a low risk solution. The low risk solution has a net return that is 3.6 percent lower than that of the profit maximizing solution. However, downside risk is reduced substantially for this solution. The relatively large reduction in downside risk is related to the negative correlation (-0.070) between the W-RT and WGS-NT rotations. It is important to also note that the indices for sediment yield and total phosphorus were slightly higher for the low risk solution. These results illustrate how difficult it is to find a crop rotation with high net returns, a low level of downside risk, and good water quality characteristics.

In addition to examining optimal risk model solutions, crop rotation mixes associated with a 10 percent reduction in sediment yield and a 10 percent reduction in total phosphorus were compared to the profit maximizing solution. These results are illustrated in Table 4. Reducing sediment yield by 10 percent resulted in a 3.4 percent reduction in net return and a 12.4 percent reduction in downside risk. The crop rotation mix consisted of the W-RT and WWGG-NT rotations. Reducing total phosphorus by 10 percent resulted in a 5.7 percent reduction in net return and a 19.1 percent reduction in downside risk. The crop rotation mix again consisted of the W-RT and WWGG-NT rotations.

In summary, improving water quality in this study was possible by utilizing an alfalfa/wheat rotation or by reducing tillage. Downside risk was reduced by shifting some of the acreage away from continuous wheat to a wheat/grain sorghum/soybean rotation or a wheat/wheat/grain sorghum/grain sorghum rotation. More detail related to this study as well as information for other soils will be posted to Ag Manager in the near future.

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Cheney Lake Watershed

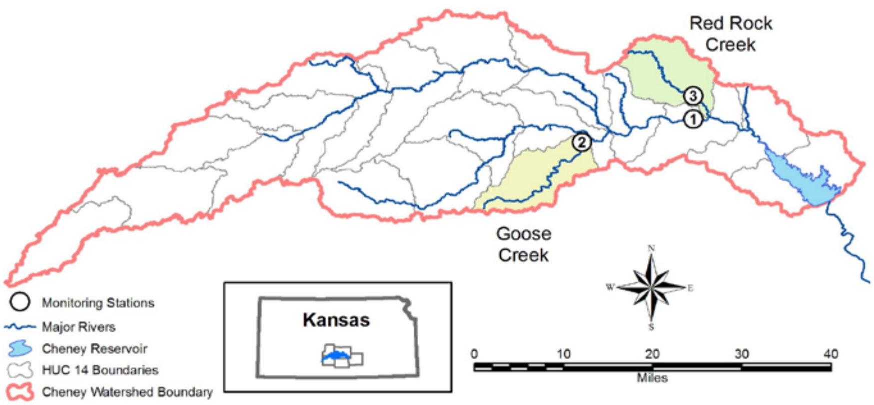

Table 1. Crop Rotations for South Central Kansas.

Abbreviation	Crop Rotation
W-CT	Continuous Winter Wheat, Conventional Tillage
W-RT	Continuous Winter Wheat, Reduced Tillage
WGS-CT	Wheat/Grain Sorghum/Soybean, Conventional Tillage
WGS-RT	Wheat/Grain Sorghum/Soybean, Reduced Tillage
WGS-NT	Wheat/Grain Sorghum/Soybean, No-Till
WWGG-CT	Wheat/Wheat/Grain Sorghum/Grain Sorghum, Conventional Tillage
WWGG-NT	Wheat/Wheat/Grain Sorghum/Grain Sorghum, No-Till
CS-CT	Corn/Soybean, Conventional Tillage
CS-NT	Corn/Soybean, No-Till
AW	Alfalfa/Wheat

Table 2. Net Return, Risk, and Water Quality Information for Each Crop Rotation.

Crop Rotation	Net Return	Risk	Sediment Yield	Total P
W-CT	$92.39	107.56	1.000	1.000
W-RT	$107.75	43.65	0.403	0.433
WGS-CT	$72.16	281.99	2.273	2.085
WGS-RT	$84.22	177.41	1.167	1.150
WGS-NT	$95.11	89.35	0.522	0.655
WWGG-CT	$65.22	218.00	1.061	1.144
WWGG-NT	$83.90	72.70	0.143	0.265
CS-CT	$25.86	910.59	1.841	1.769
CS-NT	$70.52	487.81	0.278	0.537
AW	$177.60	0.00	0.106	0.120

Table 3. Risk Model Results.

Item	Profit Maximum	Low Risk
Net Return to Land and Management	$107.75	$103.82
Total Negative Deviations	43.65	0.00
Sediment Yield (SY)	0.403	0.440
Total Phosphorus (TP)	0.433	0.502
W-RT	1.000	0.689
WGS-NT	0.000	0.311

Table 4. Water Quality Improvement Results.

Item	10% ↓ SY Index	10% ↓ TP Index
Net Return to Land and Management	$104.08	$101.64
Total Negative Deviations	38.22	35.31
Sediment Yield (SY)	0.363	0.336
Total Phosphorus (TP)	0.407	0.390
W-RT	0.846	0.744
WWGG-NT	0.154	0.256

RECOMMENDATIONS FOR FURTHER READING

The purpose of this section of the newsletter is to briefly discuss articles and web sites that may be of interest to readers. In general, the articles discussed will not report on original research. Rather, the articles will contain citations to web sites and articles that discuss topics of general interest.

Kevin Dhuyvetter recently posted a paper to Ag Manager pertaining to projected rental rates for 2011. The paper contains projected average short season and full season lease rates for bluestem pasture for 2011 as well as actual lease rates from the *Bluestem Pasture Release* published by the Kansas Department of Agriculture Statistics Division from 2005 to 2009, and projected rates for 2010. Kevin notes that there are three factors that explain much of the variability in average rental rates: rates tend to trend up over time, rates are positively related to cattle prices, and rates are positively related to corn prices. In general, the 2011 rates are expected to be 6 to 10 percent higher than the 2010 rates.

Dillon Feuz, an economist with Utah State University, has recently written an article on his cattle marketing web site (www.cattlemarketanalysis.org) entitled "Economic Forces Now Favor Yearlings" that pertains to the economics of backgrounding. As the price of corn has increased, feeders are looking for ways to add weight before cattle enter finishing lots. He notes that the cheapest way to typically add this weight is through winter pasture grazing, wheat pasture, feed grain stalks, and summer pasture grazing. The whole point of the short article is to point out the importance of carefully evaluating your feeding options. In particular, carefully evaluate whether it is cheaper to add weight in a backgrounding or grazing program before placing cattle in a finishing lot.

With all of the discussion of state and fiscal debt problems, it is easy to get the impression that most of the news is negative. However, as noted by Laurence Chandy and Geoffrey Gertz at the Brookings Institution in a recent article entitled "Missing Poverty's New Reality", global poverty has lessened over the last 5 years. The authors estimate that between 2005 and 2010 nearly half a billion people escaped extreme hardship as the total number of the world's poor fell to 878 million people. As the authors indicate, never before in history have so many people been lifted out of poverty is such a short period. Emerging markets and growth lie at the heart of poverty reduction. India and China, in particular, have made great strides in terms of reducing poverty in their respective countries. For those wanting additional information, I have posted a report entitled "Poverty in Numbers" to my contributor site under "Recommendations for Further Reading".

William Gale, a senior fellow at the Brookings Institution, recently wrote an article entitled "What Will It Take to Reform the Tax System". As he indicates in the article, reforming the system involves two issues: the structure of taxes and level of revenue. Structural adjustments may involve broadening the tax base by reducing the use of tax expenditures such as the mortgage interest deduction, and the taxation of nonrenewable energy use. As the author notes, it also important to try to align revenues with spending levels. The author asks and subsequently answers the following question: why is reform so hard? Reform is difficult because taxes are built into everything business and individuals do. Reform creates winners and losers. The losers oppose reform and often demand relief as a new system is adopted.

The Ag Manager web site contains a multitude of information on leasing land including land rental rates, lease forms, and decision tools that can be used to investigate cash and share rental arrangements. To access this information, click on "Farm Management" on the main Ag Manager web page and then "Leasing".

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The Kansas Farm Management Association (KFMA) Newsletter is distributed monthly to provide farm management information to farm decision makers. Further farm management information can be found on the KFMA program website: www.agmanager.info/kfma; and, on the Extension Agricultural Economics website: www.agmanager.info. The Newsletter is edited by Michael Langemeier, Professor, Department of Agricultural Economics, Kansas State University.

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