# THE IMPACT OF EQIP-FUNDED AGRICULTURAL CONSERVATION PRACTICES ON WATER QUALITY IN COLORADO

## REPUBLICAN, SOUTH PLATTE, ARKANSAS, AND RIO GRANDE WATERSHEDS

SEPTEMBER 2020

Prepared by the One Water Solutions Institute and Colorado State University

ONE WATER SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

*Photo: NRCS, 2020*

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# ACKNOWLEDGEMENTS

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# SUMMARY

Water quality degradation is one of the world's most pressing environmental concerns. The implementation of Colorado Regulation 85 (5 CCR 1002-85) in 2012 has led to increased awareness of the potential water quality impacts of agricultural and other nonpoint sources of pollution. The use of agricultural conservation practices is widely accepted as a means of reducing nonpoint source pollution from agricultural runoff. Research shows that agricultural conservation practices can abate sediment, pesticide, salt, and nutrient losses from fields and livestock operations.

The Natural Resources Conservation Service (NRCS) implemented the Environmental Quality Incentives Program (EQIP) under the 1996 Farm Bill to assist producers with applying sustainable on-farm conservation practices. However, there has been no research to quantify the progress on water quality protection resulting from the application of EQIP-funded practices in Colorado.

Water quality models have become increasingly relevant in determining watershed-level characteristics related to environmental concerns. The effects of agricultural practices on water quality have been heavily studied using water quality modeling and assessment. Many types of water quality models and techniques have been used to evaluate nutrient transport into water bodies. The Soil and Water Assessment Tool (SWAT) model has been a prevailing water quality model in many research studies. SWAT simulates surface, subsurface, and shallow groundwater hydrologic processes and has the ability to model erosion and transport of sediment, nutrients, pesticides, and even bacteria. The model also simulates specific farming practices and their corresponding effects, including erosion, runoff, and edge-of-field losses.

In this analysis, SWAT simulation quantified the effects of specific EQIP-funded agricultural conservation practices on field runoff in the Republican, South Platte, Arkansas, and Rio Grande watersheds of Colorado. Practices included in this analysis were different levels of tillage, irrigation systems, and establishment of a conservation buffer. Edge-of-field discharges of nitrogen and phosphorus were modeled before and after EQIP conservation practices were implemented. The modeling included EQIP conservation practices applied between 2008 and 2018 and incorporated existing Colorado State University (CSU) edge-of-field water quality data, providing a means of calibrating the model to realistic and attainable results.

Results showed the most significant county level average annual percent reductions in Total Nitrogen (TN) came from counties with high adoption of EQIP-funded irrigation practices, such as sprinkler or drip irrigation. On average, these counties yielded a 7.1% reduction in TN per county, which equates to 6.8 tons of TN reduced across all four watersheds. The combined reductions in TN from all EQIP-funded practices averaged 8.2% per county, which totaled approximately 19.5 tons reduced across all four watersheds over the full ten-year period of analysis. The greatest reductions in Total Phosphorus (TP) were observed in counties with high adoption rates of irrigation system upgrades, which yielded an average 33.5% reduction in TP per county. The implementation of all EQIP-funded practices produced a 27.7% average reduction in TP per county across all counties considered. This was equivalent to a TP reduction of 291 tons across all four watersheds throughout

the full ten-year period of analysis. The findings indicate the modeled EQIP conservation practices are significantly reducing nutrient losses from irrigated agricultural lands.



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# CHAPTER 1: INTRODUCTION

## BACKGROUND

Water quality degradation by all sectors is one of the world's most pressing environmental concerns. Both point and nonpoint sources of pollution contribute to the adverse effects of excess nutrients within water bodies, but as point sources become further regulated, nonpoint source pollution has come under greater scrutiny. The agriculture industry is considered to be a significant contributor of nonpoint source pollution. However, agricultural producers have also been at the forefront of environmental conservation efforts in order to maintain their natural resources both for sustainable agricultural production and a healthier environment. Despite these efforts, there is still tremendous pressure on the agricultural industry to reduce its contribution of diffuse pollution to water bodies.

The implementation of Colorado Regulation 85 in 2012 led to increased awareness of nonpoint source pollution to water bodies from the agriculture sector. The Colorado Department of Public Health and Environment (CDPHE) established Regulation 85 to control nutrient discharges to surface waters. Regulation 85 provides more stringent regulation of point sources while promoting voluntary implementation of best management practices (BMPs) to reduce nonpoint source pollution in agriculture. If the Water Quality Control Commission (WQCC) deems these voluntary measures inadequate in reducing nutrient losses to Colorado water bodies, it may adopt regulatory controls as early as 2022 (CSU-Extension, 2019).

Agricultural conservation practices have been widely accepted as a means of preventing and reducing nonpoint source pollution from agricultural runoff. The United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS) initiated the Environmental Quality Incentives Program (EQIP) under the 1996 Farm Bill to assist producers with applying sustainable on-farm conservation practices. The goal of the program is to provide financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits, including improved water quality. NRCS-administered EQIP is one of the country's largest voluntary programs. Colorado agricultural producers have participated in EQIP and other Farm Bill programs for decades to address water quality and soil health concerns. More than 164 conservation practices are available for adoption through the program, ranging from forest and wetlands restoration to conservation cover and nutrient management, and all are eligible for EQIP program funds (USDA- NRCS, 2019a). Conservation Practice Standards are written to be independent of any program, whether it be EQIP, Conservation Technical Assistance (CTA), the Conservation Stewardship Program (CSP), or others, and they set forth the minimum quality criteria that must be met during the application of that practice in order to achieve its intended purpose(s). These Conservation Practice Standards are used in the EQIP program, and the USDA NRCS tracks each EQIP-funded project by specific practice applied, the location and number of acres treated, the cost, and the year each practice was applied (USDA NRCS, 2019b).

Research has shown that agricultural conservation practices can have positive effects on nutrient abatement. Vedachalam, Cassell, and Heath (2019) evaluated the effects of conservation programs on six watersheds in Iowa, Illinois, and Wisconsin based on various practices and levels of implementation and found that nutrient reductions could range from 3-6% based on current practices in use, to nearly 55-66% reductions with full implementation of conservation practices. McLellan et al. (2015) found nutrient reductions within the range of 7.5% to 17.5%, depending on the level of conservation practice implementation during a similar study in the Corn Belt region. Some research has led to findings that reductions can be more effective if conservation practices are targeted to higher-risk areas. Kalcic et al. (2015) found that total nutrient reductions could be as high as 60%, with nitrogen reductions in the range of 20 to 30%, and phosphorus reductions of nearly 70%, if spatial optimization of conservation practice implementation was used. While these values are quite promising, this research study was conducted in west-central Indiana on mainly tile-drained watersheds, which is a very different agricultural system than those commonly found in Colorado. Other research has focused on the effectiveness of agricultural conservation practices in areas from Massachusetts to the Great Lakes, Mississippi River Basin, and the Gulf of Mexico, highlighting the range of possible reductions based on location and level of practice implementation (Wong et al., 2018; Baker et al., 2018; Liu et al., 2017; Rittenburg et al., 2015; Dodd & Sharpley, 2015; Ribaudo et al., 2017; Cullum et al., 2010; Chaubey et al., 2010). While all of these studies show promising effects of conservation practices, it is important to note that there is virtually no research available for the type of systems and climate regimes found in Colorado, so any comparisons to these previous findings should be taken as simple approximations of potential upper and lower bounds of the results rather than the goal for the modeled results in this analysis.

Research has been conducted on the effectiveness of BMP implementation in other areas of the country (Denny et al., 2019; Christianson et al., 2018; Formica et al., 2018; Reimer, Denny, & Stuart, 2018; Marshall et al., 2018; Jacquemin et al., 2018; Her et al., 2016; Helling et al., 2015), but the available literature documenting the effects of the EQIP program on water quality in Colorado are limited. The impacts of agricultural conservation practices are often not immediately evident or visible due to lag times between practice implementation and environmental response, and it can take multiple years for that progress to be realized (Daniels et al., 2018). Heightened awareness of nonpoint source pollution from the agriculture sector resulting from Regulation 85 increases the priority to quantify the effectiveness of agricultural conservation practices on nonpoint source pollution in Colorado watersheds.

Farmers, technical service providers, stakeholders, and program and policy agencies increasingly rely on water quality models for assessing characteristics of several environmental concerns at different scales. These models simulate the effects of various scenarios in a system based on physical environmental processes. While the use of observed monitoring data to assess the effects of conservation practices would be ideal, it is often expensive and resource-intensive, and it is nearly impossible to collect such detailed data at a statewide scale. Therefore, simulation models provide widely applicable and effective methods of estimating actual effects at the watershed level. Models facilitate the assessment of various scenarios based on monitoring data and actual experiments, as well as providing a means of determining potential outcomes of simulated

scenarios at various spatial and temporal scales. They have the ability to estimate outcomes of various scenarios that cannot be feasibly determined using observed data or actual experiments.

The effects of agricultural practices on water quality have been heavily studied using water quality modeling and assessment (Marshall et al., 2018; Liu et al., 2017). Some of the most impactful and long-term studies include the National Conservation Effect Assessment Program (CEAP) Cropland Studies. These studies used the Soil and Water Assessment Tool (SWAT), Agricultural Policy/Environmental eXtender Model (APEX) and the Environmental Policy Integrated Climate (EPIC) models to assess the impacts that applied conservation practices had on their landscapes and to determine the potential effects that additional conservation practices could have if implemented on high-risk land areas. These studies were completed for the major river basins across the country, including the Upper Mississippi River Basin, the Chesapeake Bay region, the Great Lakes system, and the Arkansas-White-Red Basin (Tomer et al., 2014). Thirteen of the fourteen benchmark watersheds in the CEAP Cropland Studies program are predominantly non-irrigated, so the scale of the effects in these watersheds may be different from the predominantly irrigated agricultural fields in the semi-arid climate of Colorado. There is still a need to evaluate the effects of the EQIP-funded practices on agricultural pollution to water bodies in this region.

Many types of water quality models and techniques have been used to evaluate the effects of agricultural nutrient pollution in water bodies (Delgado et al., 2019; Pokhrel & Paudel, 2019; Jabbar & Grote, 2018; Fales et al., 2016; Dodd & Sharpley, 2015; Cai et al., 2018; García et al., 2016). The Water Quality Analysis Simulation Program (WASP)(Mbuh, Mbih, & Wendi, 2019), the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model (Leanard, Knisel, & Still, 1987), the National Agricultural Pesticide Risk Analysis (NAPRA) model (Thomas et al., 2007), the SPAtially Referenced Regression On Watershed attributes (SPARROW) model and decision support system (McLellan et al., 2015), the Annualized Agricultural Non-Point Source (AnnAGNPS) model, (Abdelwahab et al., 2018; Xie et al., 2015), and others have been effectively used to evaluate nutrient reductions from agricultural practices.

This study focuses on the Soil and Water Assessment Tool (SWAT) model that has been a prevailing water quality model in many research studies. The SWAT model was developed in Temple, Texas, in 1992 by J.G. Arnold at the USDA. Since its creation, it has been continuously reviewed and improved to expand its modeling capabilities (Williams, et al., 2010). The SWAT model is one of the most widely used watershed- and river basin- scale models in the world with nearly 30 years of development and improvement. It is highly flexible for application to various water resource concerns and can be applied to a large range of hydrologic and environmental regions and issues. It has extensive documentation and online support, and its comprehensive nature and open access source code make SWAT widely accepted for application to a variety of regions and water resource concerns (Gassman, et al., 2014).

SWAT has been predominantly used to quantify the effects of agricultural practices on nonpoint source pollution in water bodies (Mittelstet et al., 2016; Krysanova & White, 2015; Engebretsen et al., 2019; Rittenburg, et al., 2015; Rundhaug et al., 2018; Scavia et al., 2017). Kalcic et al. (2015) studied the spatial optimization of six different conservation practices using the SWAT model and

found total nutrient reductions of nearly 60%. Giri et al. (2016) used SWAT to study the effects of targeting critical source areas as potential areas for conservation practice implementation. Mostofa Amin et al. (2016) simulated nonpoint source pollution and hydrologic processes using SWAT and found that the model results were within observed values. SWAT is also a prominent model used internationally. Briak et al. (2019) used SWAT to determine the effects of agricultural BMPs North of Morrocco, and Abdelwahab et al. (2018) modeled soil erosion using SWAT in southern Italy. The widespread use and continued improvement and calibration of the SWAT model ensures the accuracy and robustness of the model for evaluating nutrient pollution effects from agricultural conservation practices across many regions and climates.

SWAT simulates surface, subsurface, and shallow groundwater hydrologic processes, water balance, crop growth, as well as erosion, sedimentation, nutrient loss, pesticide loss, and pathogen loss from agricultural areas. The model can be configured to process soil, climate, and cropping system inputs to compute these effects at the field scale. In particular, SWAT uses sophisticated routines for agricultural management practices regarding fertilizer and manure applications, and tillage practices to simulate specific farming practices and their effects. SWAT, developed by the USDA Agricultural Research Service (USDA-ARS), extended and enhanced through collaborations with universities and research organizations world-wide, provides demonstrated applicability and accuracy across a wide range of environments (Liu et al., 2019a; Liu et al., 2019b; Himanshu et al., 2019; Karki et al., 2019; Merriman et al., 2018; Teshager et al., 2016; Muenich et al., 2016; Wardropper et al., 2015). SWAT's widespread use by program agencies (such as NRCS and EPA), and continuous improvement by research collaborators, makes the model desirable for assessing conservation effects in Colorado.

This analysis used the SWAT model integrated in the Edge of Field Conservation Planning (EoFCP) Tool, a web application in the Environmental Resource Assessment and Management System (eRAMS). Underlying eRAMS, the Cloud Services Integration Platform (CSIP) efficiently runs large batch model simulations, returning results to be processed, displayed, and reported through eRAMS geospatial capabilities. EoFCP, eRAMS, and CSIP are hosted by the CSU One Water Solutions Institute (OWSI). The EoFCP tool integrates the SWAT model with other agricultural models including the Colorado Nitrogen Leaching Index Risk Assessment, Version 3 (2012), the Colorado Phosphorus Index Risk Assessment, Version 5 (2012), the Water Irrigation Scheduler for Efficiency (WISE), and the Land Use and Agricultural Management Practice Service (LAMPS) tools, among other technologies. The integration of these components into a geospatial application allows for better processing time of large amounts of data and a comprehensive edge-of-field analysis.

The EoFCP tool provides a means of modeling the impacts of conservation practices on crop yield and water quality, among other impacts. Practices for input into the EoFCP tool range from nutrient and irrigation management to tillage conservation and crop rotations, and it provides the ability to map specific fields to capture site-specific characteristics that may influence nutrient movement and water quality (CSU, 2019b). EoFCP and the aforementioned integrated tools were used to quantify the effects of specific EQIP-funded agricultural conservation practices on water quality in the Republican, South Platte, Arkansas, and Rio Grande watersheds of Colorado.

## GOALS AND OBJECTIVES

The goal of this analysis is to quantify the effects and potential benefits of EQIP-funded agricultural conservation practices on nutrient losses from irrigated agricultural fields in Colorado using existing NRCS-EQIP conservation practice data and the SWAT model through the EoFCP tool.

The objectives are to (i) assess the effects of agricultural conservation practices on edge-of-field discharges of nitrogen and phosphorus in the Republican, South Platte, Arkansas, and Rio Grande watersheds over the period of 2008-2018; and (ii) report findings and conclusions to the WQCC and to the public to demonstrate and promote the progress of agriculture in protecting water resources.

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# CHAPTER 2: STUDY WATERSHEDS

The state of Colorado is in the semi-arid western region of the United States. The Rocky Mountains cut through the west-central part of the state, with the San Juan Mountains and San Luis Valley to the south and the Great Plains occupying the eastern part of the state. The Great Plains area contains most of the agricultural land, with significant acreage also cultivated in the San Luis Valley. This analysis will focus on modeling irrigated agricultural land in four separate watersheds: Republican, South Platte, Arkansas, and Rio Grande, particularly the portions of these watersheds within the state of Colorado. The four watersheds combined represent 72% of the irrigated cropland in the state and have been assigned into three separate divisions, with the Republican and South Platte watersheds making up Division (Div.) 1, the Arkansas watershed as Div. 2, and the Rio Grande watershed in the San Luis Valley as Div. 3.

The Div. 1 Republican and South Platte Watersheds (HUC's 1025 and 1019, respectively) are in the northeastern part of the state and make up 28% of Colorado's irrigated cropland. The Div. 2 Arkansas Watershed (HUC 1102) in the southeastern region accounts for 26% of the state's cropland, and the Div. 3 Rio Grande Watershed (HUC 1301) in the south-central part of the state represents 18% of Colorado's irrigated cropland.

Figure 1 below shows the location of each division within Colorado, and Figure 2 shows the total number of agricultural acres and the total number of EQIP-funded agricultural acres between 2008 and 2018 in each division, by county. The counties that make up Div. 1 include Adams, Arapahoe, Boulder, Broomfield, Chaffee, Cheyenne, Clear Creek, Denver, Douglas, El Paso, Elbert, Gilpin, Grand, Jefferson, Kit Carson, Lake, Larimer, Lincoln, Logan, Morgan, Park, Phillips, Sedgwick, Summit, Teller, Washington, Weld, and Yuma counties. Div. 1 consists of a total of 28,093 square miles. Div. 2 is occupied by the counties of Alamosa, Baca, Bent, Chaffee, Cheyenne, Costilla, Crowley, Custer, Douglas, El Paso, Elbert, Fremont, Huerfano, Kiowa, Kit Carson, Lake, Las Animas, Lincoln, Otero, Park, Prowers, Pueblo, Saguache, and Teller. Div. 2 is roughly 28,274 square miles. The Rio Grande Watershed (Div. 3) covers a total of 7,545 square miles and consists of the counties of Alamosa, Archuleta, Chaffee, Conejos, Costilla, Custer, Fremont, Hinsdale, Huerfano, Mineral, Rio Grande, Saguache, and San Juan.

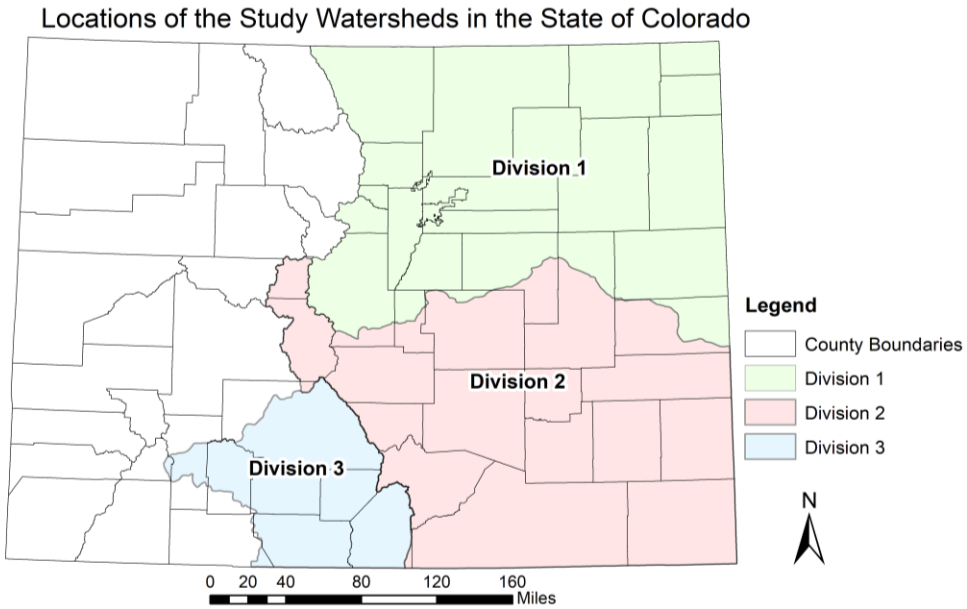


*Figure 1. Locations of the study watersheds by Division within the state of Colorado.*

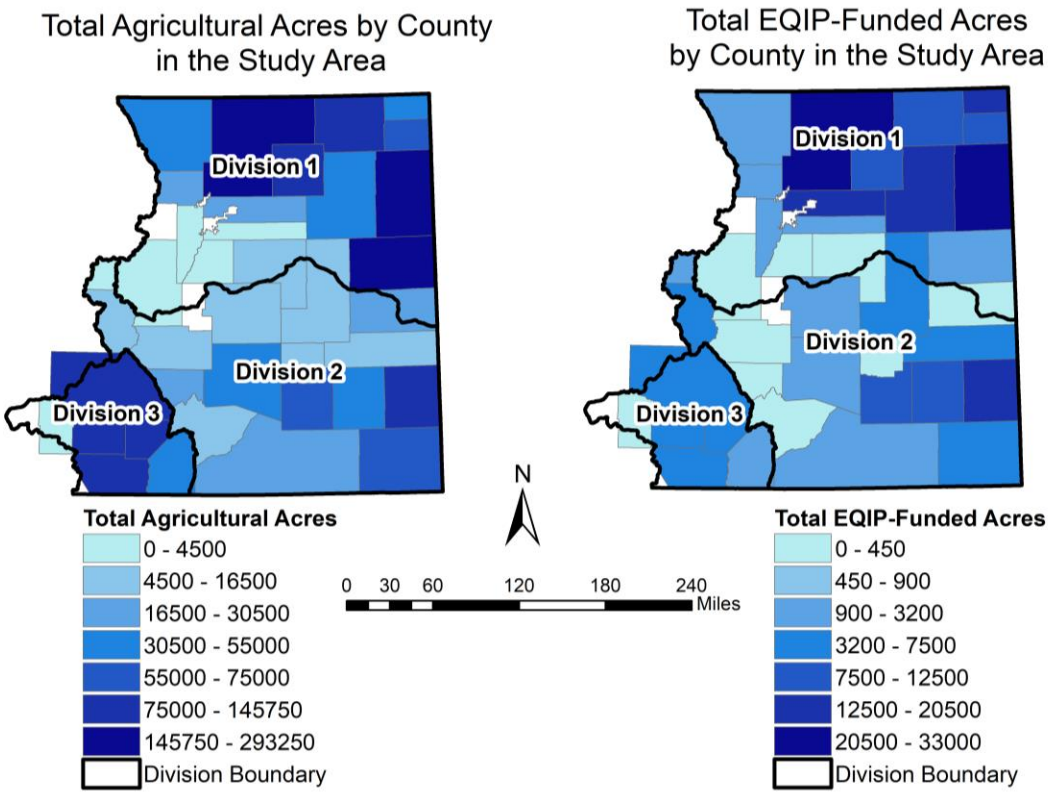


*Figure 2. shows the amount of acres of total agricultural land in each division (2018) of the study area (left) and the total amount of agricultural acres that are funded by the EQIP program (2008-2018) in this analysis (right).*

## 2.1. LOCAL CLIMATE

The study watersheds are broadly classified as having semi-arid climates. The average annual maximum temperature for the years 1981 to 2010 in Div. 1 was 61.6 °F, and the average annual minimum temperature was in the range of 33 °F. Div. 2 generally yields average annual maximum temperatures of 64.3 °F, with average annual minimum temperatures near 34.5 °F. In Div. 3, average annual maximum temperatures can reach 54 °F, and the average annual minimum temperatures can fall to 24.6 °F. However, because they are mid-continent, the watersheds may experience prolonged heat and cold extremes in any year.

Average annual precipitation in Div. 1 is around 17.5 inches, with average precipitation depths of 0 to 4 inches in January and 1 to 4 inches in July. The average annual precipitation in Div. 2 is 16.5 inches, with an average of 0 to 3 inches in January and an average of 1 to 5 inches in July. Div. 3 average annual precipitation is 19.8 inches, with an average depth of 0 to 6 inches in January and 1 to 4 inches in July. However, this does not reflect the precipitation gradient in the San Luis Valley of the Rio Grande, declining dramatically from west to east (PRISM, 2019). This study evaluates mainly irrigated agricultural lands, so precipitation has the greatest effect on edge-of-field runoff during extreme weather events and when considering irrigation water management.

## 2.2 LAND USE AND COVER

Figure 3 shows the distribution of land cover across the study watersheds evaluated in this analysis (NLCD, 2016). The western portions of each of the watersheds are dominated by the Rocky Mountains, are mostly (herbaceous) mountain rangeland and evergreen forest. The Rio Grande watershed in the southwestern portion of the map shows predominantly cultivated crops within the San Luis Valley.

The land use in Div. 1 is dominated by (herbaceous) rangeland (42.7%) and cultivated crops (31.5%), with evergreen forest making up 11.7% of the land area, followed by 3.6% consisting of shrub or scrub rangeland, and 3.2% of the land area consisting of developed open space. Developed land (low intensity) is roughly 1.5% of the land area, with medium and high intensity developed land areas making up only fractions of a percent. Hay and pastureland make up about 1.1% of the land area, with the remaining land area consisting of woody and emergent herbaceous wetlands, deciduous forest, open water, and barren land (NLCD, 2016).

Div. 2 is dominated by herbaceous rangeland (58.6%) followed by shrub or scrub rangeland (11.8%), evergreen forest (11.7%), and cultivated cropland (10.5%). Developed open space accounts for about 1.9% of the land area, followed by deciduous forest accounting for about 1.3%. The remaining land area consists of other land uses, including mixed forest, hay and pastureland, woody and emergent herbaceous wetlands, barren land, and open water, each accounting for fractions of a percent of the land area (NLCD, 2016).

Div. 3 is dominated by shrub or scrub rangeland (28.6%) followed by evergreen forest (25.1%) and herbaceous rangeland (22.2%). Hay and pastureland area is about 8.9%, with deciduous forest accounting for roughly 5.8% of the land area. Woody wetlands make up roughly 2.7% of the land area, followed by barren land at 2.1%, emergent herbaceous wetlands at 1.6%, and mixed forest at roughly 1.1% of the land area. Other land uses, such as developed land and open water account or the remaining land area. Cultivated crops account for about 0.34% of the land area in Div. 3 (NLCD, 2016). This portion of the watershed is the area of analysis in which EQIP-funded agricultural practices were implemented. It is also important to note that some cropland, such as cover crop land and crops such as potatoes, can be mislabeled as herbaceous land or shrub or scrubland, so some agricultural land in each of these watersheds may be characterized within these alternative categories.

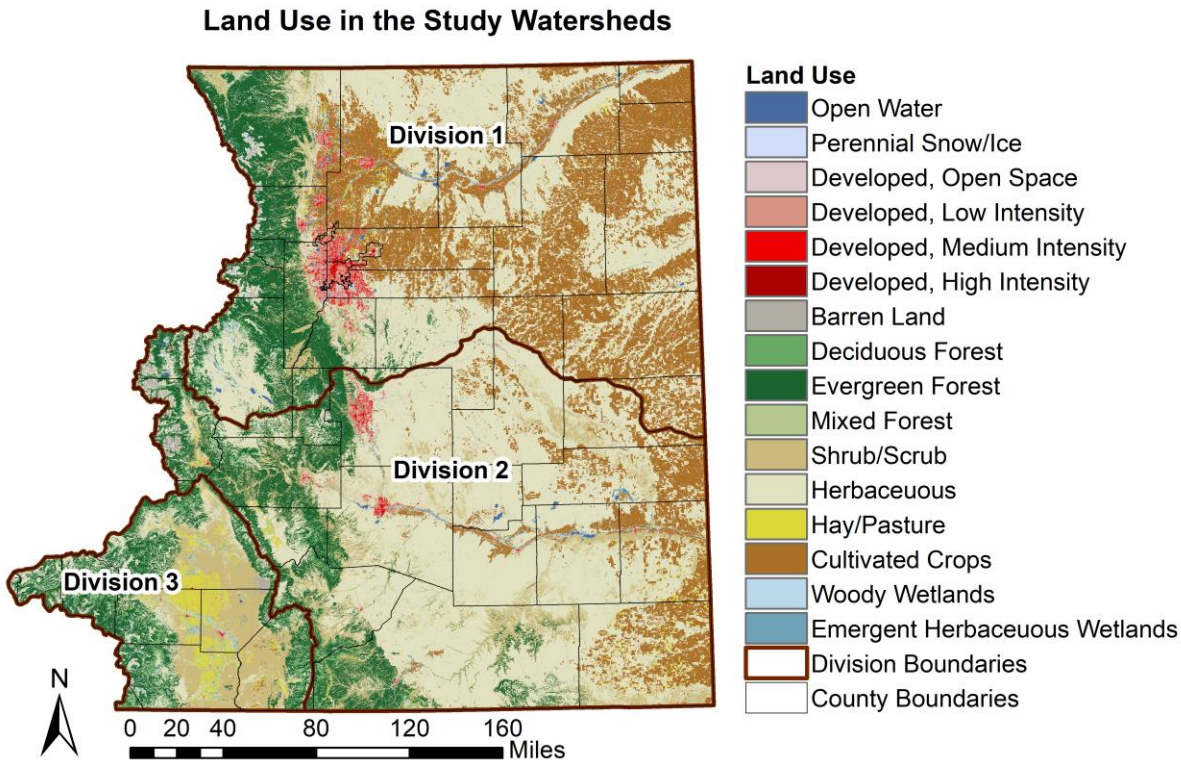


*Figure 3. Map of land use for the counties considered in this EQIP analysis using NLCD data from 2016. The western portion of the study area shows Div. 1, the Republican and South Platte watersheds, (top right) and Div. 2, the Arkansas watershed, (bottom right), and both are dominated by agricultural land within the Great Plains region. Common cropping systems in these areas include corn, sorghum, wheat, melons, and barley. Div. 3, the Rio Grande watershed, (bottom left) is largely cropped with potatoes, barley, alfalfa, and spring wheat.*

## 2.3 SOIL CHARACTERISTICS AND HYDROLOGY

Soil characteristics can be important indicators of the capacity of soils to transport water and nutrients, as well as indicators of the vulnerability of soils to various types of erosion. Factors

including hydrologic group, slope, flooding frequency, water storage and drainage capacity, texture, and erodibility influence soil erosion and sediment and nutrient transport. Proximity to rivers and their tributaries substantially effects the impacts of nutrient transport on water quality. Figure 4 below shows the primary stream courses considered in this analysis and their proximity to irrigated agricultural fields.

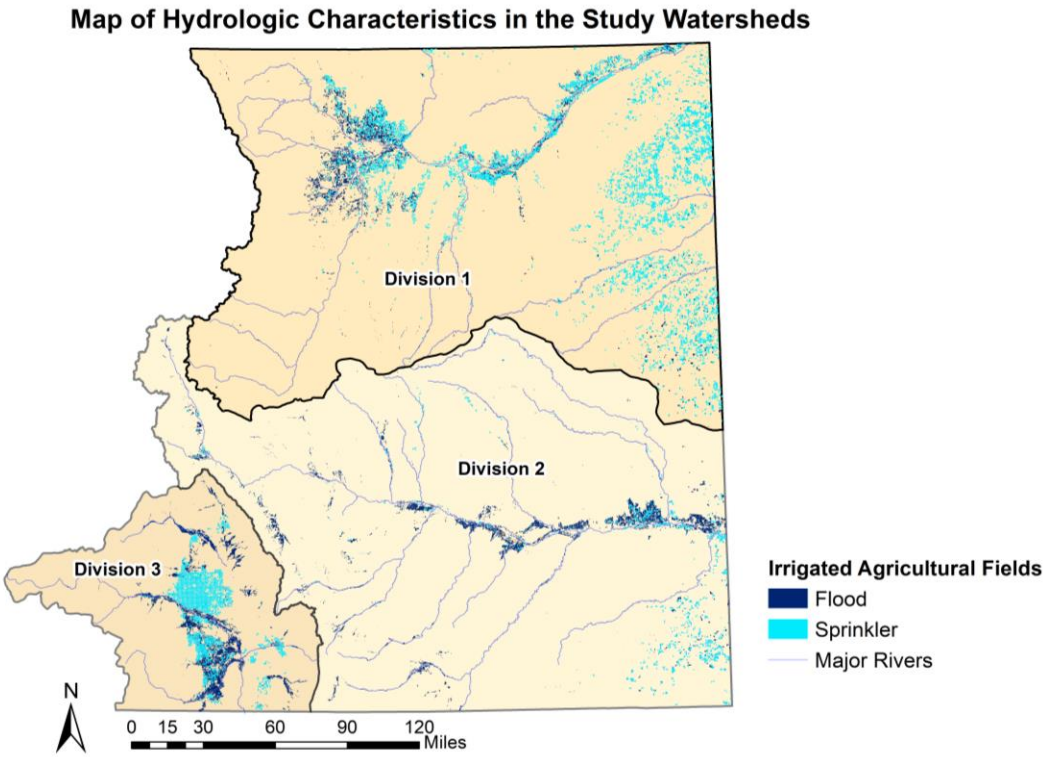


*Figure 4. Map of important hydrologic characteristics for the Colorado counties considered in this analysis. This map shows the proximity of irrigated agricultural fields to primary stream courses, which may increase the likelihood of nutrient runoff reaching surface waters.*

## 2.4 OBSERVED DATA

Observed data was used to calibrate the model. Average annual nutrient loads were observed at the Kerbel study site for various agricultural management practices that could then be used to validate the model results. The Kerbel study site is an irrigated 14-acre field located in the South Platte River Basin in eastern Colorado. Nutrient, sediment, and surface runoff data was collected over a period from 2013 to 2015 during precipitation and irrigation events. Corn was cultivated in 2015, and various sections of the field were managed using conventional tillage, reduced tillage, and strip tillage. The crops were irrigated using surface (flood) irrigation, and the resulting nutrient response during these irrigation events was recorded. This data was collected at the edge of the field using a Teledyne ISCO 6712 Portable Sampler (PS) equipped with a 730 Bubbler Flow Module. Grab samplings or the PS system were used during storm events to measure nutrient data flow and were flow weighted.


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Under conventional tillage, all fertilizer was applied at once (160 lbs/ac of N, 60 lbs/ac of P). Reduced and strip tillage had two fertilizer applications amounting to 90 lbs/ac of N and 30 lbs/ac of P after the initial tillage operations and then a second application of nitrogen was applied after planting at a rate of 70 lbs/ac (Deleon, 2017; Wardle, Bauder, & Pearson, 2015) . The SWAT model was calibrated to these Kerbel field observations for a representative regional assessment of agricultural runoff related to various management practices.

The values for curve number (CN), denitrification exponential rate coefficient (CDN), overland manning number (OV_N), nitrogen (nitrate) percolation coefficient (NPERCO), phosphorus percolation coefficient (PPERCO), phosphorus soil partitioning coefficient (PHOSKD), and phosphorus uptake distribution parameter (P_UPDIS) were changed based on the literature (SWAT Literature Database, 2019; Arnold et al., 2012) and a previous sensitivity analysis (Ahmadi et al., 2014; Arabi et al., 2007). However, the no-tillage scenario was not tested at Kerbel, therefore typical values found in the literature were used to validate these results (Arnold et al., 2012).

Jobin et al. (2017) manually calibrated the model to this observed monitoring data to determine the proper values for each tillage practice, followed by a model run from the year 2002 to 2017 in order to validate that model outputs conformed to field observations. This model validation found good correlation between the model results and observed values. Similar CSU edge-of-field monitoring sites are being studied and observed in divisions 2 and 3 using analogous procedures, and the observed data will be used to calibrate the model to each specific region in order to boost confidence in the model results.

## 2.5 MODELING ASSUMPTIONS

A modeling effort of this magnitude requires a large amount of time and resources. It is impossible to account for all variables in a system at this scale of modeling area. Certain assumptions were necessary for this analysis to be completed in a reasonable amount of time using resources efficiently.

In modeling the EQIP-funded conservation practices, only irrigated agricultural fields were modeled. Additionally, only the EQIP practices that were designated as “certified” were included. Practices that were not labeled as certified could not be confirmed to have been implemented to the standard and specification tied to the specific conservation practice, whereas certified practices were field confirmed in-use by an NRCS employee. Also, only certain EQIP practices were included and modeled. The practices chosen were those most commonly implemented in Colorado agriculture related to water quality and were meant to represent the majority of the EQIP program in Colorado on irrigated cropland.

Practices included transitioning to more efficient types of irrigation, tillage, and field border and filter strips. The number of EQIP acres reported in this analysis reflects the number of acres of the chosen practices on the land use irrigated cropland and the effects on water quality. It is important to note that there are many other EQIP practices implemented, and additional acres that were



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funded. The scale and resources available for this analysis simply could not capture the full range of EQIP practices and the full scale of actual implementation in the state. It is likely that the extent of impact of the EQIP program is greater than this analysis can capture with the limited time and resources allowed.

The EQIP data available through the Freedom of Information Act (FOIA) only included the number of acres on which a given practice had been implemented and did not specify the number of fields. It is possible that multiple practices were implemented on a single field. Therefore, some fields may have been counted multiple times when determining the number of acres of EQIP-funded practices. Additionally, the publicly available FOIA data did not specify exact locations of each EQIP practice implemented in order to protect the privacy of producers. Instead, the FOIA data only included the county in which each practice was implemented. The exact field-level locations were used at a later time to validate the model results. The validation work was conducted in cooperation with the USDA-NRCS in order to maintain the privacy of individual producers and to comply with the policies of the USDA-NRCS. This model validation at the field-scale was then aggregated to the county level for reporting purposes in conjunction with privacy policies and to protect producers.

The management actions and cropping dates used for modeling in SWAT were determined based on producer surveys in the state, as well as conversations with CSU-Extension employees. The dates of tillage, planting, harvest, and other actions were based on overall trends and were verified by CSU-Extension and USDA-NRCS employees to be representative of each region of the state. The types of crops modeled were based on the percentage of land cultivated for each crop, as well as the significance of the crop in that region and actual land use from USDA National Agricultural Statistics Service (NASS) land use data. For example, melons account for a fraction of a percent of the land use in Div. 2. However, melons are an important crop to producers in that region due to economic and cultural reasons, so it was deemed necessary to include melon production modeling in that division.

It is acknowledged that the actual cropping dates and managements implemented are dependent on producer preferences, seasonal climatic factors, and other variables within each region. However, in order to perform this analysis across multiple watersheds, certain assumptions had to be made, including generalized cropping and management dates and actions. It is acknowledged that the results may not be representative of exact practices, cropping systems, and nutrient management in every area of the state for each year. Divisions were grouped by watersheds with similar cropping systems and dates in an effort to model the overall trends in agricultural production and conservation practice implementation in similar regions of Colorado. This was done to keep assumptions as simplified and reasonable as possible.

## 2.6 PROMINENT AGRICULTURAL PRACTICES

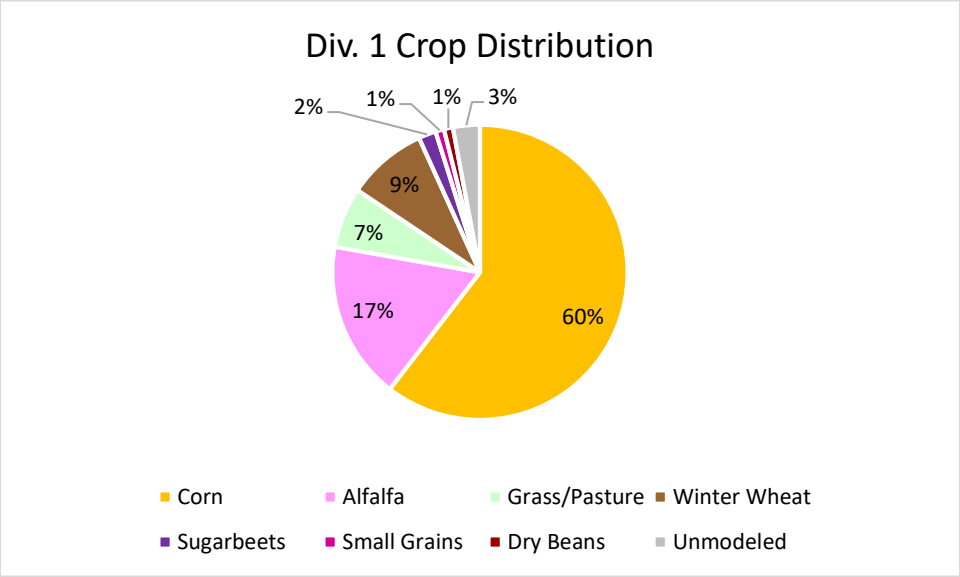
### 2.6.1 Dominant Crops

The dominant crop types and rotations for each watershed were extracted for the years 2008 to 2018 from the NASS database. The dominant crop types in Div. 1 Republican and South Platte watersheds by acreage were found to be corn (60%), alfalfa (17%), grass pasture (7%), winter wheat (9%), sugar beets (2%), small grains (1%), and dry beans (1%). The small grains category includes barley, triticale, oats, rye, and other small grains. Approximately 3% of the total crop types in Div. 1 were not modeled, most of which were specialty crops that make up fractions of a percent of the land area in the division. Modeling every crop type would take more time and resources than the scope of this analysis allowed.

The Div. 2 Arkansas watershed from 2008 to 2018 was dominated by alfalfa (42%), grass and pasture (17%), corn (12%), winter wheat (20.6%), sorghum (7%), small grains (0.5%), and melons (0.2%). Small grains include oats, triticale, barley, rye, and other small grains. As in Div. 1, the remaining crop types, which make up about 1.5% of the total land area, were not modeled because each makes up fractions of a percent of the land area.

The dominant crop types that were modeled in Div. 3 Rio Grande watershed include alfalfa (34%), grass and pasture (28%), potatoes (12%), and small grains (15%). The small grains include barley, oats, spring wheat, durum wheat, triticale, and rye. The crops that were not modeled in Div. 3 made up roughly 11% of the total land area in the watershed, which is larger than the first two divisions because nearly 10.5% of this un-modeled land is shrubland. Figures 5 through 8 show the distributions of dominant crop types within each division based on the number of acres cultivated of each crop.

**Dominant Crops in each Division**



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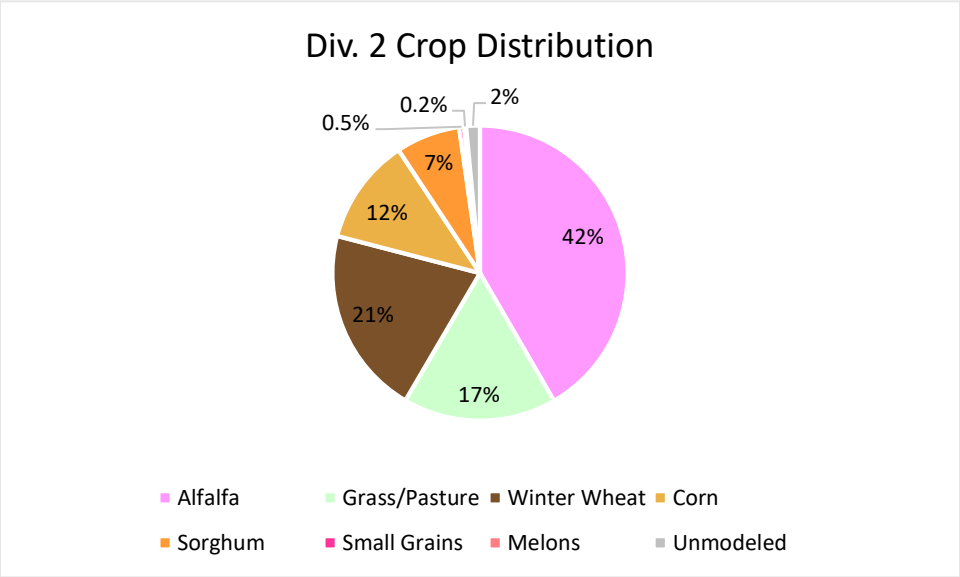


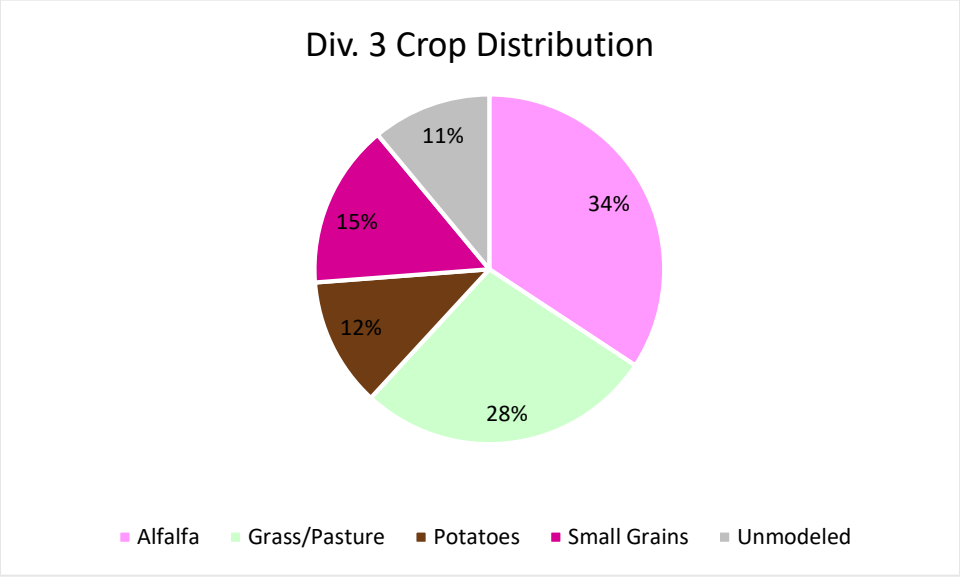


*Figure 5. Crop distribution within each watershed based on the crop acreage values from NASS data from the year 2008 to 2018.*



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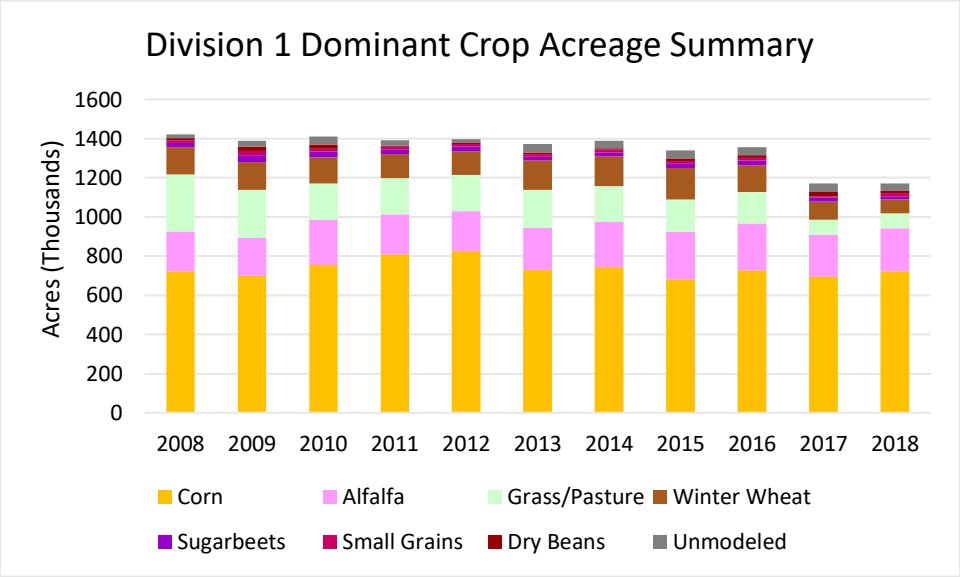


*Figure 6. Crop acreages of the dominant crops in Div. 1 from 2008 to 2018. The crop acres were obtained from USDA National Agricultural Statistics Service Dataset. Sugarbeets, small grains, and dry beans account for relatively small percentages of the crop acres, but they are regionally important crops, and so were considered in this analysis.*

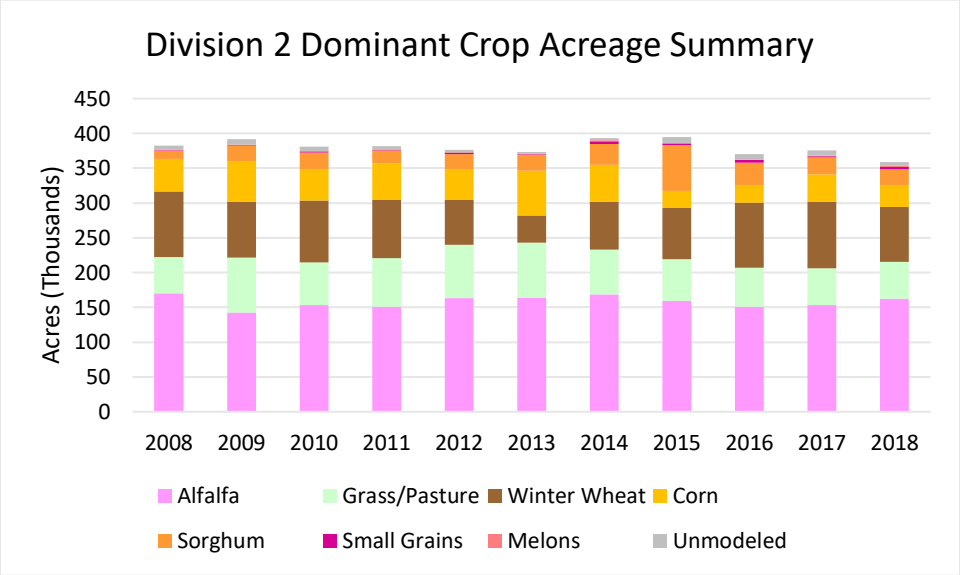


*Figure 7. Crop acreages of the dominant crops in Div. 2 from 2008 to 2018. The crop acres were obtained from USDA National Agricultural Statistics Service Dataset. In this division, melons and small grains account for relatively small percentages of the crop acres, but they are regionally important crops, and so were considered in this analysis.*

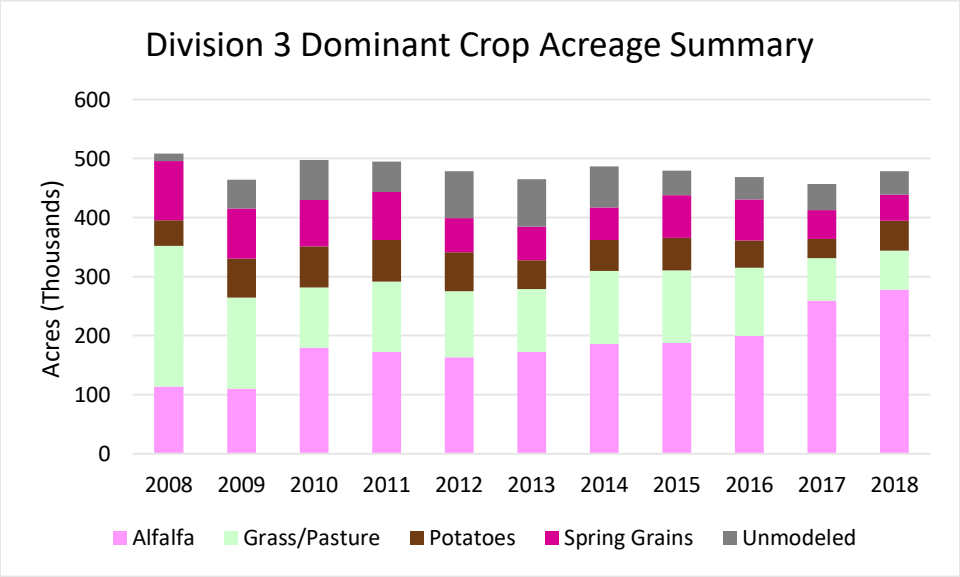


*Figure 8. Crop acreages of the dominant crops in Div. 3 from 2008 to 2018. The crop acres were obtained from USDA National Agricultural Statistics Service Dataset.*

### 2.6.2 Irrigation Types

There are roughly 1.75 million irrigated agricultural acres in the watersheds considered for this analysis, or about 48,000 fields, as of 2015 (https://www.colorado.gov/pacific/cdss/gis-data-category). The Div. 1 South Platte and Republican watersheds contain 809,257 irrigated acres, farmed as roughly 22,000 fields. The Div. 2 Arkansas watershed contains about 430,877 irrigated acres, managed as 17,114 fields, and the Div. 3 Rio Grande watershed contains about 508,624 of those irrigated acres, broken into about 8,800 fields. A majority of the agricultural land in these watersheds is irrigated. Figures 9 through 11 below show the breakdown of irrigated agricultural land by the amount of flood, sprinkler, and drip irrigated acres in each division. In total, EQIP funded nearly 195,000 acres of irrigation conservation practices between 2008 and 2018 for this area of interest. Figure 12 shows the amount of irrigated agriculture land funded by EQIP by county for the watersheds considered, with the highest number of EQIP irrigation contracts in Weld and Yuma counties.


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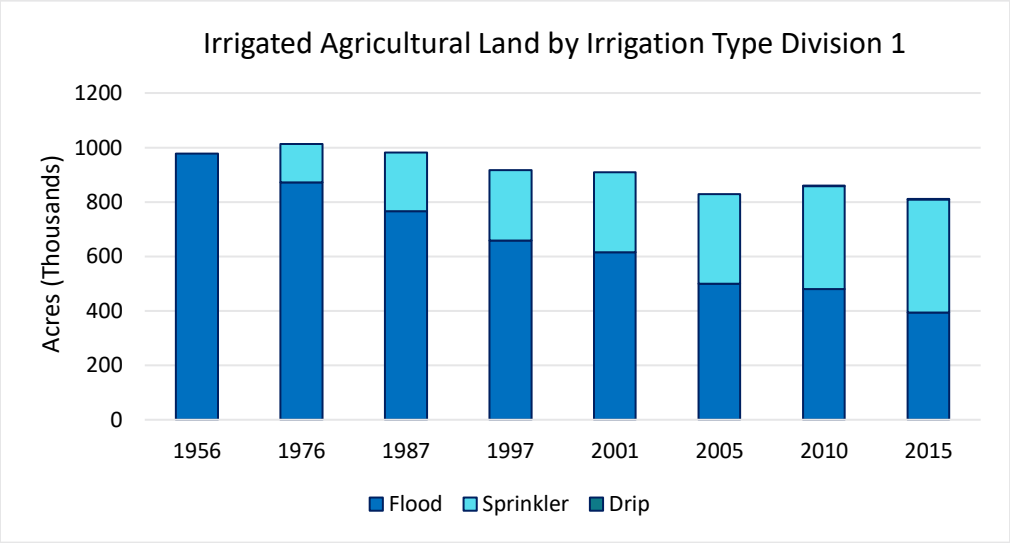


*Figure 9. Distribution of acres of irrigation type by year from 1956 to 2015 in Division 1, showing a definite shift from flood to sprinkler irrigation in the region. The years included are based on the available data (Source: https://www.colorado.gov/cdss).*

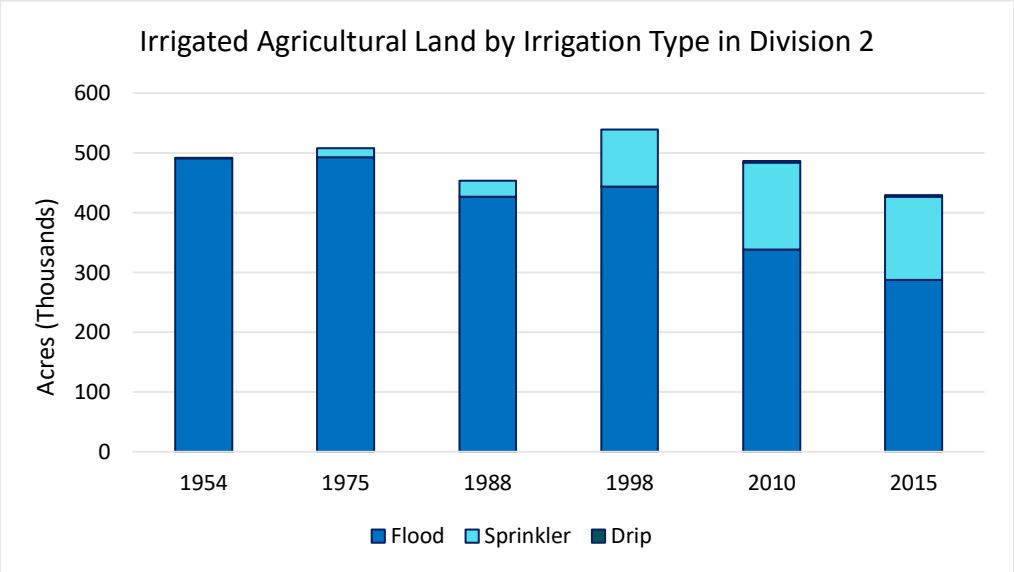


*Figure 10. Distribution of acres of irrigation type by year from 1954 to 2015 in Division 2. There were four other years of available data (2013, 2014, 2017, and 2018) that were not included in this graph due to inconsistencies and low confidence in the data. There was a severe drought in 2012, and that affected the available data in the years 2013 and 2014, when residual effects were still being seen in the available water and, therefore, the acreage of irrigated fields. Those years of data were considered outliers and not representative of the general irrigation management of the region. Therefore, those years were not included in this graph (Source: https://www.colorado.gov/cdss).*



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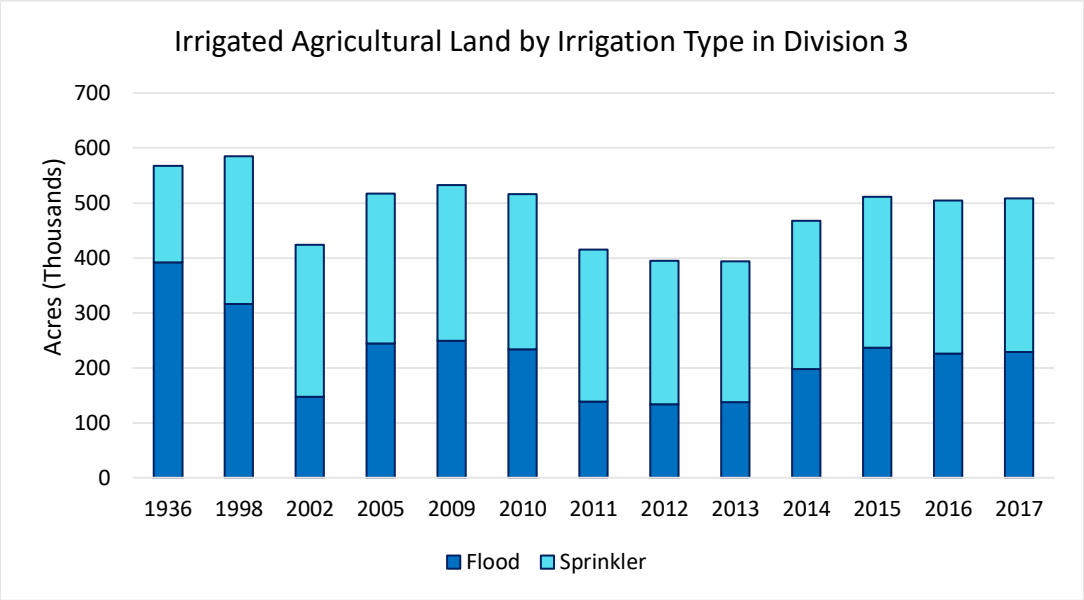


*Figure 11. Distribution of acres of irrigation type by year from 1936 to 2018 in Division 3. The years included are based on the available data (Source: https://www.colorado.gov/cdss).*



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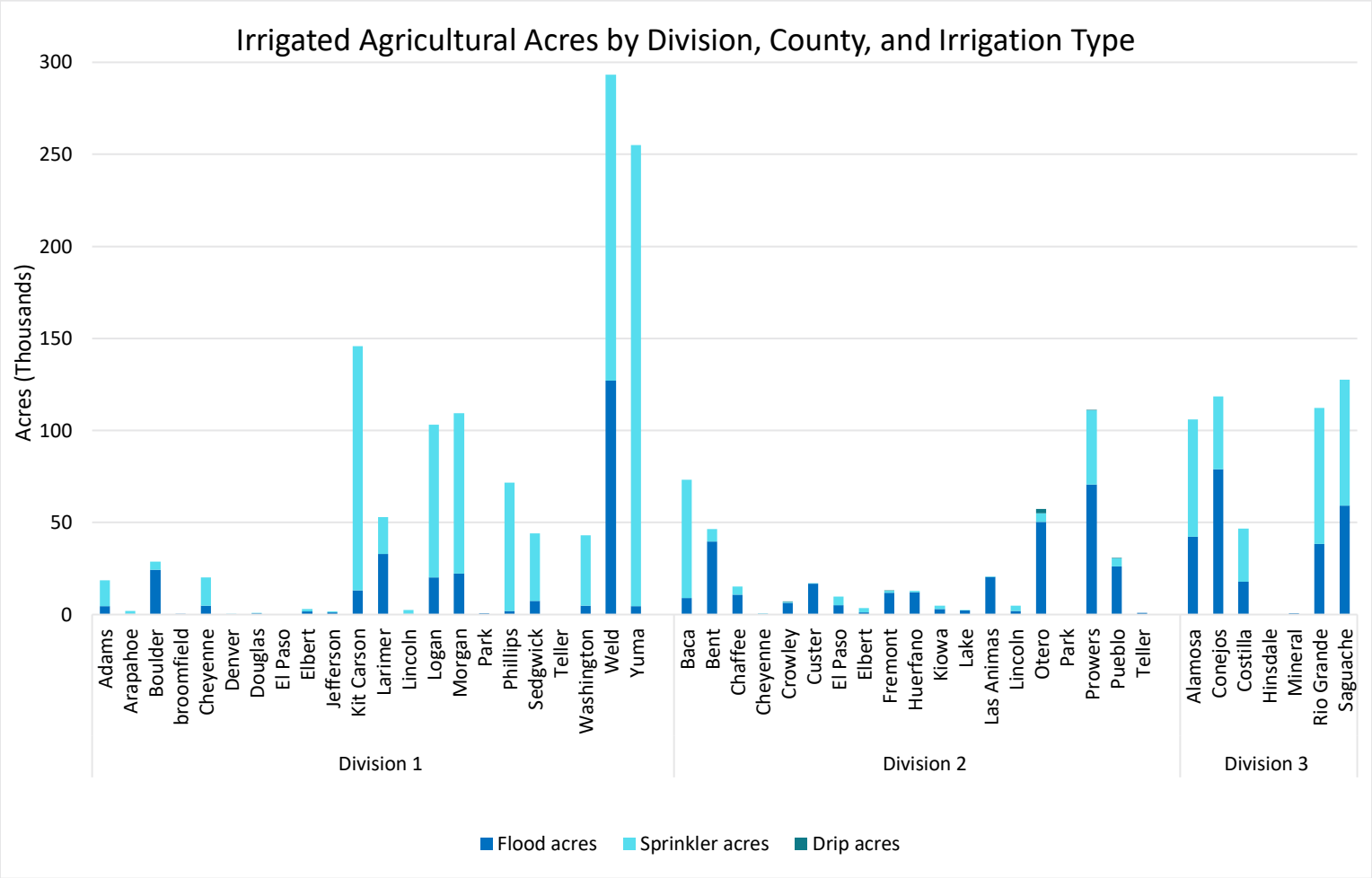


*Figure 12. Distribution of irrigated agriculture fields by county for the counties considered in this analysis. This data was collected from Colorado's Decision Support Systems GIS data layer for irrigated agricultural land in 2015 (https://www.colorado.gov/cdss).*

### 2.6.3 Conservation Practices

#### *Common Practices Used in Colorado*

This analysis considers structural, vegetative, and management conservation practices implemented through EQIP. Structural conservation practices are installed and maintained for a specific practice lifespan, typically 20 years. They are long-term practices meant, among other purposes, to mitigate sediment and nutrient loss within and from the edge of a field. Examples that are commonly installed in Colorado include sprinkler and head gate irrigation systems, anaerobic digesters, etc. Vegetative practices include filter strips, buffer strips, grassed waterways, and field borders. Management conservation practices refer to farming operations throughout the year as a part of the cropping system that conserve and improve resource conditions. The operations, among other things, work to improve soil health and structure and reduce the amounts of nutrients, pesticides, and sediment that may be transported by wind or water. Examples common to Colorado include tillage and residue management, nutrient management, and irrigation water management. Most agricultural producers already utilize one, and often multiple, conservation practices on-farm.


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The practices already in use before the application of additional EQIP-funded practices were accounted for in this analysis as part of the baseline modeling scenarios.

This analysis focuses on the most commonly applied conservation practices in this region funded through the EQIP program. Those practices include reduced tillage, no till, sprinkler irrigation, drip irrigation, field borders and buffer and filter strips, as shown in Figure 13. These practices are defined and described in further detail in section 3.6 of the Methods Section.

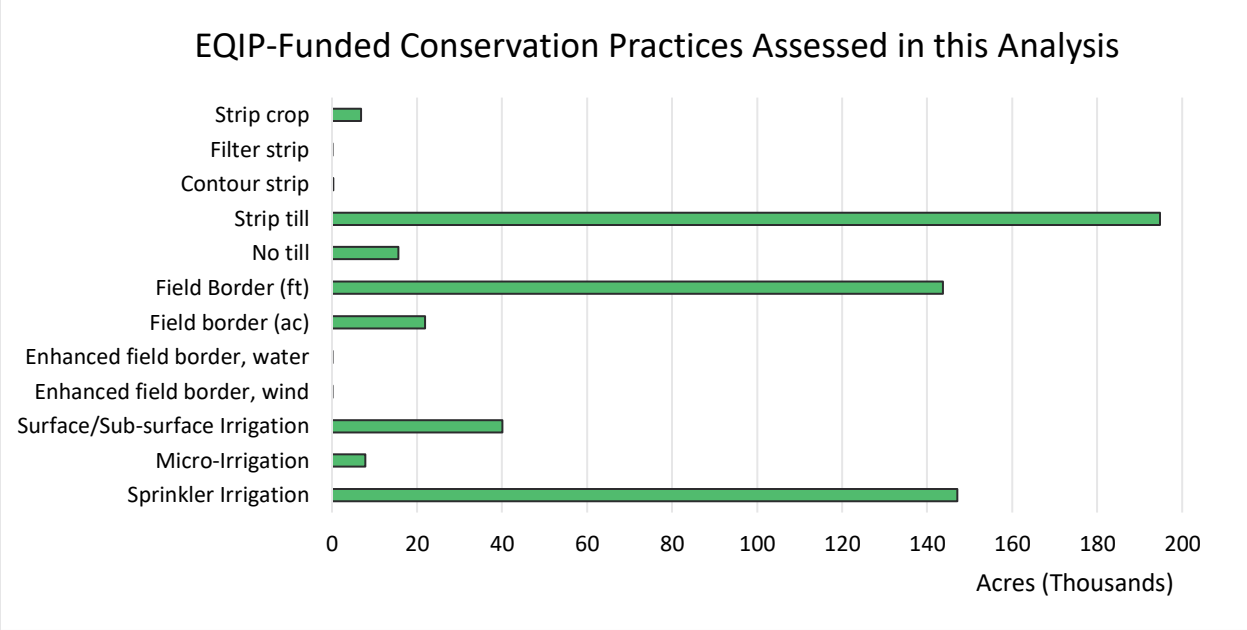


*Figure 13. The EQIP-funded conservation practices that are considered and modeled in this analysis by acreage.*



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# CHAPTER 3: METHODS

## 3.1 OVERVIEW

The Soil and Water Assessment Tool (SWAT) was used through the CSU Edge of Field Conservation Planning (EoFCP) tool to model the effectiveness of EQIP-funded agricultural conservation practices throughout the Republican, South Platte, Arkansas, and Rio Grande watersheds. Edge-of-field monitoring is expensive and resource-intensive, and it is not applicable on such a large scale. For this reason, modeling was used to simulate the effects of various management scenarios. The model was validated with observed edge-of-field data for calibration purposes. The SWAT and EoFCP models integrate land use, soils, and climate data and can simulate site-specific farming activities. They are able to estimate losses, such as sediment and nutrient losses, at the field scale, as well as account for the long-term impacts throughout a watershed.

SWAT was used under Colorado State University's Environmental Resource Assessment and Management System (eRAMS) platform utilizing EoFCP. eRAMS is a cloud-based, open source software platform offering online services that support geospatially enabled web applications for the purpose of natural resource management, while the EoFCP tool is a geospatial web application that allows users to compare potential and modeled water quality and crop yield impacts from implementation of various agricultural BMPs (CSU, 2019a; CSU, 2019b). This platform allows for a single point of access to public data, making large databases more readily available to users for incorporation into tools or other systems. This EoFCP tool through the eRAMS platform allows for automatic data extraction, cloud-based storage, and parallel computing helpful in modeling large watersheds. These abilities allow for a SWAT-based model with reduced computational burden.

## 3.2 MODELING SCENARIOS

***Baseline (current conditions without EQIP) Scenario:*** This scenario reflects edge-of-field nutrient runoff under management and conservation practices being utilized before the implementation of the modeled EQIP-funded practices beginning in 2008.

***Practices-In-Use Scenario (with EQIP):*** This scenario accounts for the EQIP-funded conservation practices implemented between 2008 and 2018. Conservation practice effects are determined by evaluating the difference in the results of these scenarios versus the baseline scenario.



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## 3.3 THE SOIL AND WATER ASSESSMENT TOOL (SWAT) MODEL AND EDGE OF FIELD CONSERVATION PLANNING TOOL (EOFCP)

Direct measurement of the effectiveness of nonpoint source conservation practices through edge-of-field monitoring is costly and resource intensive, and field data is limited in scope. Therefore, modeling was used to develop a comparison of various management scenarios for common representative crop rotations and informed by edge-of-field monitoring of a select set of practices in each watershed. There are numerous models that can be used to simulate agricultural processes and determine annual nutrient load contributions from each irrigated agricultural field within a watershed (Shackelford et al., 2019; Alarcon & Gretchen, 2016; Vagstad et al., 2009).

SWAT, a continuous-time, semi- distributed, process-based watershed model, was chosen to model the effectiveness of agricultural management practices on irrigated agricultural fields due to its extensive use within the literature (Dagnew et al., 2019; Arnold et al., 2011; Gassman et al., 2007; Arnold et al., 2012, SWAT Literature Database, 2019). SWAT has sophisticated routines for agricultural management practices pertaining to fertilizer and manure application, tillage practices, and crop growth. Field observations were coupled with the use of models for this research to get a more representative regional assessment of the effects of different agricultural practices on a watershed scale.

The tools used in this analysis simulate farming practices including planting, tillage operations, and fertilizer and pesticide application, as well as irrigation operations and harvest. SWAT can simulate the basic biological, hydrological, chemical, and meteorological processes that occur within agricultural systems, including interactions between soil structure and composition, nutrient processes, and hydrologic processes (Arnold et al., 2011). The SWAT model was accessed through the eRAMS platform utilizing the Edge of Field Conservation Planning (EoFCP) tool.

The EoFCP tool is a web-based geospatial application that allows users to compare potential and modeled water quality and crop yield effects after the implementation of various agricultural BMPs. The BMPs that can be considered include various irrigation managements, tillage operations, and nutrient management options. The EoFCP tool provides additional information on agricultural BMP implementation and calculates nutrient recommendations based on user inputs. Agricultural fields can be analyzed for N and P losses using the N-index and P-index risk modules that are incorporated into the EoFCP tool. Field boundaries can be mapped and analyzed within this tool to provide site characteristics and information about how nutrient management practices may affect water resources. The EoFCP tool incorporates the Nitrogen Index, Phosphorus Index, SWAT model, the Water Irrigation Scheduler for Efficiency (WISE) model, the Land Use and Agricultural Management Practice Service (LAMPS), and other applications that allow for a comprehensive geospatial evaluation of agricultural fields and the edge of field impacts of various BMPs (CSU, 2019b).

Modeling results were calibrated using Edge-of-Field monitoring data from the Kerbel study site. Other observed data was used from public databases accessible through the eRAMS platform for ensuring realistic and attainable results. The data that are accessible through this platform include, but are not limited to, databases such as: NOAA; National Climatic Data Center; SSURGO soils data;

National Agricultural Statistic Service Land Use; USGS National Land Cover Database; USGS National Water Information System real-time for the Nation; EPA Water Quality Portal and WATERS; USGS Hydrography, Transportation, and Government Boundaries (CSU, 2019). The EoFCP tool specifically retrieves data from the USDA NRCS Soil Survey Geographic Database (SSURGO), the Parameter Elevation Regression on Independent Slopes Model (PRISM), the Global Historical Climatology Network-Daily (GHCND), and the Colorado Agricultural Meteorological Network.

## 3.4 MODEL SETUP

A single Hydrologic Response Unit (HRU) is used to define each field based on majority soil type and majority slope class. In this analysis, each HRU is a single irrigated agricultural field. Land use for each field is defined based on NASS crop data for each year. Therefore, the model does not need to assume crop rotations because it uses actual crops grown per field in each year. The HRUs are not always contiguous within a watershed. This process of division in HRUs based on soil type and slope allows the model to determine changes in evapotranspiration (ET) depending on crop and soil type of the area. A water balance equation is used for runoff simulation of each field and routing in order to quantify the total runoff in the watershed using a process-based approach. This approach enhances the physical description of the water balance and allows for a more representative simulation (Arnold et al., 2011).

## 3.5 CROPPING SYSTEM

For this study, scenarios were developed for each field based on dominant crop, data availability, and regional prominence. Irrigated field boundaries from the Colorado Department of Water Resources (DWR) were used as the basis of irrigated agricultural field extents for these watersheds. NASS land use data from 2008 to 2018 was combined with the Land-use and Agricultural Management Practice web-Service (LAMPS) (Kipka et al., 2016), and dominant land use crop types for each irrigated field were identified for each year. These were used to identify the dominant crops in each watershed, which were outlined previously in Figures 4 through 7. It is acknowledged that other minor crops such as dry beans, sunflowers, other forages, and vegetables are grown in these basins. However, producing the dozens of modeled scenarios for every crop rotation in the basin would require more time and resources than this project allowed, so only major crop types, and those deemed of significance within a region, were modeled.

Various crops and management actions were used to simulate changes in nutrient and irrigation applications, as well as tillage and harvest actions and dates on each field. Tables 1 through 12 describe the management actions and dates for each crop based on the watershed region. These tables show the conventional managements with flood irrigation as an example of the table input format. The “id” column describes the order of management actions, the “date” column is the date the action occurs, and the “operation” column dictates to the SWAT model the exact management to perform. The “Type” column tells the model the exact type of operation, “lbs/acre” describes the

amount of nutrient applied in pounds per acre when the "Type" column specifies a nutrient operation, and "Incorporated (Y/N)" describes whether or not the nutrient is incorporated into the soil as it is applied. The full set of tables that includes all management actions and dates can be found in Appendix A. These dates are representative of the entire analysis period of 2008 to 2018 and vary by year based on weather conditions, region of the state, and watersheds.

Each crop has 16 total scenarios. There are 4 tillage operations per crop in conjunction with two different irrigation types and various nutrient applications resulting in 16 scenarios per crop type. The tillage operations include conventional tillage, strip tillage, reduced tillage, and no tillage. The irrigation types include flood and sprinkler irrigation, and the nutrient application variable is split apply nutrient application versus conventional application. A complete list of these managements per crop is available in Appendix A.

**Conventional Scenario Crop Management Table Examples**

Tables 1 through 12 show examples of the input tables used in the SWAT model listing important dates and management actions for modeling conventional tillage, flood irrigation, and conventional fertilizer application. Further management tables specifying crop dates and management actions for strip till, reduced till, no till, sprinkler irrigation, and split apply fertilizer application for all divisions can be found in Appendix A.

*Corn-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | Lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/2008 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/23/2008 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/23/2008 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/27/2008 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 4/14/2008 | Nutrient | Elemental Nitrogen | 160 | no |
| *6* | 4/14/2008 | Nutrient | Elemental Phosphorous | 60 | no |
| *7* | 4/14/2008 | Tillage | BEDDER (DISK) | | |
| *8* | 4/14/2008 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 4/30/2008 | Planting | Corn | | |
| *10* | 6/24/2008 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 9/14/2008 | Harvest & Kill | | | |

*Table 1. Corn-Conventional Tillage- Flood Irrigation*



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*Alfalfa-ConventionalTill-Flood**

| *id* | date | operation | par1 | par2 | par3 |
|---|---|---|---|---|---|
| *1* | 2/28/2008 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/2/2008 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/5/2008 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/7/2008 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 3/10/2008 | Nutrient | Elemental Phosphorous | 125 | no |
| *6* | 3/10/2008 | Nutrient | Elemental Nitrogen | 26 | no |
| *7* | 3/10/2008 | Tillage | BEDDER (DISK) | | |
| *8* | 3/10/2008 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 3/15/2008 | Planting | Alfalfa | | |
| *10* | 6/1/2009 | Harvest | | | |
| *11* | 7/5/2009 | Harvest | | | |
| *12* | 8/15/2009 | Harvest | | | |
| *13* | 9/30/2009 | Harvest | | | |
| *14* | 4/15/2010 | Nutrient | Elemental Nitrogen | 10 | no |
| *15* | 4/15/2010 | Nutrient | Elemental Phosphorous | 50 | no |
| *16* | 6/1/2010 | Harvest | | | |
| *17* | 7/5/2010 | Harvest | | | |
| *18* | 8/15/2010 | Harvest | | | |
| *19* | 9/30/2010 | Harvest | | | |
| *20* | 4/15/2011 | Nutrient | Elemental Nitrogen | 10 | no |
| *21* | 4/15/2011 | Nutrient | Elemental Phosphorous | 50 | no |
| *22* | 6/1/2011 | Harvest | | | |
| *23* | 7/5/2011 | Harvest | | | |
| *24* | 8/15/2011 | Harvest | | | |
| *25* | 9/14/2011 | Harvest & Kill | | | |

*Table 2. Alfalfa -Conventional Tillage- Flood Irrigation*

**Because alfalfa is a multi-year perennial crop, when an observation of alfalfa was encountered in the modeling, this multi-year rotation was applied and ignored the next 3 years of observed satellite crop to allow the alfalfa to grow to completion*



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*GrassPasture-ConventionalTill-Flood**

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/08 | Planting | Pasture | | |
| *2* | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *3* | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4* | 5/15/08 | Harvest | | | |
| *5* | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *6* | 8/1/08 | Harvest | | | |
| *7* | 9/1/08 | Harvest & Kill | | | |

*Table 3. Grass Pasture -Conventional Tillage- Flood Irrigation*

** Due to the lack of tillage operations there was no variation in tillage scenarios for this crop type*

*WinterWheat-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 9/15/07 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 9/16/07 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 9/17/07 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 9/20/07 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 9/25/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *6* | 9/25/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *7* | 9/25/07 | Tillage | BEDDER (DISK) | | |
| *8* | 9/28/07 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 9/30/07 | Planting | Winter Wheat | | |
| *10* | 7/8/08 | Harvest & Kill | | | |

*Table 4. Winter Wheat -Conventional Tillage- Flood Irrigation*

*SugarBeets-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/10/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 4/1/08 | Nutrient | Elemental Nitrogen | 120 | no |
| *6* | 4/1/08 | Nutrient | Elemental Phosphorous | 75 | no |
| *7* | 4/1/08 | Tillage | BEDDER (DISK) | | |
| *8* | 4/1/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 4/10/08 | Planting | Sugarbeet | | |
| *10* | 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 9/14/08 | Harvest & Kill | | | |

*Table 5. Sugarbeets -Conventional Tillage- Flood Irrigation*

*SmallGrains-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/2/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| *6* | 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *7* | 3/15/08 | Tillage | BEDDER (DISK) | | |
| *8* | 3/15/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 3/16/08 | Planting | Spring Barley | | |
| *10* | 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 8/1/08 | Harvest & Kill | | | |

*Table 6. Small Grains -Conventional Tillage- Flood Irrigation*

*DryBeans-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/2008 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/23/2008 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/23/2008 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/27/2008 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 5/1/2008 | Nutrient | Elemental Nitrogen | 80 | no |
| *6* | 5/1/2008 | Nutrient | Elemental Phosphorous | 30 | no |
| *7* | 5/1/2008 | Tillage | BEDDER (DISK) | | |
| *8* | 5/1/2008 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 5/20/2008 | Planting | Dry beans | | |
| *10* | 6/15/2008 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 8/15/2008 | Harvest & Kill | | | |

*Table 7. Dry Beans -Conventional Tillage- Flood Irrigation*

*Potatoes-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/15/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 4/14/08 | Nutrient | Elemental Phosphorous | 200 | no |
| *4* | 4/15/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 4/15/08 | Tillage | Bedder (Disk) | | |
| *6* | 4/30/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *7* | 4/30/08 | Planting | Potatoes | | |
| *8* | 5/5/08 | Tillage | Bedder (Disk) | | |
| *9* | 5/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *10* | 5/30/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *11* | 6/5/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *12* | 6/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *13* | 6/25/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *14* | 7/10/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *15* | 7/20/08 | Nutrient | Elemental Nitrogen | 10 | no |
| *16* | 8/20/08 | Kill | | | |
| *17* | 9/15/08 | Dig | POTATO DIGGER | | |
| *18* | 9/15/08 | Harvest | | | |

*Table 8. Potatoes -Conventional Tillage- Flood Irrigation*

*SpringGrains-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/15/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3* | 3/15/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *4* | 4/30/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *5* | 4/30/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *6* | 4/30/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *7* | 5/1/08 | Planting | Small grains | | |
| *8* | 8/31/08 | Harvest | | | |
| *9* | 9/15/08 | Harvest & Kill | | | |

*Table 9. Spring Grains -Conventional Tillage- Flood Irrigation*



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*Melons-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *2* | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3* | 4/14/08 | Nutrient | Elemental Nitrogen | 125 | no |
| *4* | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *5* | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *6* | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *7* | 5/20/08 | Planting | Melons | | |
| *8* | 9/14/18 | Harvest & Kill | | | |

*Table 10. Melons -Conventional Tillage- Flood Irrigation*

*SmallGrains-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 4/14/08 | Nutrient | Elemental Nitrogen | 55 | no |
| *6* | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *7* | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *8* | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 4/1/08 | Planting | SmallGrains | | |
| *10* | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 8/15/08 | Harvest & Kill | | | |

*Table 11. Small Grains-Conventional Tillage- Flood Irrigation*

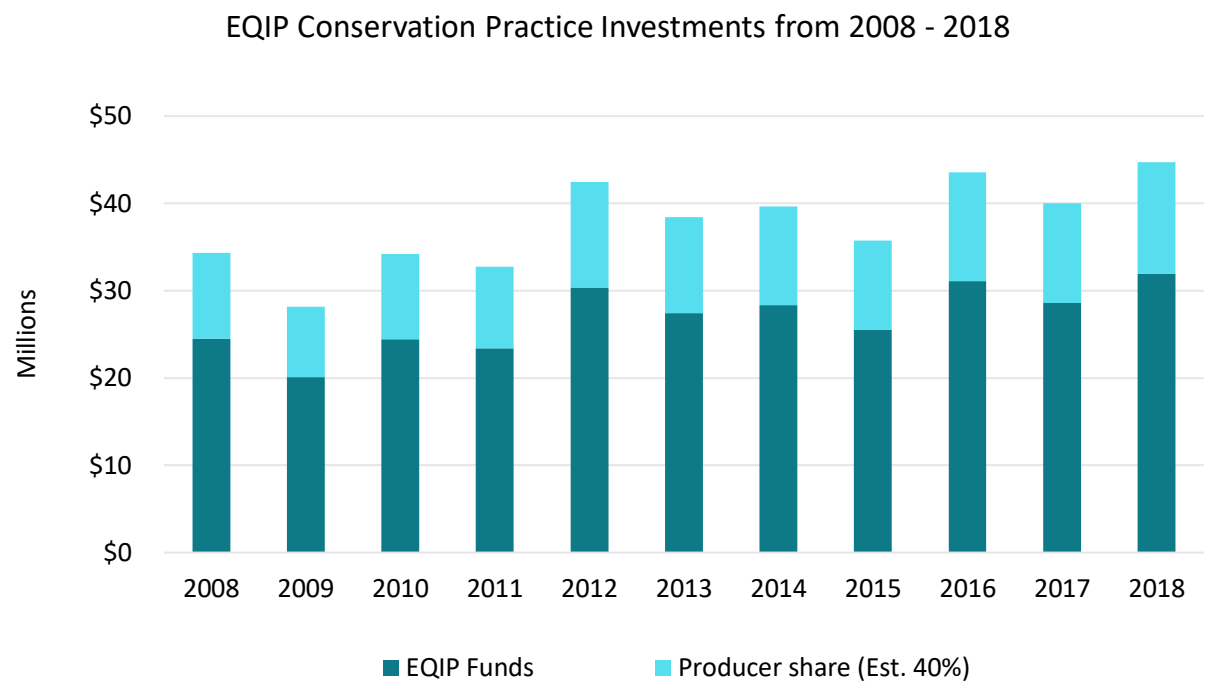
*GrainSorghum-ConventionalTill-Flood*

| *ID* | Date | Operation | Type | lbs/ac | Incorporated (Y/N) |
|---|---|---|---|---|---|
| *1* | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *2* | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3* | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *4* | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5* | 4/14/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6* | 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *7* | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *8* | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9* | 6/1/08 | Planting | Grain Sorghum | | |
| *10* | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *11* | 9/14/08 | Harvest & Kill | | | |

*Table 12. Grain Sorghum -Conventional Tillage- Flood Irrigation*

## 3.6 REPRESENTATION OF CONSERVATION PRACTICES

The conservation practices considered in this study are those funded by the EQIP program from 2008 to 2018. Figure 14 below details the investments in EQIP conservation practice from 2008 to 2018 by EQIP funds and the producer share, which is estimated to be close to 40% of the cost of the conservation practice. Several practices were considered, and they are represented in Table 13. Each practice is summarized below with their descriptions, effects at the field scale and on water quality, and their efficacy. Practice standards and uses were pulled from the NRCS Field Office Technical Guide (USDA NRCS, 2019c). The SWAT model and EoFCP tool allow for detailed simulations at both the watershed and sub-basin levels, as well as the at edge-of-field. In this analysis, simulations were run for each individual field in order to gather edge-of-field estimations and were then aggregated to the county level.




*Source: Colorado EQIP obligations, NRCS ASTC Programs , 2019.*

*Figure 14. Total funds obligated to producer contracts each year from 2008 to 2018 through the EQIP program, along with the associated expenditures committed by producers for conservation practice implementation. The producer share is estimated to be 40% of the cost.*



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| EQIP-Funded Practice | Field Office Technical Guide Code | Total Acres Funded and Implemented |
|---|---|---|
| Strip Cropping | 585 | 6,900 |
| Filter Strip | 393 | 50 |
| Contour Buffer | 332 | 370 |
| Strip Tillage | 329 | 194,811 |
| No Tillage | 329 | 15,639 |
| Field Border | 386 | 21,924 |
| Surface/Sub-surface Irrigation | 443 | 40,052 |
| Micro-Irrigation | 441 | 7,844 |
| Sprinkler Irrigation | 442 | 147,138 |
| Enhanced Field Border, water | E386101Z | 6 |

*Table 13. The EQIP-Funded Conservation Practices Assessed in Each Watershed*

| *County* | *Irrigation* | *Field Border* | *Strip Tillage* | *No Tillage* |
|---|---|---|---|---|
| *Adams* | 7,065 | 32 | 38,880 | 2,923 |
| *Alamosa* | 3,215 | | | |
| *Arapahoe* | 2,957 | 8 | 14,800 | |
| *Baca* | 4,597 | 370 | 31,324 | |
| *Bent* | 6,305 | 10 | | |
| *Boulder* | 2,746 | 0.5 | 1,050 | 530 |
| *Chaffee* | 825 | | | |
| *Cheyenne* | 264 | | 4,116 | |
| *Conejos* | 5,187 | | | |
| *Costilla* | 1,907 | | | |
| *Crowley* | 193 | | | |
| *Custer* | 420 | | | |
| *Douglas* | 82 | | | |
| *El Paso* | 267 | | | |
| *Elbert* | 197 | 6 | 1,540 | |
| *Fremont* | 265 | | | |
| *Huerfano* | 354 | | | |
| *Jefferson* | 1 | | | |
| *Kiowa* | 123 | | | 1,951 |
| *Kit Carson* | 1,762 | 3 | 15,634 | 764 |
| *Lake* | 88 | | | |
| *Larimer* | 2,870 | 22 | 3,375 | |
| *Las Animas* | 941 | | | |
| *Lincoln* | 381 | | 730 | 549 |
| *Logan* | 11,633 | 43 | 19,524 | 829 |
| *Mineral* | | | | |
| *Morgan* | 8,689 | | 624 | |

| | | | | |
|---|---|---|---|---|
| *Otero* | 13,115 | | | |
| *Park* | 40 | | | |
| *Phillips* | 5,216 | 1 | 5,265 | 3,071 |
| *Prowers* | 17,796 | | 2,397 | |
| *Pueblo* | 903 | | 118 | |
| *Rio Grande* | 6,569 | | | |
| *Saguache* | 4,746 | | | |
| *Sedgwick* | 8,267 | | 12,102 | |
| *Washington* | 4,920 | 4 | 8,638 | 1,106 |
| *Weld* | 12,709 | 71 | 12,872 | 1,013 |
| *Yuma* | 3,850 | | 26,315 | 2,882 |

*Table 14. Breakdown of Acreages of Each Conservation Practice by County*

### 3.6.1 EQIP-Funded Field Borders and Filter Strips

#### *Field Borders and Filter Strips*

A field border is a strip of permanent vegetation established at the edge or around the perimeter of a field. Field borders are used for wind and water erosion reduction and for the protection of soil and water quality from runoff by filtering out sediment, nutrients, and organic matter. Filter strips are narrow strips of permanent, herbaceous vegetative cover established to remove contaminants from overland flow. Field borders and filter strips reduce pesticides, sediment, nutrients, and organic matter, and increase water infiltration into the soil. Therefore, they are expected to reduce total runoff from fields, which will reduce TN and TP losses at the edge-of-field. SWAT requires a set field border and filter strip width, which was assumed to be 30 feet, as that is the minimum width requirement by the EQIP practice standards. In this analysis, filter strips and contour buffers were included under the field border category for modeling purposes, and the total number of acres of EQIP-funded field border and filter strips is summarized by county in Table 14.



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*Figure 15. Field borders and filter strips help to improve water quality by mitigating runoff (NRCS, 2020).*



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*Figure 16. A field border can intercept nutrients and sediment in runoff, reducing or preventing excess nutrients from entering surface waters (NRCS, 2020).*

## 3.6.2 EQIP-Funded Irrigation Practices

### *Sprinkler Irrigation*

A sprinkler system is an irrigation distribution system that applies water by means of nozzles operated under pressure. Sprinklers increase water use efficiency and uniformly apply water on irrigated lands, improve plant productivity and health, prevent the entry of excessive nutrients, organics, and other chemicals to water resources, as well as improve the condition of soils contaminated with salts and other chemicals. Due to more efficient and precise irrigation water application using a sprinkler system, the amount of runoff leaving a field is greatly reduced compared to furrow or flood irrigation. Therefore, the amount of TN and TP lost at the edge-of-field is expected to be reduced significantly. The irrigation parameters change when converting from flood to sprinkler irrigation in the SWAT model. The total number of acres of EQIP-funded irrigation practices are summarized by irrigation type and county in Table 14, while Table 15, below, details the SWAT irrigation parameters used in this analysis.

| Scenario | SWAT Type | SWAT Method | SWAT Efficiency (%) | SWAT Irrigation Event Depth (mm) |
|---|---|---|---|---|
| **Flood** | Surface Irrigation | Graded Furrow | 50 | 90 |
| **Sprinkler** | Center Pivot | Spray Heads without End Gun | 85 | 25 |

*Table 15. SWAT Irrigation Parameters*

*Figure 17. Center pivot irrigation in Yuma County, Colorado (NRCS, 2020).*

## *Drip Irrigation*

Drip irrigation, also called micro irrigation or trickle irrigation, is used to make frequent applications of small quantities of water on or below the soil surface, placed along a water delivery line and applied directly to the root zone of the plant. It is meant to maintain soil moisture for optimum plant growth while limiting excess water usage. Therefore, drip irrigation involved little to no runoff at the edge-of-field, meaning that there is little to no excess TN or TP that can be lost in runoff when drip irrigation is in use.



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*Figure 18. Example of drip irrigation system. Drip irrigation helps to conserve water by targeting the root zone of the plant and allowing for precise application rates (NRCS, 2020).*

### 3.6.3 EQIP-Funded Tillage Practices

EQIP funded nearly 194,811 acres of strip tillage practices and 15,639 acres of no tillage conservation practices from 2008 to 2018. Table 14, above, shows the distribution of EQIP-funded strip and no tillage practices that were implemented between 2008 and 2018 among the counties considered in this analysis.

#### *Strip Tillage*

Strip tillage, also known as reduced tillage, is done by managing the amount, orientation, and distribution of crop and other plant residue on the soil surface throughout the year while also limiting soil disturbance due to crop growth and harvest activities in systems where the field surface is tilled prior to planting. This is done to reduce soil erosion and tillage-induced particulate emissions in runoff, and to improve soil health and organic matter content. Although the field is being tilled to an extent, the amount of residue that is left on the field helps to prevent soil erosion and surface runoff. Also, the process of tilling residue into the soil incorporates some of the fertilizer that had been applied to the field, so those nutrients are not as easily lost in runoff. Therefore, strip tillage is expected to reduce nutrient losses from edge-of-field runoff. Strip tillage and strip cropping were deemed to have similar effects on edge-of-field nutrient losses, so those acreages were combined for modeling purposes.



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*Figure 19. Strip tillage, also known as reduced or conservation tillage, leaves at least 30% of the soil covered with the previous year's crop residues to prevent erosion from both wind and water (NRCS, 2020).*

## *No Tillage*

No tillage management limits the soil disturbance on a field surface to manage the amount, orientation, and distribution of crop and plant residue throughout the year. All residues are distributed uniformly over the entire field. Under no tillage management, the fertilizers that are applied to the field generally remain on the surface and are more likely to be lost in surface runoff during precipitation events or irrigation events that cause surface runoff. In order to combat this issue, no tillage management sometimes involves injection of the fertilizer into the soil to help incorporate the nutrients and prevent losses in runoff. Overall, nutrient losses via surface runoff tend to be greater in no tillage management compared to strip tillage management, but there are still reductions in nutrient losses compared to conventional tillage. In this analysis, no tillage management involved incorporation of elemental phosphorus by injection into the surface of the soil.

*Figure 20. No-till conservation practices are used to prevent erosion by wind and water (NRCS, 2020).*

## *The Randomization Process: Assigning EQIP Practices within the Model*

The exact location data individual EQIP-funded practices was protected under law and could not be used in the model in order to protect the privacy of Colorado producers. Therefore, a randomization process was used to assign EQIP-funded practices to individual fields within each division based on the county in which that practice was implemented.

The baseline irrigation scenarios were known and were based on the CDWR/CDSS irrigated field layer from 2015 (Colorado.gov/cdss). Any changes to irrigation practices from the county-level EQIP data were added to the baseline scenario by randomly selecting a flood irrigation field and converting that to a sprinkler or micro-irrigation practice.

The exact baseline tillage practices were not known, but a survey of Colorado Agriculture by CSU-Extension, in which producers self-reported their tillage practices, provided the baseline information for a distribution of tillage scenarios. The distribution of baseline tillage scenarios across the modeled fields was 60% conventional tillage, 30% reduced tillage, and 10% strip tillage and no tillage. For the baseline scenarios, a random set of fields that satisfied the given distribution of acreage were selected for each of the tillage types (i.e., a random set of the fields that made up 60% of the irrigated agricultural field area was designated as conventional tillage, then from the remaining fields a random set of reduced tillage were selected that accounted for 30% of the

irrigated agricultural land area, and the remaining 10% of the irrigated agricultural fields were designated as strip tillage for the baseline scenario). In the model, agricultural acreage is handled on a 'per-modeling period' basis and not a 'per year' basis. Therefore, when a new operation is applied to a field, that operation remains in effect for the remainder of the modeling scenario. Then for any EQIP field that changed tillage (strip/no till), we assumed that conventional tillage fields would upgrade to strip/no till. Once those upgrades were exhausted (i.e., no fields left performing conventional tillage), we assumed the reduced tillage fields would convert, etc. Therefore, a field in conventional tillage could only be upgraded to strip till/no till, and a field could only be converted to reduced tillage from strip till/no till.

The baseline assumption for field borders was that no field had a field border, so any EQIP field that upgraded was randomly selected from all of the above fields. All of the above random selections were performed independently of each other. This randomization process was repeated 150 times in order to get a consistent average expected change. Because of the random nature of the field selection process within the model, field borders were allowed to be applied to any type of field, whether it was a field of annual or perennial crops. It is acknowledged that it is often not likely that a field border would be applied to a field of perennial crops. However, due to time and resource restraints, this was not addressed in this iteration of modeling. This averaged value for each county is reported in the results section, with units of average annual pounds per acre per EQIP field, aggregated to the county level.

### *Validation of Model Results*

Once the modeling process was completed, it was necessary to validate the model results using field-level location data from the USDA-NRCS for the exact EQIP practices implemented on specific fields. This was done in cooperation with the USDA-NRCS in order to comply with the established privacy policies. The data was accessed from a secure government-run system at the USDA-NRCS headquarters in Denver, Colorado. NRCS leadership and CSU researchers convened to determine a process for validation that would be efficient, effective, and also abide by the law and privacy policies in place.

CSU researchers brought a GIS field layer of the model results and data to the NRCS headquarters, where the NRCS employees could then break down the modeled results data by field. From the NRCS actual field-level data, the actual EQIP fields were identified, and the observed practice that had been applied on that field was noted. From there, the identical field was found in the modeled data, and that observed practice was selected from the modeled scenarios. This was performed for a select number of fields in a random assortment of counties. Once all of the selected modeled fields had been compared to their corresponding actual EQIP field, the total nutrient reductions were summed, and that observed county-level result was compared to the modeled county-level result, which was found by randomly assigning practices per county, as discussed previously. If this value was within a reasonable range of the modeled value, then the modeled results were properly validated.

# CHAPTER 4: RESULTS AND CONCLUSION

## RESULTS

The application of EQIP-funded conservation practices has led to substantial reductions in TN and TP from agricultural runoff according to model outputs. This analysis evaluated the effects of specific EQIP-funded practices with regard to TN and TP reductions for the Republican, South Platte, Arkansas, and Rio Grande watersheds of Colorado from 2008-2018. It was found that there were substantial reductions for each nutrient and practice.

Overall, the combined effect of the EQIP-funded practices included in this study reduced TN by an average of 8.2% from the affected acreage across the study watersheds. These reductions led to a total of 19.48 tons of TN reduced across the four study watersheds from 2008 to 2018. The maximum reduction was observed in Arapahoe County at 25.8%, while little to no reductions were observed in Jefferson, Kiowa, Logan, and Mineral counties. These low reductions could be attributed to few EQIP-funded acres being present in these counties, or very few irrigated agricultural acres being present, among other factors.

In all, from 2008 to 2018, the implementation of conservation practices within the four watersheds reduced edge-of-field TN losses from an average of 1.83 to 1.68 pounds per acre. This is a total reduction of 19.48 tons across the four study watersheds for this time period.

> "The implementation of EQIP-funded conservation practices … reduced TN by an average of 8.2% per county... and TP by an average of 27.7% per county on the affected acreage across the four study watersheds."

The implementation of EQIP-funded conservation practices reduced edge-of-field TP from 0.24 pounds per acre to 0.17 pounds per acre over the same period, resulting in a reduction of approximately 27.7% of TP from the affected acreage across the four study watersheds. This amounted to 290.94 tons of TP reduced across the four study watersheds for this period. The maximum TP reduction was seen in Logan county at 60.3%. corroborated

The most significant reductions in both TN and TP came from counties with high adoption rates of EQIP-funded irrigation conservation practices, such as sprinkler or drip irrigation (7.1% reduction in TN and 33.5% reduction in TP). The next most significant reductions in TN were found in counties with high adoption rates of strip tillage (6.9% reduction) and no tillage (6.9% reduction), followed by combinations of strip and no tillage practices, which reduced TN by 6.4%. The next most significant reductions in TP were found in counties with high adoption rates of field borders, which yielded a 30.1% reduction, followed by counties with high adoption rates of strip tillage practices (29.6%



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reductions of TP). However, it is also important to note that certain crops are associated with varying levels of nutrient application throughout the growing season, so the number of acres of certain crops in a given year can affect the amount of reduction modeled per county.

In all cases, the modeling found that significant reductions in nutrient loads were achieved through the implementation of the selected EQIP-funded practices. Therefore, the EQIP program has had a clear impact on Colorado agricultural conservation efforts with regard to nutrient abatement.

These results were validated using field-level EQIP data from the USDA-NRCS. Upon observation of the actual conservation practices that were implemented per county, the total reductions in TN and TP were aggregated at the county level and compared to these model outputs. The initial validation process included specific selected counties. Observed reductions for the initial counties were similar to the modeled reduction outputs, providing a level of confidence in the modeled results.

Previous modeling efforts had been adjusted in order to attain these finalized, improved model results. The harvest dates of certain crops were adjusted to be later in the year in order to better model the in-field effects of biomass production, nutrient uptake, and soil erosion prevention. Additionally, phosphorus was incorporated for all no tillage practices in order to be more realistic. In addition, initial model outputs were parsed incorrectly for some fields, resulting in zero runoff values for fields with conventional tillage. This gave a false value for the baseline scenario. In these instances, QA/QC of the modeling results by hand allowed for this error to be fixed for each field, improving the accuracy of the result summaries compared with the initial draft modeling results.

> "The EQIP program has had a clear impact on Colorado agricultural conservation efforts with regard to nutrient abatement."

### *Field Scale Results*

An analysis of the results of each management action at the field scale can show the impacts at the edge-of-field of various conservation practices. The following section shows the trends in the single field scale impacts of applying conservation practices. Table 16 shows the varying levels of nitrogen and phosphorus loss rate reductions at the edge-of-field with the implementation of certain conservation practices. Irrigation practices had the greatest impact on reducing TN and TP with 7.1% and 33.5% reductions, respectively, on the combined acreage where these practices were implemented. This is likely due to increased application efficiency of irrigation water and the resulting effect of reduced runoff from the field. The total impact of the EQIP program on reducing TP within the four watersheds was 27.7 %, and the total impact on reducing TN within the four watersheds was 8.2%.

Table 17 shows the total reductions, in total tons, from the baseline scenario to the conservation practice scenario as an average of all counties in the four watersheds. The strip tillage practices had



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the highest individual TN tonnage reductions at 15.51 tons, followed by combinations of strip and no tillage practices, which reduced TN tonnages by 15.36 tons. The least reductions of TN were observed for the implementation of field borders, likely due to the fact that field borders function mainly to trap sediment and slow runoff. TN is soluble and is often absorbed in the runoff, which is only slowed, and sometimes filtered, by field borders. Therefore, field borders are most successful in stopping particulate pollutants, such as TP, which is often adsorbed to soil particles in the runoff. Irrigation practice implementation (sprinkler and drip) had the highest individual TP reductions at 291.71 tons across the four watersheds, with very similar reductions in tons for each of the other considered EQIP-funded conservation practices. The implementation of all EQIP practices reduced the total tons of TN by 19.48 tons and the total tons of TP by 290.94 tons. The total reductions of TN are much lower than those of TP. This is likely due to the fact that much of the nitrogen is moved from surface runoff to percolation to groundwater through the management scenarios used in this model. However, because these are total runoff values (i.e. surface plus subsurface), nitrogen reduction is likely lower than if only surface runoff had been examined.

> "EQIP-funded conservation practices led to a total reduction of 19.48 tons of TN…and 290.94 tons of TP… across the four study watersheds from 2008 to 2018."

| *EQIP-Funded Conservation Practice* | *% Reduction of Total Nitrogen* | *% Reduction of Total Phosphorus* |
|---|---|---|
| *Baseline* | - | - |
| *Irrigation (Sprinkler and Drip)* | 7.1 | 33.5 |
| *Field Border* | 6.3 | 30.1 |
| *Strip Till* | 6.9 | 29.6 |
| *No Till* | 6.9 | 24.4 |
| *Strip and No Till Combinations* | 6.4 | 23.4 |
| *All EQIP Progress* | 8.2 | 27.7 |

*Table 16: Edge-of-Field Nutrient Loss Reductions as a Percentage* Due to EQIP-Funded Conservation Practices Implemented between 2008 and 2018 in the Four Study Watersheds.***

**The percentages reported are the average percent reductions, averaged across the counties in each division*
***South Platte, Republican, Lower Arkansas, Rio Grande*

| *EQIP-Funded Conservation Practice* | *Reduction of Total Nitrogen (tons)* | *Reduction of Total Phosphorus (tons)* |
|---|---|---|



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| | | |
|---|---|---|
| *Baseline* | - | - |
| *Irrigation (Sprinkler and Drip)* | 8.68 | 291.71 |
| *Field Border* | 4.14 | 290.06 |
| *Strip Till* | 15.51 | 290.16 |
| *No Till* | 5.6 | 289.3 |
| *Strip and No Till Combinations* | 15.36 | 289.24 |
| *All EQIP Progress* | 19.48 | 290.94 |

*Table 17: Edge-of-Field Nutrient Loss Reductions (tons) due to EQIP-Funded Conservation Practices Implemented between 2008 and 2018 in the Four Study Watersheds.***

***South Platte, Republican, Lower Arkansas, Rio Grande*

Table 18 below shows similar information to Table 16, but the percent nutrient reductions are broken down by division. Table 19 shows information similar to Table 17, except that the nutrient reductions are broken down by division. Some counties are split between divisions, but the model outputs were aggregated at the county level, so those county's reductions were included in the average for each of the divisions in which they are located. The total reductions resulting in each division are affected by the number of EQIP-funded agricultural acres in each division, as well as the actual practices that are implemented and the application rate of the modeled practices. For example, Division 2 is approximately 430,000 acres, which is nearly 3 times smaller than Division 1 at 1.2 million acres. Therefore, when analyzing the difference in the reduction of total tons of nutrient in each watershed, we can expect to see a difference in those values similar to the scale of change in size of each watershed. Additionally, Division 3 had minimal EQIP adoption compared to the other divisions, which will lead to less reductions of nutrients observed simply due to the smaller scale of EQIP adoption rates, and not necessarily due to less nutrient abatement in the area. Also, land that has been taken out of production during the period of analysis, 2008-2018, will affect the range of total reductions seen in each county. For example, a county that transitioned from predominantly agricultural land in 2008 to predominantly urban land in 2018 may show higher reductions of TN and TP than might be observed.



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| | EQIP-Funded Conservation Practice | % Reduction of Total Nitrogen | % Reduction of Total Phosphorus |
|---|---|---|---|
| Division 1 | Irrigation (Sprinkler and Drip) | 7.7 | 46.3 |
| | Field Border | 7.1 | 43.8 |
| | Strip Till | 8.6 | 43.7 |
| | No Till | 5.7 | 38.9 |
| | Strip and No Till Combinations | 7.9 | 37.3 |
| | All EQIP Progress | 10.8 | 42.0 |
| Division 2 | Irrigation (Sprinkler and Drip) | 9.2 | 19.5 |
| | Field Border | 7.0 | 15.4 |
| | Strip Till | 6.8 | 15.3 |
| | No Till | 7.8 | 15.6 |
| | Strip and No Till Combinations | 7.1 | 13.3 |
| | All EQIP Progress | 9.9 | 18.8 |
| Division 3 | Irrigation (Sprinkler and Drip) | 5.8 | 7.1 |
| | Field Border | 3.2 | 1.6 |
| | Strip Till | 3.6 | 2.6 |
| | No Till | 5.1 | 2.8 |
| | Strip and No Till Combinations | 4.7 | 2.1 |
| | All EQIP Progress | 5.6 | 6.8 |

*Table 18: Edge-of-Field Nutrient Loss Reductions as a Percentage* Due to EQIP-Funded Conservation Practices Implemented Between 2008 and 2018 in the Three Divisions Included in This Analysis.*

**The percentages reported here are crop-area weighted average percent reductions of each county in each division and do not reflect a linear sum of previous reductions.*



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| | EQIP-Funded Conservation Practice | Reduction of Total Nitrogen (tons) | Reduction of Total Phosphorus (tons) |
|---|---|---|---|
| Division 1 | Irrigation (Sprinkler and Drip) | 4.3 | 231.2 |
| | Field Border | 1.9 | 230.5 |
| | Strip Till | 13.1 | 230.7 |
| | No Till | 2.9 | 229.8 |
| | Strip and No Till Combinations | 14 | 229.9 |
| | All EQIP Progress | 15.7 | 230.6 |
| Division 2 | Irrigation (Sprinkler and Drip) | 3.4 | 43.8 |
| | Field Border | 1.8 | 43.0 |
| | Strip Till | 1.7 | 42.9 |
| | No Till | 2.3 | 43.0 |
| | Strip and No Till Combinations | 0.9 | 42.8 |
| | All EQIP Progress | 2.9 | 43.7 |
| Division 3 | Irrigation (Sprinkler and Drip) | 1.0 | 16.7 |
| | Field Border | 0.4 | 16.5 |
| | Strip Till | 0.7 | 16.6 |
| | No Till | 0.4 | 16.5 |
| | Strip and No Till Combinations | 0.5 | 16.5 |
| | All EQIP Progress | 0.9 | 16.7 |

*Table 19: Edge-of-Field Nutrient Loss Reductions (tons) Due to EQIP-Funded Conservation Practices Implemented Between 2008 and 2018 in the Three Divisions Included in This Analysis.*

Tables 20 and 21, below, detail the total reductions in tons of both TN and TP per county and EQIP-funded conservation practice. The model outputs were aggregated at the county level for reporting purposes, so county-level dissemination of the results provides a more accurate description of the effects of various conservation practices. Tables 22 and 23, below, show the percent reductions at the county level for both TN and TP by EQIP-funded conservation practice. The values in Tables 20-23 are total off-site values of the reduction from both the surface and subsurface flow that leaves the field and the field's shallow soil profile.

| | Reduction of Total Nitrogen (tons) | | | | | |
|---|---|---|---|---|---|---|
| *County* | Irrigation (Sprinkler and Drip) | Field Border | Strip Till | No Till | Strip and No Till Combinations | All EQIP Practices |
| *Adams* | 0.2 | 0.0 | 1.6 | 0.3 | 1.4 | 1.7 |
| *Alamosa* | 0.2 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| *Arapahoe* | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 |
| *Baca* | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 |
| *Bent* | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| *Boulder* | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 |
| *Chaffee* | 0.4 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 |
| *Cheyenne* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Conejos* | 0.2 | 0.1 | 0.2 | 0.0 | 0.1 | 0.1 |
| *Costilla* | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| *Crowley* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Custer* | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.0 |
| *Douglas* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *El Paso* | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| *Elbert* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Fremont* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Huerfano* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Jefferson* | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| *Kiowa* | 1.0 | 0.7 | 0.3 | 0.9 | 0.0 | 0.0 |
| *Kit Carson* | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| *Lake* | 0.3 | 0.5 | 0.3 | 0.4 | 0.0 | 0.6 |
| *Larimer* | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| *Las Animas* | 0.1 | 0.1 | 0.0 | 0.1 | 0.2 | 0.0 |
| *Lincoln* | 0.1 | 0.0 | 0.3 | 0.0 | 0.1 | 0.3 |
| *Logan* | 0.6 | 0.1 | 0.1 | 0.6 | 0.2 | 0.0 |
| *Mineral* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Morgan* | 0.3 | 0.1 | 0.0 | 0.0 | 0.2 | 0.1 |
| *Otero* | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 |
| *Park* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Phillips* | 0.0 | 0.6 | 0.7 | 0.3 | 0.6 | 0.1 |
| *Prowers* | 0.3 | 0.1 | 0.1 | 0.1 | 0.0 | 0.6 |
| *Pueblo* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Rio Grande* | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| *Saguache* | 0.0 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| *Sedgwick* | 0.8 | 0.0 | 4.3 | 0.2 | 4.1 | 5.1 |
| *Washington* | 0.3 | 0.1 | 0.8 | 0.1 | 1.2 | 1.5 |
| *Weld* | 0.4 | 0.0 | 0.6 | 0.3 | 0.5 | 0.8 |
| *Yuma* | 0.2 | 0.0 | 4.0 | 0.4 | 5.3 | 4.9 |

*Table 20. Summary of Reductions (Tons) of Total Nitrogen per Conservation Practice by County*

| | *Reduction of Total Phosphorus (tons)* | | | | | |
|---|---|---|---|---|---|---|
| *County* | Irrigation (Sprinkler and Drip) | Field Border | Strip Till | No Till | Strip and No Till Combinations | All EQIP Practices |
| *Adams* | 6.7 | 6.6 | 6.6 | 6.3 | 6.3 | 6.5 |
| *Alamosa* | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| *Arapahoe* | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| *Baca* | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |
| *Bent* | 2.1 | 2.0 | 2.0 | 1.9 | 2.0 | 2.1 |
| *Boulder* | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| *Chaffee* | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| *Cheyenne* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| *Conejos* | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| *Costilla* | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| *Crowley* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Custer* | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| *Douglas* | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| *El Paso* | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| *Elbert* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| *Fremont* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| *Huerfano* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| *Jefferson* | 0.5 | 0.5 | 0.5 | 0.2 | 0.2 | 0.1 |
| *Kiowa* | 5.4 | 5.4 | 5.4 | 5.4 | 5.3 | 5.3 |
| *Kit Carson* | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| *Lake* | 4.8 | 4.8 | 4.8 | 4.8 | 4.7 | 4.8 |
| *Larimer* | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| *Las Animas* | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| *Lincoln* | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| *Logan* | 13.9 | 13.8 | 13.8 | 13.8 | 13.8 | 13.9 |
| *Mineral* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Morgan* | 9.4 | 9.4 | 9.4 | 9.4 | 9.4 | 9.4 |
| *Otero* | 2.4 | 2.1 | 2.1 | 2.1 | 2.1 | 2.4 |
| *Park* | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| *Phillips* | 15.6 | 15.6 | 15.6 | 15.6 | 15.6 | 15.6 |
| *Prowers* | 7.0 | 6.7 | 6.7 | 6.7 | 6.7 | 7.0 |
| *Pueblo* | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| *Rio Grande* | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| *Saguache* | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| *Sedgwick* | 35.8 | 35.6 | 35.7 | 35.6 | 35.7 | 35.8 |
| *Washington* | 18.3 | 18.2 | 18.2 | 18.2 | 18.2 | 18.2 |
| *Weld* | 22.1 | 22.0 | 22.0 | 22.0 | 22.0 | 22.1 |
| *Yuma* | 88.9 | 88.9 | 89.0 | 88.9 | 88.9 | 88.9 |

*Table 21. Summary of Reductions (Tons) of Total Phosphorus per Conservation Practice by County*



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| | *Percent Reduction of Total Nitrogen* | | | | | |
|---|---|---|---|---|---|---|
| *County* | Irrigation (Sprinkler and Drip) | Field Border | Strip Till | No Till | Strip and No Till Combinations | All EQIP Practices |
| *Adams* | 2.4 | 0.5 | 21.8 | 4.0 | 20.1 | 23.3 |
| *Alamosa* | 14.4 | 0.0 | 7.0 | 8.6 | 6.0 | 12.4 |
| *Arapahoe* | 9.1 | 13.7 | 9.1 | 1.5 | 10.5 | 25.8 |
| *Baca* | 1.0 | 0.1 | 0.5 | 6.3 | 0.0 | 2.6 |
| *Bent* | 6.0 | 0.7 | 0.7 | 0.0 | 1.1 | 5.0 |
| *Boulder* | 5.4 | 3.4 | 1.0 | 4.1 | 4.0 | 2.3 |
| *Chaffee* | 6.2 | 0.5 | 3.1 | 0.0 | 0.5 | 3.3 |
| *Cheyenne* | 6.8 | 3.2 | 3.8 | 0.0 | 16.7 | 18.9 |
| *Conejos* | 4.8 | 3.1 | 5.4 | 0.6 | 3.4 | 3.2 |
| *Costilla* | 8.4 | 1.9 | 5.0 | 1.6 | 2.4 | 8.1 |
| *Crowley* | 3.3 | 8.5 | 0.9 | 0.0 | 5.4 | 5.8 |
| *Custer* | 7.5 | 4.7 | 3.9 | 14.5 | 5.6 | 1.8 |
| *Douglas* | 0.0 | 16.6 | 16.4 | 4.3 | 5.0 | 21.4 |
| *El Paso* | 8.4 | 0.0 | 1.6 | 3.2 | 7.7 | 8.4 |
| *Elbert* | 13.1 | 8.7 | 7.3 | 7.7 | 9.3 | 9.5 |
| *Fremont* | 8.8 | 9.0 | 4.9 | 17.7 | 15.0 | 10.0 |
| *Huerfano* | 4.1 | 6.5 | 0.0 | 5.1 | 9.7 | 4.2 |
| *Jefferson* | 12.7 | 15.6 | 8.7 | 8.1 | 7.5 | 0.0 |
| *Kiowa* | 17.5 | 12.2 | 5.6 | 15.0 | 0.5 | 0.0 |
| *Kit Carson* | 4.0 | 2.1 | 0.6 | 0.1 | 1.6 | 3.6 |
| *Lake* | 6.4 | 10.7 | 5.5 | 7.7 | 0.0 | 11.0 |
| *Larimer* | 8.8 | 4.5 | 3.4 | 2.1 | 0.0 | 0.6 |
| *Las Animas* | 12.2 | 5.9 | 0.0 | 10.8 | 19.4 | 3.1 |
| *Lincoln* | 4.6 | 0.0 | 8.5 | 0.0 | 4.0 | 9.7 |
| *Logan* | 4.0 | 0.6 | 0.4 | 3.8 | 1.3 | 0.0 |
| *Mineral* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Morgan* | 3.2 | 1.4 | 0.0 | 0.2 | 2.0 | 1.2 |
| *Otero* | 6.4 | 0.6 | 0.0 | 0.8 | 0.5 | 7.1 |
| *Park* | 61.6 | 63.0 | 62.0 | 66.7 | 48.5 | 57.2 |
| *Phillips* | 0.0 | 3.7 | 4.6 | 2.0 | 3.5 | 0.7 |
| *Prowers* | 3.6 | 0.9 | 1.6 | 1.0 | 0.0 | 6.6 |
| *Pueblo* | 5.8 | 0.0 | 9.8 | 5.2 | 0.5 | 8.3 |
| *Rio Grande* | 1.9 | 0.3 | 0.1 | 0.0 | 0.5 | 4.3 |
| *Saguache* | 1.4 | 5.6 | 6.8 | 3.4 | 3.5 | 8.7 |
| *Sedgwick* | 2.2 | 0.0 | 11.6 | 0.7 | 11.2 | 13.8 |
| *Washington* | 1.7 | 0.4 | 4.4 | 0.7 | 6.4 | 7.9 |
| *Weld* | 1.7 | 0.0 | 2.4 | 1.4 | 2.0 | 3.5 |
| *Yuma* | 0.2 | 0.0 | 4.4 | 0.4 | 5.9 | 5.4 |

*Table 22. Summary of Percent Reduction of Total Nitrogen per Conservation Practice by County*

| | Percent Reduction of Total Phosphorus | | | | | |
|---|---|---|---|---|---|---|
| *County* | Irrigation (Sprinkler and Drip) | Field Border | Strip Till | No Till | Strip and No Till Combinations | All EQIP Practices |
| *Adams* | 63.1 | 54.0 | 55.5 | 37.1 | 37.4 | 49.2 |
| *Alamosa* | 14.2 | 0.0 | 4.6 | 3.2 | 1.2 | 11.4 |
| *Arapahoe* | 67.8 | 65.9 | 61.0 | 60.1 | 60.8 | 71.5 |
| *Baca* | 37.3 | 36.0 | 35.0 | 36.1 | 35.5 | 35.9 |
| *Bent* | 11.0 | 0.4 | 0.3 | 0.0 | 0.6 | 11.5 |
| *Boulder* | 40.9 | 35.7 | 34.9 | 35.7 | 34.9 | 39.6 |
| *Chaffee* | 8.9 | 1.2 | 2.9 | 0.5 | 0.0 | 5.8 |
| *Cheyenne* | 54.9 | 52.6 | 58.5 | 57.1 | 58.5 | 55.1 |
| *Conejos* | 5.7 | 2.3 | 2.9 | 1.3 | 2.9 | 5.4 |
| *Costilla* | 12.2 | 5.1 | 4.5 | 4.7 | 2.3 | 13.8 |
| *Crowley* | 2.5 | 4.6 | 3.3 | 0.0 | 2.9 | 5.1 |
| *Custer* | 4.0 | 0.8 | 2.3 | 8.9 | 4.3 | 0.0 |
| *Douglas* | 51.6 | 56.6 | 55.5 | 49.2 | 48.7 | 60.0 |
| *El Paso* | 3.9 | 3.8 | 2.8 | 1.5 | 0.0 | 7.5 |
| *Elbert* | 45.3 | 44.3 | 39.8 | 44.8 | 44.9 | 43.7 |
| *Fremont* | 3.9 | 0.0 | 3.9 | 5.7 | 1.4 | 3.4 |
| *Huerfano* | 0.0 | 0.0 | 0.6 | 1.6 | 4.3 | 2.3 |
| *Jefferson* | 81.0 | 81.6 | 80.2 | 8.6 | 7.8 | 0.0 |
| *Kiowa* | 24.6 | 21.5 | 9.8 | 19.5 | 6.8 | 4.8 |
| *Kit Carson* | 47.6 | 44.8 | 45.8 | 45.9 | 45.7 | 47.7 |
| *Lake* | 9.9 | 12.7 | 6.7 | 12.2 | 0.0 | 11.3 |
| *Larimer* | 39.2 | 35.0 | 35.0 | 35.7 | 33.4 | 37.6 |
| *Las Animas* | 7.0 | 1.6 | 1.4 | 2.6 | 4.1 | 4.3 |
| *Lincoln* | 16.8 | 11.5 | 9.5 | 3.1 | 0.0 | 9.9 |
| *Logan* | 60.8 | 55.7 | 55.2 | 55.6 | 55.8 | 60.3 |
| *Mineral* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Morgan* | 59.0 | 55.4 | 55.7 | 55.1 | 55.4 | 59.0 |
| *Otero* | 17.6 | 0.7 | 0.8 | 0.4 | 0.2 | 18.0 |
| *Park* | 50.7 | 51.1 | 55.7 | 58.9 | 41.1 | 51.3 |
| *Phillips* | 56.4 | 56.3 | 56.7 | 55.8 | 56.4 | 56.9 |
| *Prowers* | 13.2 | 0.0 | 0.7 | 0.5 | 0.0 | 13.2 |
| *Pueblo* | 5.2 | 0.9 | 3.2 | 1.6 | 0.0 | 4.9 |
| *Rio Grande* | 14.0 | 3.1 | 0.0 | 2.0 | 0.2 | 14.3 |
| *Saguache* | 8.3 | 3.6 | 3.8 | 0.0 | 3.9 | 11.5 |
| *Sedgwick* | 49.9 | 43.5 | 45.9 | 43.9 | 45.8 | 52.1 |
| *Washington* | 57.6 | 54.8 | 56.2 | 52.4 | 52.8 | 57.1 |
| *Weld* | 49.6 | 47.2 | 47.5 | 47.2 | 47.1 | 49.8 |
| *Yuma* | 57.0 | 56.8 | 57.8 | 55.5 | 57.0 | 57.0 |

*Table 23. Percent Reduction of Total Phosphorus by Conservation Practice and County*

## *Reduction by EQIP-funded Irrigation Practices*

Figures 21 and 22 show the total average reductions of TN and TP achieved through the implementation of EQIP-funded irrigation practices. The transition to more efficient, EQIP-funded irrigation techniques led to edge-of-field averaged reductions of 0.13 lb/acre of TN (7.1% reduction) total and an average reduction of 0.08 lb/acre of TP (33.5% reduction) total from the affected irrigated acres across the four study watersheds, meaning the improved irrigation techniques reduced edge-of-field losses by 0.13 lb/ac for TN and 0.08 lb/ac for TP across all four watersheds.

The total reductions of TN from the affected EQIP-funded irrigated acres in Division 1, averaged across all counties in Division 1, were approximately 0.16 lb/acre (7.7% reduction), and the total reductions of TP from the affected EQIP-funded irrigated acres in Division 1, averaged across all counties in Division 1, were 0.12 lb/acre (46.3% reduction). Division 2 saw reductions of TN and TP at nearly 0.18 lb/acre (9.2% reduction) and 0.05 lb/acre (19.6% reduction), respectively. Division 3 had average reductions of TN and TP at approximately 0.11 lb/acre (5.8% reduction) and 0.012 lb/acre (7.1% reduction) respectively.

Some counties included in this analysis have fewer irrigated agricultural acres than other counties, which may affect the model outputs in those regions and should be addressed. For example, Park county consistently shows very high reductions across all conservation practice results. However, Park county only has 41 EQIP-funded irrigated agricultural acres. Therefore, the results for each of those fields in Park county have a higher weight in calculating the reduction values than the individual fields in counties with very high amounts of EQIP-funded acres.

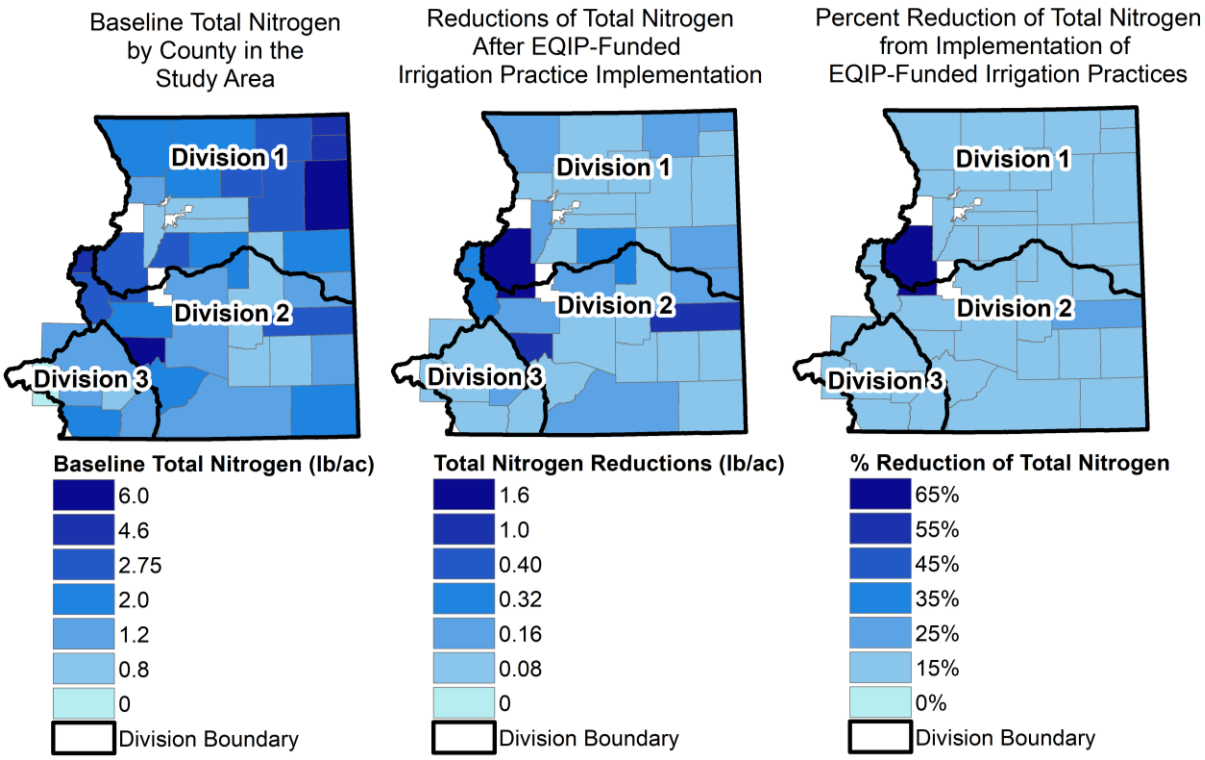




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*Figure 21: Total Nitrogen reduction from irrigation practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded irrigation (sprinkler and drip) practices (middle) from 2008 to 2018. The map on the right shows the percent change in TN after the implementation of these practices.*

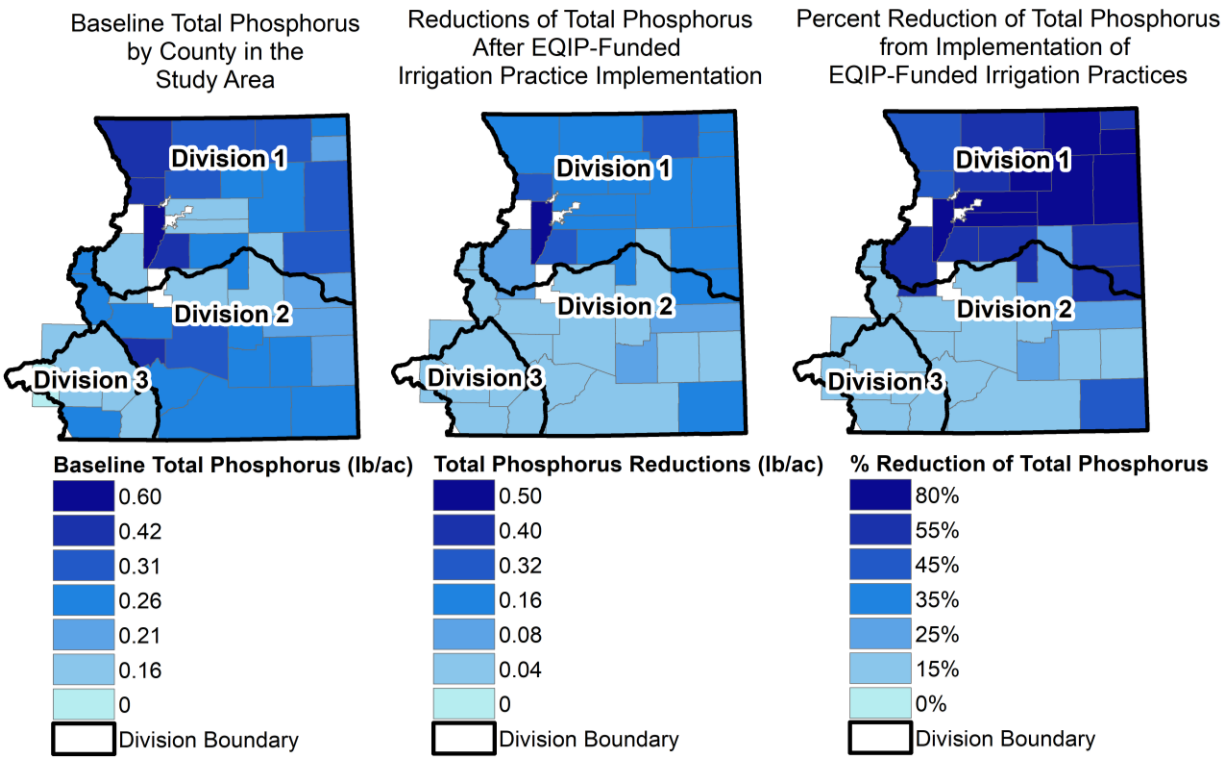


*Figure 22: Total Phosphorus reduction from irrigation practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded irrigation (sprinkler and drip) practices (middle) from 2008 to 2018. The map on the right shows the percent change in TP after the implementation of these practices.*

## *Reduction by EQIP-funded Strip Tillage Practices*

Figures 23 and 24 show the average reductions in TN and TP from the implementation of EQIP-funded strip tillage practices. The transition to strip tillage techniques led to an average reduction of 0.13 lb/acre of TN (a 6.9% reduction) and an average reduction of 0.07 lb/acre of TP (a 29.6% reduction) total from the affected EQIP-funded irrigated agricultural acres across the four study watersheds.

The total average reductions of TN in Division 1, averaged across all counties in Division 1, were approximately 0.19 lb/acre (8.6% reduction) from the affected EQIP-funded acreages, and the total reductions of TP in Division 1, averaged across all counties in Division 1, were 0.11 lb/acre (43.7% reduction). Division 2 saw average reductions of TN and TP at nearly 0.15 lb/acre (6.8% reduction) and 0.04 lb/acre (15.3% reduction), respectively, from the affected EQIP-funded acreages. Division

3 had average reductions of TN and TP at approximately 0.06 lb/acre (3.6% reduction) and 0.01 lb/acre (2.6% reduction), respectively, from the affected EQIP-funded acres.

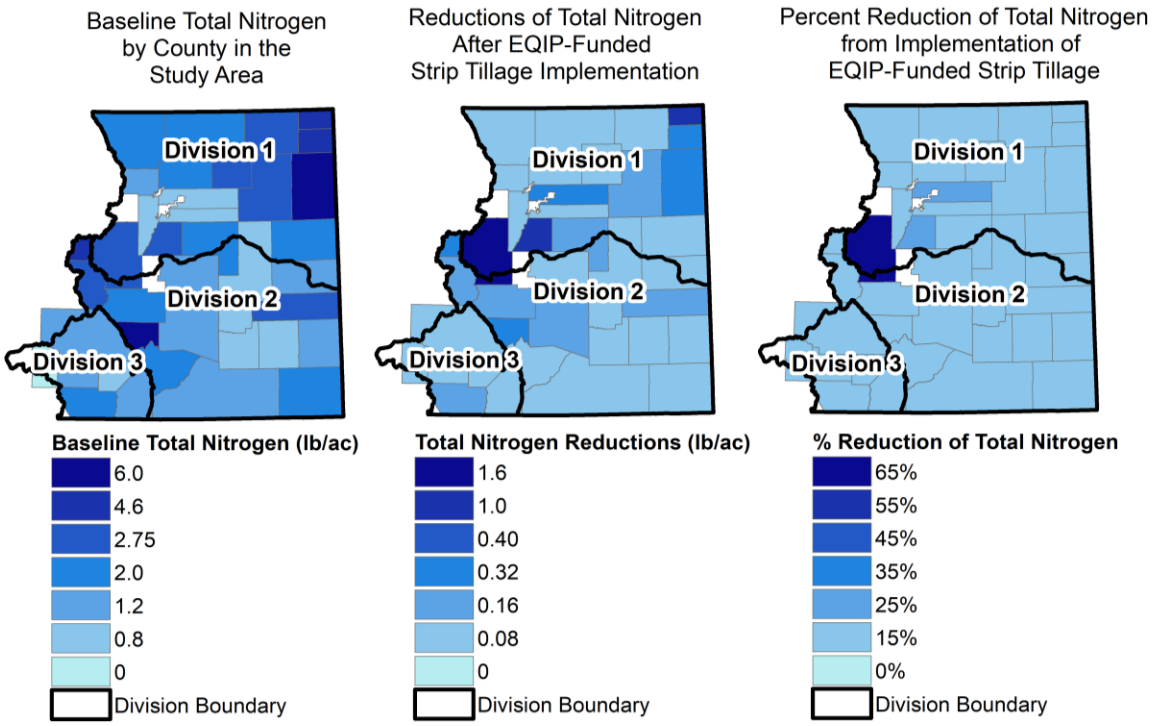


*Figure 23: Total Nitrogen reduction from the implementation of strip tillage practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded strip tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TN after the implementation of these practices.*

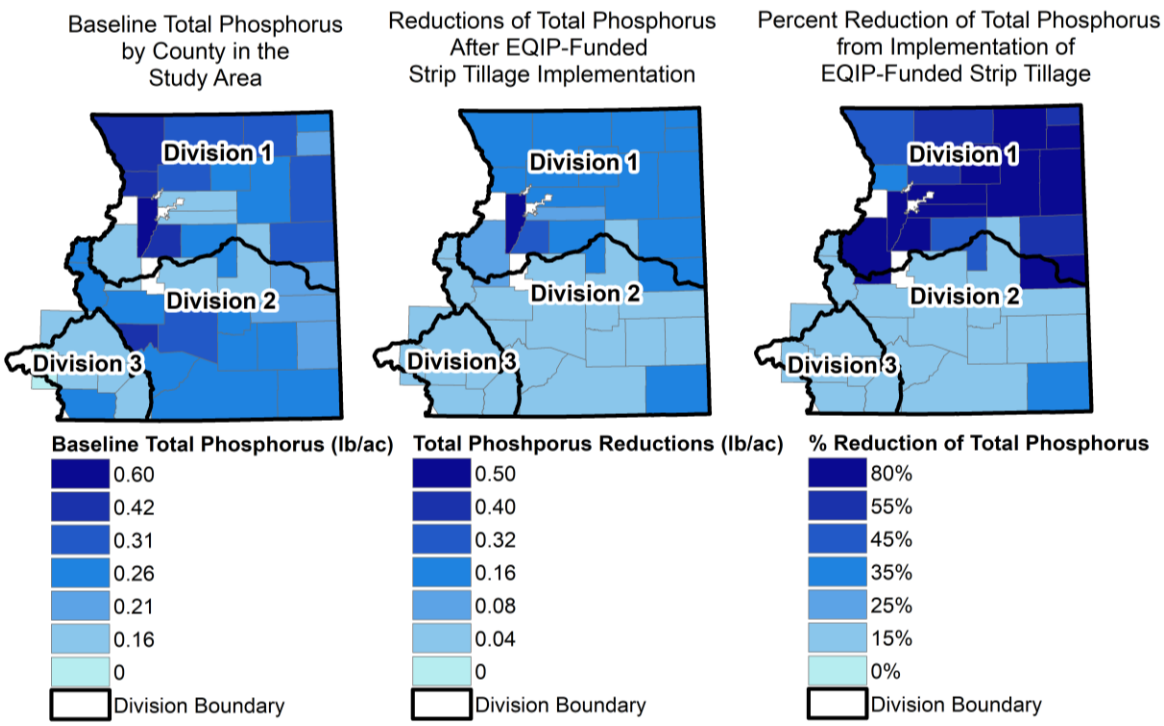


*Figure 24: Total Phosphorus reduction from the implementation of strip tillage practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded strip tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TP after the implementation of these practices.*

## *Reduction by EQIP-funded No Tillage Practices*

Figures 25 and 26 show the average reductions in TN and TP from the implementation of EQIP-funded no tillage practices. The transition to no tillage conservation techniques led to an average reduction of 0.13 lb/acre of TN (a 6.9% reduction) and an average reduction of 0.06 lb/acre of TP (a 24.4% reduction) total from the affected EQIP-funded irrigated agricultural acres across the four study watersheds.

The total averaged reductions of TN in Division 1, averaged across all counties in Division 1, were approximately 0.13 lb/acre (5.7% reduction), and the total reductions of TP in Division 1, averaged across all counties in Division 1, were 0.10 lb/acre (38.8% reduction) for the affected EQIP-funded acres. Division 2 saw reductions, averaged across all counties in Division 2, of TN and TP at nearly 0.19 lb/acre (7.8% reduction) and 0.04 lb/acre (15.6% reduction), respectively, from the affected EQIP-funded acres. Division 3 had reductions of TN and TP, averaged across all counties in Division 3, at approximately 0.13 lb/acre (5.1% reduction) and 0.01 lb/acre (2.8% reduction) respectively, from the affected EQIP-funded acres.


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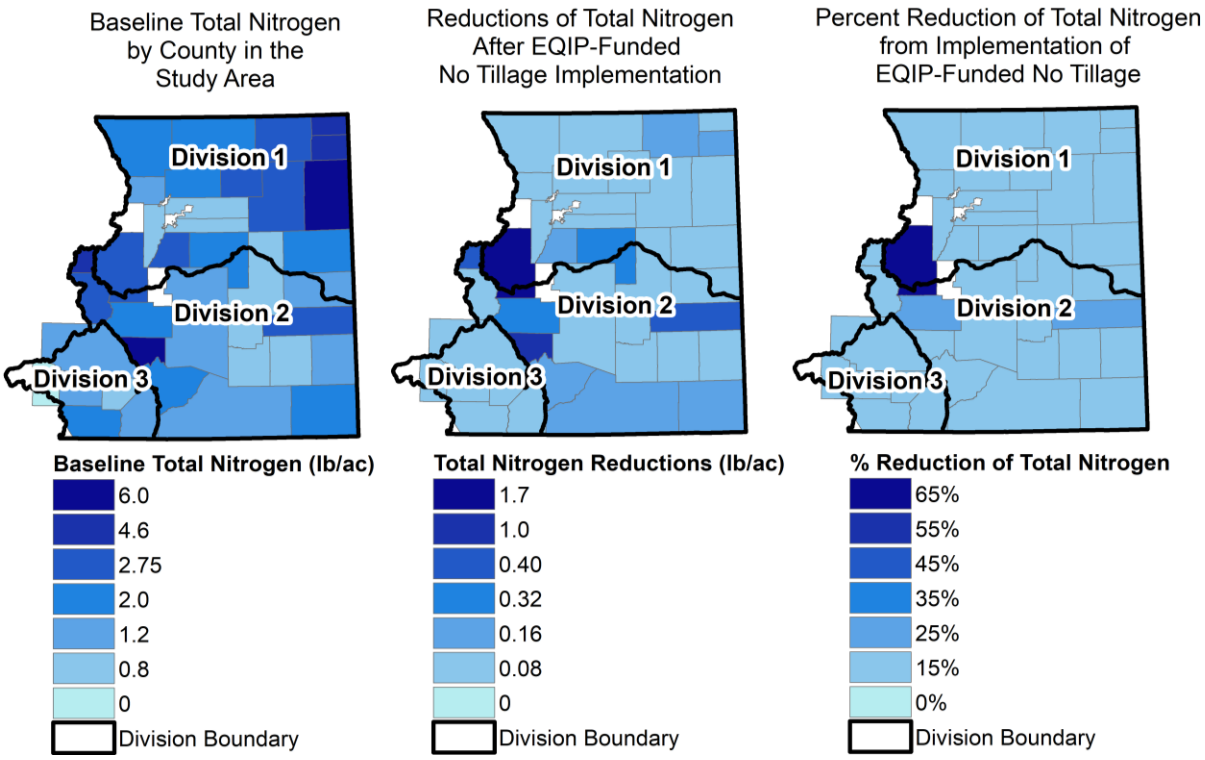


*Figure 25: Total Nitrogen reduction from no tillage practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded no tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TN after practice implementation.*

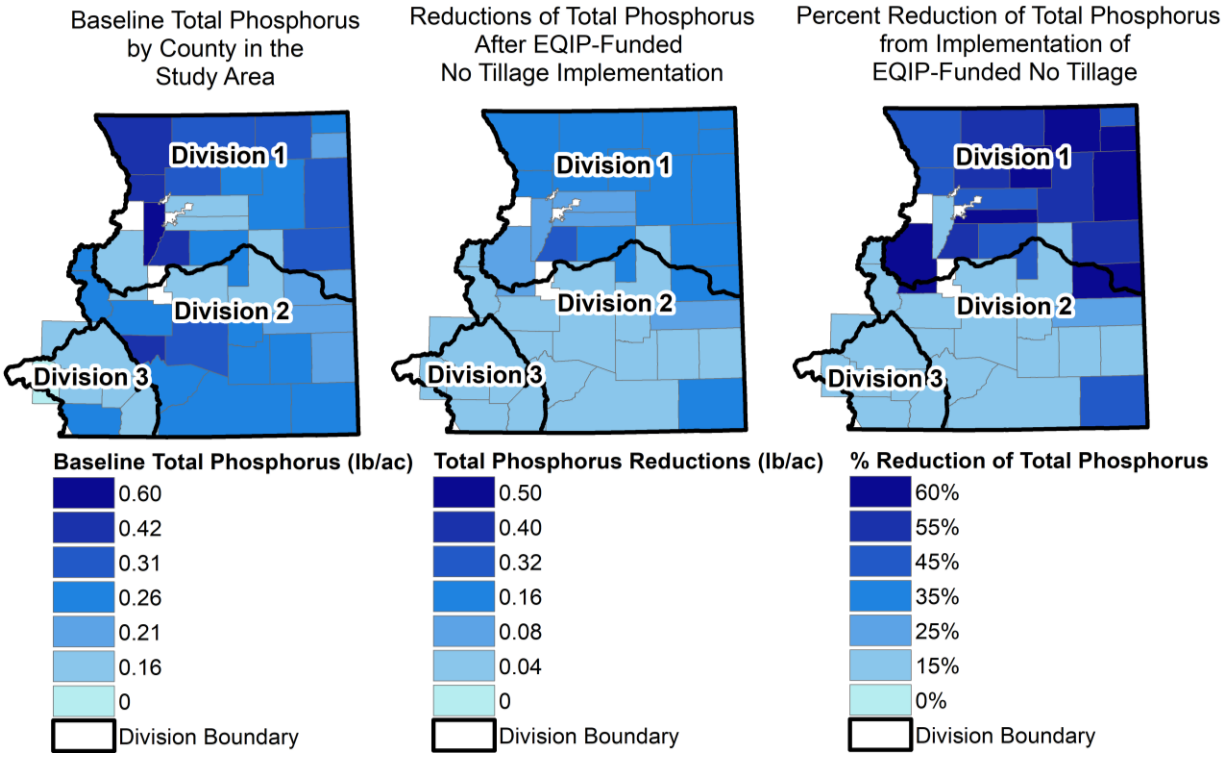


*Figure 26: Total Phosphorus reduction from no tillage practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded no tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TP after practice implementation.*

## *Reduction by EQIP-funded Strip and No Tillage Practice Combinations*

Figures 27 and 28 show the average reductions in TN and TP from the implementation of any combination of EQIP-funded strip and no tillage practices. The transition to these combinations of strip and no tillage conservation techniques led to an average reduction, averaged across all counties in the four study watersheds, of 0.12 lb/acre of TN (a 6.4% reduction) and a reduction of 0.06 lb/acre of TP (a 23.3% reduction) total across the four study watersheds.

The total reduction of TN in Division 1, averaged across all counties in Division 1, was approximately 0.16 lb/acre (7.97% reduction), and the total reduction of TP in Division 1, averaged across all counties in Division 1, was 0.09 lb/acre (37.3% reduction) for the affected EQIP-funded acres. Division 2 saw reductions of TN and TP, averaged across all counties in Division 2, at nearly 0.13 lb/acre (7.1% reduction) and 0.03 lb/acre (13.3% reduction), respectively, for the affected EQIP-funded acres. Division 3 had reductions of TN and TP, averaged across all counties in Division 3, at approximately 0.09 lb/acre (4.6% reduction) and 0.004 lb/acre (2.05% reduction) respectively, for the EQIP-funded acres.


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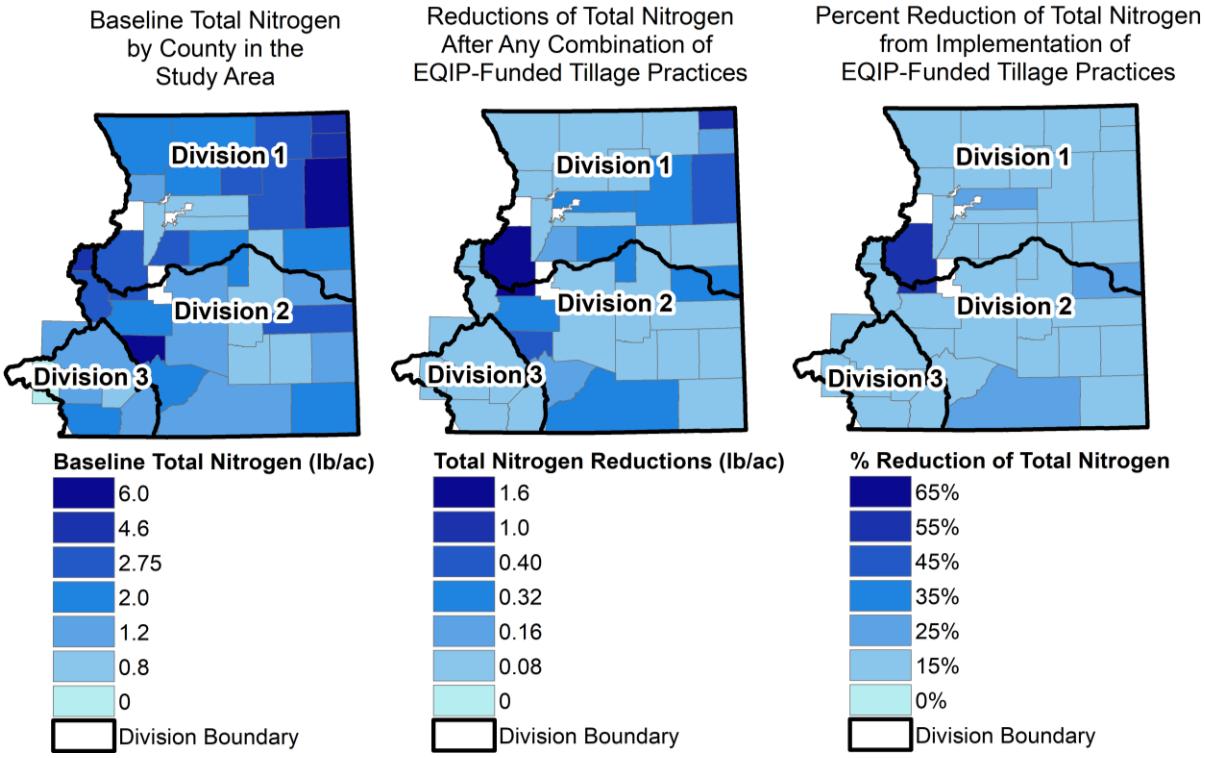


*Figure 27: Total Nitrogen reduction from randomized combinations of EQIP-funded tillage practices comparing the baseline agricultural practices (left) vs. the implementation of any combination of EQIP-funded tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TN after the implementation of these random combinations of tillage practices.*



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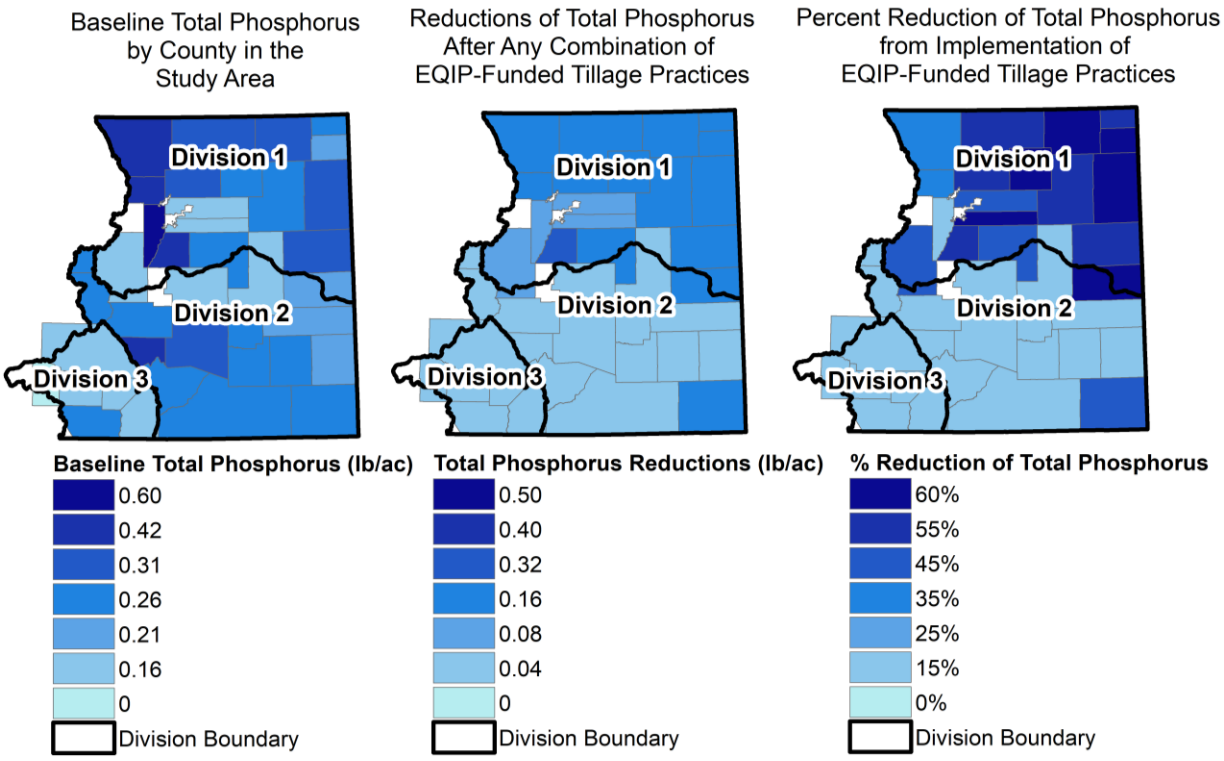


*Figure 28: Total Phosphorus reduction from randomized combinations of EQIP-funded tillage practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded tillage practices (middle) from 2008 to 2018. The map on the right shows the percent change in TP after the implementation of these random combinations of tillage practices.*

## *Reduction by EQIP-funded Field Border Implementation*

Figures 29 and 30 show the average reductions in TN and TP from the implementation of EQIP-funded field border implementation. The transition to field border conservation techniques led to an average reduction of 0.11 lb/acre of TN (a 6.3% reduction) and an average reduction of 0.07 lb/acre of TP (a 30.1% reduction) total for the affected EQIP-funded acres across the four study watersheds.

The total average reduction of TN in Division 1, averaged across all counties in Division 1, was approximately 0.16 lb/acre (7.1% reduction), and the total reduction of TP in Division 1, averaged across all counties in Division 1, was 0.12 lb/acre (43.8% reduction) for the affected EQIP-funded acres. Division 2 saw reductions of TN and TP, averaged across all counties in Division 2, at nearly 0.17 lb/acre (7.0% reduction) and 0.04 lb/acre (15.4% reduction), respectively, for the EQIP-funded acres. Division 3 had reductions of TN and TP, averaged across all counties in Division 3, at approximately 0.07 lb/acre (3.2% reduction) and 0.003 lb/acre (1.6% reduction) respectively, for all EQIP-funded acres.

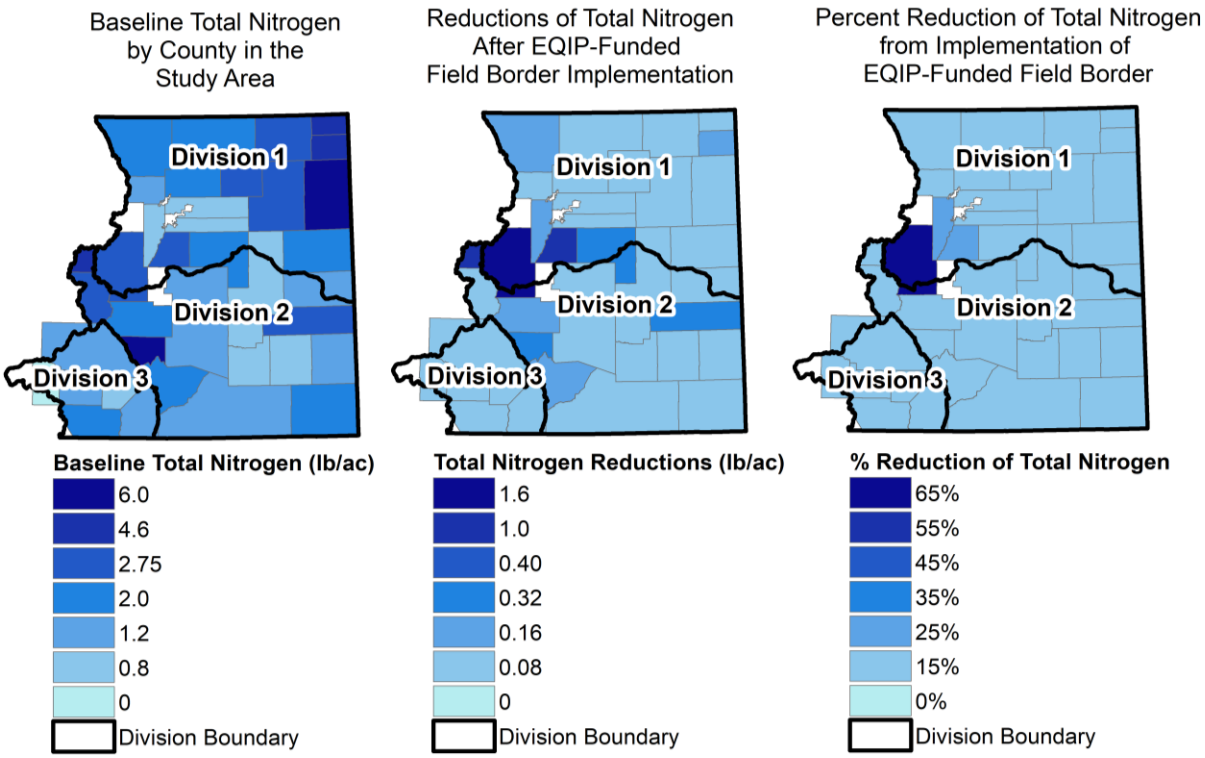


*Figure 29: Total Nitrogen reduction from field border implementation comparing the baseline practices (left) vs. the implementation of EQIP-funded field border practices (middle) from 2008 to 2018. The map on the right shows the percent change in TN after practice implementation.*

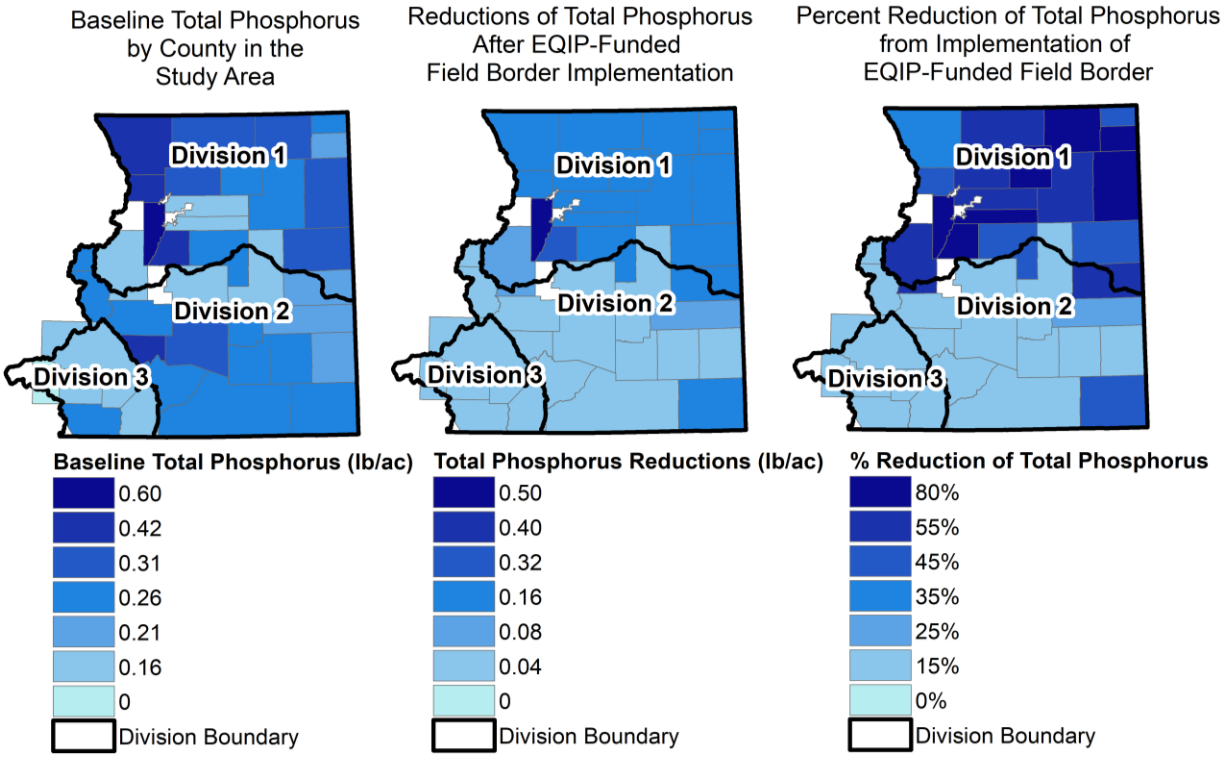


*Figure 30: Total Phosphorus reduction from field border implementation comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded field border practices (middle) from 2008 to 2018. The map on the right shows the percent change in TP after the implementation of these practices.*

## *Reduction by All EQIP-funded Conservation Practices*

Figures 31 and 32 show the average reductions in TN and TP from the implementation of all EQIP-funded conservation practices when combined. The use of the installed practices and management techniques led to an average reduction of 0.15 lb/acre of TN (8.2% reduction) and an average reduction of 0.07 lb/acre of TP (a 27.7% reduction) total for the affected EQIP-funded acres averaged across the four study watersheds.

The total average reductions of TN in Division 1, averaged across all counties in Division 1, were approximately 0.22 lb/acre (10.8% reduction), and the total average reductions of TP in Division 1, averaged across all counties in Division 1, were 0.10 lb/acre (42.0% reduction), for the affected EQIP-funded acres. Division 2 saw reductions of TN and TP, averaged across all counties in Division 2, at nearly 0.18 lb/acre (9.8% reduction) and 0.044 lb/acre (18.8% reduction), respectively, for the affected EQIP-funded acres. Division 3 had reductions of TN and TP, averaged across all counties in Division 3, at approximately 0.074 lb/acre (5.6% reduction) and 0.012 lb/acre (6.8% reduction) respectively, for the affected EQIP-funded acres.

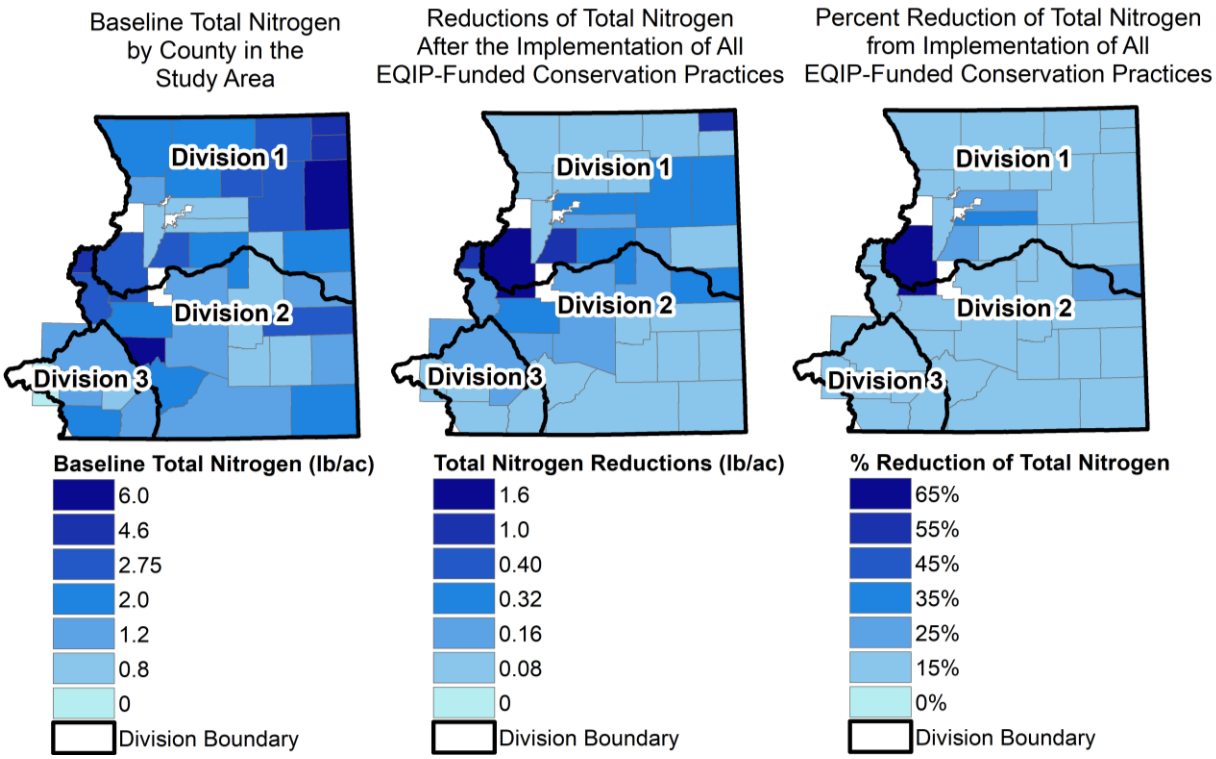


*Figure 31: Total Nitrogen reduction from the implementation of all EQIP-funded conservation practices, comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded practices (middle) from 2008 to 2018. The map on the right shows the percent change in nitrogen after the implementation of these practices.*

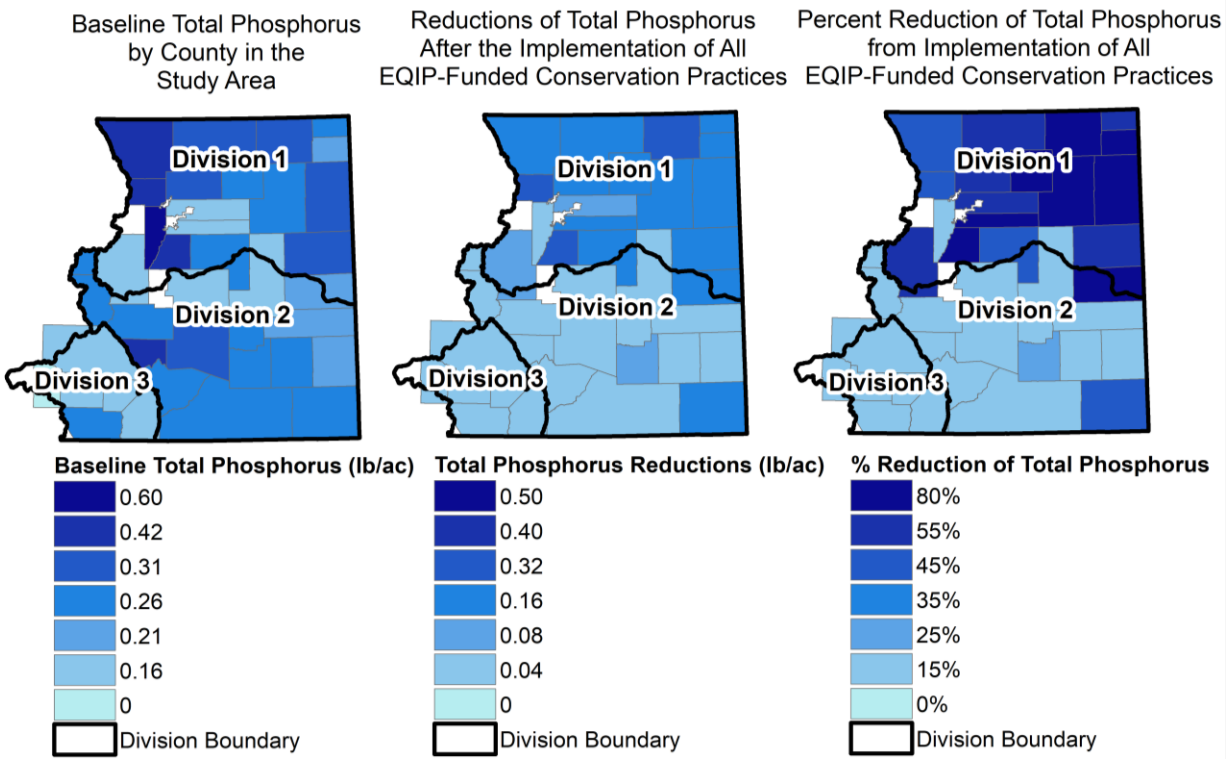


Figure 32: Total Phosphorus reduction from the implementation of all EQIP-funded conservation practices comparing the baseline agricultural practices (left) vs. the implementation of EQIP-funded practices (middle) from 2008 to 2018. The map on the right shows the percent change in phosphorus after the implementation of these practices.

## *Model Validation Using Field-Level EQIP Location Data*

The USDA NRCS tracks location data related to specific EQIP practices implemented within the state of Colorado, as well as the exact number of acres on which the practice was implemented. This data was used, in cooperation with the USDA NRCS, to validate the model results by comparing actual field-level data with the results of the model. If the model results were within a reasonable range of the EQIP location data results, the model was deemed accurate. In order to protect the privacy of producers in the state and to operate within the bounds of the policies of the USDA NRCS, this data was aggregated to the county level for reporting purposes.

The method for creating county level summaries (i.e. the iterations of randomly assigning results) from unknown geospatial locations was compared to known locations of implementations by partnering with the NRCS. This was accomplished by taking an example county and comparing the random county summary to the hand-calculated result totals of known locations of implementations. These comparisons resulted in similar reductions for each of the selected counties, thereby validating the results of the modeling efforts.


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# CONCLUSION

The modeling results indicate TN and TP loads were substantially reduced by the adoption of EQIP-funded conservation practices. The implementation of all EQIP practices analyzed across the three divisions resulted in overall average reductions of 8.2% Total Nitrogen and 27.7% Total Phosphorus. These results illustrate the effectiveness of EQIP-funded conservation practices and the progress the agricultural industry is making in reducing its contributions of TN and TP to Colorado's surface waters.

The effects of conservation practices are often difficult to notice upon simple observation, and the positive impacts may take years to become evident. This modeling analysis is unique in that it examines the effects of conservation practices that have already been applied, and it quantifies those effects based on edge-of-field discharges. By modeling selected conservation practices over a decade, the study demonstrates the cumulative water quality impacts of the adopted practices. This model incorporated existing edge-of-field runoff data into the modeling tool, providing a means of calibrating the model to realistic and attainable results.

The results indicate EQIP conservation practices have significantly reduced nonpoint source discharges from agricultural fields. The NRCS-EQIP program was initiated in 1996. Thus, the beneficial effects of the program since its inception are not fully captured and are likely substantially greater than those reflected in this analysis. Additionally, previous CSU producer surveys have found that many agricultural producers implement sustainable practices on-farm that are not funded through EQIP and, therefore, are not captured in this analysis. The compounding effects of these additional conservation practices implemented outside of the EQIP program aid in providing additional nutrient abatement benefits that are not represented in this modeling analysis.

All models have limitations and assumptions that should be considered. The extent to which individual conservation practices are effective varies. These variations depend on multiple factors, such as cropping system, companion practices, soil characteristics, and topography, among other variables. Future work could focus on targeting high-risk areas as a means to increase the effectiveness of practice application. The NRCS data that was obtained through a FOIA request did not include the field-specific information, such as location, soil type, slope, and other characteristics that may impact the effectiveness of the conservation practice. Having had this information would, therefore, improve the accuracy of the model.

The Edge-of-Field monitoring tool cannot provide precision accuracy. However, location-specific data was used post-modeling to validate the model results. There are inevitably assumptions that must be made in any modeling effort so that a simplified, yet realistic, model may be created. In this effort, crop dates were standardized based on the region, climate, and crop type. Fertilizer and irrigation amounts and treatments were also standardized based on known management protocols in each region, among other assumptions stated previously. These simplifications introduce uncertainty in the model that must be acknowledged. It is possible that the true effects of the implemented conservation practices may deviate from these model results.

Despite these limitations, this analysis produced results similar to and within the reasonable range of observed and other modeled values for nutrient reductions based on the specific conservation practices analyzed. TN and TP reductions ranged from an average of 5% to over 70%, depending upon the nutrient being analyzed and the practice and level of implementation (Vedachalam et al., 2019; Wong et al., 2018; Baker et al., 2018; Liu et al., 2017; McLellan et al., 2015; Kalcic et al., 2015; Rittenburg et al., 2015).

These results were validated through site-specific analysis of the EQIP-funded practices based on USDA-NRCS EQIP location data, used in partnership with the local Denver NRCS staff. Allowing for the limitations cited above, there is nevertheless considerable merit to using these and other modeling tools of this kind as a way to quickly and cost-effectively quantify the impacts of conservation practices on edge-of-field discharges with relatively high levels of confidence in the results.

Going forward, the SWAT-based Edge of Field Conservation Planning tool used in this study will continue to be refined using data from CSU's expanding edge-of-field runoff data collection network. The tool can be used to model water quality impacts of existing and hypothetical field management scenarios and can assist in identifying locations where conservation practices create the greatest benefit. The Edge-of-Field Conservation tool can be accessed at <https://erams.com/catena/tools/agricultural-resources/edge-of-field/>.

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# APPENDIX A

## AGRICULTURAL METHODOLOGY: DETAILED CROP MANAGEMENT SCENARIOS

### Division 1

Corn-Grain Scenarios

*Corn-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 160 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/30/08* | Planting | Corn | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

*Corn-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 4/14/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 4/30/08 | Planting | Corn | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*Corn-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/23/08* | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/30/08* | Planting | Corn | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

Corn-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | SINGLE DISK | | |
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 4/30/08 | Planting | Corn | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*Corn-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/13/08* | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/30/08* | Planting | Corn | | |

Corn-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 4/30/08 | Planting | Corn | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

*Corn-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/30/08* | Nutrient | Elemental Nitrogen | 160 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/30/08* | Planting | Corn | | |
| *9/14/08* | Harvest & Kill | | | |

Corn-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/30/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| 4/30/08 | Planting | Corn | | |
| 9/14/08 | Harvest & Kill | | | |

*Corn-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 160 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/30/08* | Planting | Corn | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

*Corn-ConventionalTill-SplitApply-Sprinkler*

| date | operation | par 1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 4/14/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 4/30/08 | Planting | Corn | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| 9/14/08 | Harvest & Kill | | | |

*Corn-ReduceTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/23/08* | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | |
| *4/30/08* | Planting | Corn | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

Corn-ReduceTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | SINGLE DISK | | |
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 4/30/08 | Planting | Corn | | |
| 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*Corn-StripTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/13/08* | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no |

Corn-StripTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| *Corn-NoTill-SplitApply-Flood* | | | | | Corn-NoTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

# Corn-Silage Scenarios

| *Corn Silage-ConventionalTill-Flood* | | | | | *Corn Silage-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |

| *Corn Silage-ReduceTill-Flood* | | | | | Corn Silage-ReduceTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |

| *Corn Silage-StripTill-Flood* | | | | | Corn Silage-StripTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|



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| date | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
|---|---|---|---|---|---|---|---|---|---|
| 4/13/08 | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 4/14/08 | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| 4/30/08 | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| 9/10/08 | Harvest & Kill | | | | | | | | |

| *Corn Silage-NoTill-Flood* | | | | | Corn Silage-NoTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| date | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| 4/30/08 | Nutrient | Elemental Nitrogen | 160 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 160 | no |
| 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| 4/14/08 | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| 4/30/08 | Planting | Corn Silage | | | 9/10/08 | Harvest & Kill | | | |
| 9/10/08 | Harvest & Kill | | | | | | | | |

## Alfalfa Scenarios

| *Alfalfa-ConventionalTill-Flood* | | | | | *Alfalfa-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| date | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | | 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | | 3/15/08 | Planting | Alfalfa | | |
| 3/15/08 | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| 6/1/09 | Harvest | | | | 7/15/09 | Harvest | | | |
| 7/15/09 | Harvest | | | | 8/30/09 | Harvest | | | |
| 8/30/09 | Harvest | | | | 9/20/09 | Harvest | | | |
| 9/20/09 | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| 6/1/10 | Harvest | | | | 7/15/10 | Harvest | | | |
| 7/15/10 | Harvest | | | | 8/30/10 | Harvest | | | |
| 8/30/10 | Harvest | | | | 9/20/10 | Harvest | | | |
| 9/20/10 | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| 6/1/11 | Harvest | | | | 7/15/11 | Harvest | | | |
| 7/15/11 | Harvest | | | | 8/30/11 | Harvest | | | |

| | | | | |
|---|---|---|---|---|
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

*Alfalfa-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *2/28/08* | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | non |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

*Alfalfa-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

Alfalfa-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 2/28/08 | Tillage | SINGLE DISK | | |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | non |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | non |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

Alfalfa-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |



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| | | | | |
|---|---|---|---|---|
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

*Alfalfa-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

Alfalfa-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

*Alfalfa-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *2/28/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/5/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/7/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |

*Alfalfa-ConventionalTill-SplitApply-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |



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| | | | | |
|---|---|---|---|---|
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

*Alfalfa-ReduceTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *2/28/08* | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

*Alfalfa-StripTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |

| | | | | |
|---|---|---|---|---|
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

Alfalfa-ReduceTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 2/28/08 | Tillage | SINGLE DISK | | |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

Alfalfa-StripTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |



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| | | | | |
|---|---|---|---|---|
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

*Alfalfa-NoTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

Alfalfa-NoTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

## Grass Pasture Scenarios



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*GrassPasture-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

*GrassPasture-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

*GrassPasture-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

GrassPasture-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

*GrassPasture-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

GrassPasture-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

*GrassPasture-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

GrassPasture-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

*GrassPasture-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |

GrassPasture-ConventionalTill--SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |



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| | | | | |
|---|---|---|---|---|
| *9/1/08* | Harvest & Kill | | | |

*GrassPasture-ReduceTill--SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

*GrassPasture-StripTill--SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

*GrassPasture-NoTill--SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *5/15/08* | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest | | | |
| *9/1/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 9/1/08 | Harvest & Kill | | | |

GrassPasture-ReduceTill--SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

GrassPasture-StripTill--SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

GrassPasture-NoTill--SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| 5/15/08 | Harvest | | | |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest | | | |
| 9/1/08 | Harvest & Kill | | | |

## Grass Pasture (Mountains) Scenarios

*GrassPasture-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | |

*GrassPasture-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no |

*GrassPasture-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/08 | Harvest & Kill | | | |

GrassPasture-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Planting | Pasture | | |
| 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-StripTill-Flood* | | | | | GrassPasture-StripTill-Sprinkler | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-NoTill-Flood* | | | | | GrassPasture-NoTill-Sprinkler | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *GrassPasture-ConventionalTill-SpitApply-Flood* | | | | | *GrassPasture-ConventionalTill- SpitApply-Sprinkler* | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-ReduceTill- SpitApply-Flood* | | | | | GrassPasture-ReduceTill- SpitApply-Sprinkler | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-StripTill- SpitApply-Flood* | | | | | GrassPasture-StripTill- SpitApply-Sprinkler | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-NoTill- SpitApply-Flood* | | | | | GrassPasture-NoTill- SpitApply-Sprinkler | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |

# Winter Wheat Scenarios

*WinterWheat-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *9/15/07* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *9/16/07* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *9/17/07* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *9/20/07* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *9/25/07* | Nutrient | Elemental Nitrogen | 90 | no |
| *9/25/07* | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | |
| *9/28/07* | Tillage | CULTI-PACKER PULVERIZER | | |
| *9/30/07* | Planting | Winter Wheat | | |
| *7/8/08* | Harvest & Kill | | | |
| *2/1/09* | Kill | | | |

*WinterWheat-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 9/15/07 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 9/16/07 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 9/17/07 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 9/20/07 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 9/25/07 | Nutrient | Elemental Nitrogen | 90 | no |
| 9/25/07 | Nutrient | Elemental Phosphorous | 30 | no |
| 9/28/07 | Tillage | CULTI-PACKER PULVERIZER | | |
| 9/30/07 | Planting | Winter Wheat | | |
| 7/8/08 | Harvest & Kill | | | |
| 2/1/09 | Kill | | | |

*WinterWheat-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *9/15/07* | Tillage | SINGLE DISK | | |
| *9/16/07* | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | |
| *9/30/07* | Planting | Winter Wheat | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *7/8/08* | Harvest & Kill | | | |
| *2/1/09* | Kill | | | |

WinterWheat-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 9/15/07 | Tillage | SINGLE DISK | | |
| 9/16/07 | Tillage | STRIP TILLING | | |
| 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| 9/30/07 | Planting | Winter Wheat | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 7/8/08 | Harvest & Kill | | | |
| 2/1/09 | Kill | | | |

*WinterWheat-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *9/16/07* | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | |
| *9/30/07* | Planting | Winter Wheat | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *7/8/08* | Harvest & Kill | | | |
| *2/1/09* | Kill | | | |

WinterWheat-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 9/16/07 | Tillage | STRIP TILLING | | |
| 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| 9/30/07 | Planting | Winter Wheat | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 7/8/08 | Harvest & Kill | | | |
| 2/1/09 | Kill | | | |

*WinterWheat-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|

WinterWheat-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | yes | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | yes |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 7/8/08 | Harvest & Kill | | | |
| *7/8/08* | Harvest & Kill | | | | 2/1/09 | Kill | | | |
| *2/1/09* | Kill | | | | | | | | |

| *WinterWheat-ConventionalTill-SplitApply-Flood* | | | | | *WinterWheat-ConventionalTill-SplitApply-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *da* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | DEEP RIPPER- SUBSOILER | | | 9/15/07 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *9/16/07* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 9/16/07 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *9/17/07* | Tillage | MOLDBOARD PLOW REG GE10B | | | 9/17/07 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *9/20/07* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 9/20/07 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *9/25/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/25/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/25/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/25/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/28/07 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9/28/07* | Tillage | CULTI-PACKER PULVERIZER | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 4/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *4/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 7/8/08 | Harvest & Kill | | | |
| *7/8/08* | Harvest & Kill | | | | 2/1/09 | Kill | | | |
| *2/1/09* | Kill | | | | | | | | |

| *WinterWheat-ReduceTill-SplitApply-Flood* | | | | | WinterWheat-ReduceTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | SINGLE DISK | | | 9/15/07 | Tillage | SINGLE DISK | | |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 4/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *4/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 7/8/08 | Harvest & Kill | | | |
| *7/8/08* | Harvest & Kill | | | | 2/1/09 | Kill | | | |
| *2/1/09* | Kill | | | | | | | | |

| *WinterWheat-StripTill-SplitApply-Flood* | | | | | WinterWheat-StripTill-SplitApply-Sprinkle | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 4/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *4/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 7/8/08 | Harvest & Kill | | | |



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| | | | | |
|---|---|---|---|---|
| *7/8/08* | Harvest & Kill | | | |
| *2/1/09* | Kill | | | |

| | | | | |
|---|---|---|---|---|
| 2/1/09 | Kill | | | |

*WinterWheat-NoTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | yes |
| *9/25/07* | Tillage | BEDDER (DISK) | | |
| *9/30/07* | Planting | Winter Wheat | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *7/8/08* | Harvest & Kill | | | |
| *2/1/09* | Kill | | | |

WinterWheat-NoTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| 9/30/07 | Nutrient | Elemental Phosphorous | 30 | yes |
| 9/30/07 | Planting | Winter Wheat | | |
| 4/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 7/8/08 | Harvest & Kill | | | |
| 2/1/09 | Kill | | | |

# Sugarbeet Scenarios

*SugarBeets-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/1/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/2/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/10/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 120 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 75 | no |
| *4/1/08* | Tillage | BEDDER (DISK) | | |
| *4/1/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/10/08* | Planting | Sugarbeet | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

*SugarBeets-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/10/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 4/1/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/1/08 | Nutrient | Elemental Phosphorous | 75 | no |
| 4/1/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 4/10/08 | Planting | Sugarbeet | | |
| 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*SugarBeets-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/23/08* | Tillage | SINGLE DISK | | |
| *4/1/08* | Tillage | STRIP TILLING | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 120 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 38 | no |
| *4/1/08* | Tillage | BEDDER (DISK) | | |
| *4/10/08* | Planting | Sugarbeet | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *9/14/08* | Harvest & Kill | | | |

SugarBeets-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | SINGLE DISK | | |
| 4/1/08 | Tillage | STRIP TILLING | | |
| 4/1/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/1/08 | Nutrient | Elemental Phosphorous | 38 | no |
| 4/10/08 | Planting | Sugarbeet | | |
| 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*SugarBeets-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/1/08* | Tillage | STRIP TILLING | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 120 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 38 | no |

SugarBeets-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/1/08 | Tillage | STRIP TILLING | | |
| 4/1/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/1/08 | Nutrient | Elemental Phosphorous | 38 | no |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *4/1/08* | Tillage | BEDDER (DISK) | | | 4/10/08 | Planting | Sugarbeet | | |
| *4/10/08* | Planting | Sugarbeet | | | 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *SugarBeets-NoTill-Flood* | | | | | SugarBeets-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/10/08* | Nutrient | Elemental Nitrogen | 120 | no | 4/10/08 | Nutrient | Elemental Nitrogen | 120 | no |
| *4/10/08* | Nutrient | Elemental Phosphorous | 38 | yes | 4/10/08 | Nutrient | Elemental Phosphorous | 38 | yes |
| *4/1/08* | Tillage | BEDDER (DISK) | | | 4/10/08 | Planting | Sugarbeet | | |
| *4/10/08* | Planting | Sugarbeet | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *SugarBeets-ConventionalTill-SplitApply-Flood* | | | | | *SugarBeets-ConventionalTill- SplitApply-Sprinkler* | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/1/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/2/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/10/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/10/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 75 | no | 4/1/08 | Nutrient | Elemental Phosphorous | 75 | no |
| *4/1/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/1/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/10/08 | Planting | Sugarbeet | | |
| *4/10/08* | Planting | Sugarbeet | | | 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *SugarBeets-ReduceTill- SplitApply-Flood* | | | | | SugarBeets-ReduceTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/1/08* | Tillage | STRIP TILLING | | | 4/1/08 | Tillage | STRIP TILLING | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 38 | no | 4/1/08 | Nutrient | Elemental Phosphorous | 38 | no |
| *4/1/08* | Tillage | BEDDER (DISK) | | | 4/10/08 | Planting | Sugarbeet | | |
| *4/10/08* | Planting | Sugarbeet | | | 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *SugarBeets-StripTill- SplitApply-Flood* | | | | | SugarBeets-StripTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/1/08* | Tillage | STRIP TILLING | | | 4/1/08 | Tillage | STRIP TILLING | | |
| *4/1/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/1/08* | Nutrient | Elemental Phosphorous | 38 | no | 4/1/08 | Nutrient | Elemental Phosphorous | 38 | no |
| *4/1/08* | Tillage | BEDDER (DISK) | | | 4/10/08 | Planting | Sugarbeet | | |



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| | | | | |
|---|---|---|---|---|
| *4/10/08* | Planting | Sugarbeet | | |
| *5/8/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *9/14/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 5/8/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 9/14/08 | Harvest & Kill | | | |

*SugarBeets-NoTill- SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/10/08* | Nutrient | Elemental Nitrogen | 80 | no |
| *4/10/08* | Nutrient | Elemental Phosphorous | 38 | yes |
| *4/1/08* | Tillage | BEDDER (DISK) | | |
| *4/10/08* | Planting | Sugarbeet | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *9/14/08* | Harvest & Kill | | | |

SugarBeets-NoTill- SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/10/08 | Nutrient | Elemental Nitrogen | 80 | no |
| 4/10/08 | Nutrient | Elemental Phosphorous | 38 | yes |
| 4/10/08 | Planting | Sugarbeet | | |
| 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 9/14/08 | Harvest & Kill | | | |

## Small Grains Scenarios

*SmallGrains-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/1/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/2/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/2/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | no |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/15/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

*SmallGrains-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/2/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| 3/15/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

*SmallGrains-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/1/08* | Tillage | SINGLE DISK | | |
| *3/2/08* | Tillage | STRIP TILLING | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | no |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

SmallGrains-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/1/08 | Tillage | SINGLE DISK | | |
| 3/2/08 | Tillage | STRIP TILLING | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

*SmallGrains-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/2/08* | Tillage | STRIP TILLING | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | no |

SmallGrains-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/2/08 | Tillage | STRIP TILLING | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |



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| | | | | |
|---|---|---|---|---|
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

*SmallGrains-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | yes |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |
| *8/1/08* | Harvest & Kill | | | |

*SmallGrains-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/1/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/2/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/2/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 30 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/15/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Nutrient | Elemental Nitrogen | 25 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

*SmallGrains-ReduceTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/1/08* | Tillage | SINGLE DISK | | |
| *3/2/08* | Tillage | STRIP TILLING | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | no |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Nutrient | Elemental Nitrogen | 25 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

*SmallGrains-StripTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/2/08* | Tillage | STRIP TILLING | | |
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | no |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |

| | | | | |
|---|---|---|---|---|
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

SmallGrains-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| 3/16/08 | Planting | Spring Barley | | |
| 8/1/08 | Harvest & Kill | | | |

SmallGrains-ConventionalTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/1/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/2/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/2/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| 3/15/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Nutrient | Elemental Nitrogen | 25 | no |
| 4/30/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

SmallGrains-ReduceTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/1/08 | Tillage | SINGLE DISK | | |
| 3/2/08 | Tillage | STRIP TILLING | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Nutrient | Elemental Nitrogen | 25 | no |
| 4/30/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

SmallGrains-StripTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/2/08 | Tillage | STRIP TILLING | | |
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | no |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Nutrient | Elemental Nitrogen | 25 | no |



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| | | | | |
|---|---|---|---|---|
| *4/30/08* | Nutrient | Elemental Nitrogen | 25 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | no |
| *4/30/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/1/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 4/30/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/30/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/1/08 | Harvest & Kill | | | |

*SmallGrains-NoTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Nutrient | Elemental Nitrogen | 55 | no |
| *3/15/08* | Nutrient | Elemental Phosphorous | 80 | yes |
| *3/15/08* | Tillage | BEDDER (DISK) | | |
| *3/16/08* | Planting | Spring Barley | | |
| *4/30/08* | Nutrient | Elemental Nitrogen | 25 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *8/1/08* | Harvest & Kill | | | |

SmallGrains-NoTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Nutrient | Elemental Nitrogen | 55 | no |
| 3/15/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| 3/16/08 | Planting | Spring Barley | | |
| 4/30/08 | Nutrient | Elemental Nitrogen | 25 | no |
| 4/30/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| 8/1/08 | Harvest & Kill | | | |

# Dry Beans Scenarios

*DryBeans-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 80 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/1/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

*DryBeans-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 5/1/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | SINGLE DISK | | |
| *3/23/08* | Tillage | STRIP TILLING | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 80 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

DryBeans-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | SINGLE DISK | | |
| 3/23/08 | Tillage | STRIP TILLING | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/23/08* | Tillage | STRIP TILLING | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 80 | no |

DryBeans-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | STRIP TILLING | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 80 | no |



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| | | | | |
|---|---|---|---|---|
| *5/1/08* | Nutrient | Elemental Phosphorous | 30 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 5/1/08 | Nutrient | Elemental Phosphorous | 30 | no |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *5/1/08* | Nutrient | Elemental Nitrogen | 80 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 30 | yes |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Dry beans | | |
| *8/15/08* | Harvest & Kill | | | |

DryBeans-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 5/1/08 | Nutrient | Elemental Nitrogen | 80 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| 5/20/08 | Planting | Dry beans | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/1/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *6/15/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

DryBeans-ConventionalTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 5/1/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 6/15/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-ReduceTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | SINGLE DISK | | |
| *3/23/08* | Tillage | STRIP TILLING | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *6/15/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

DryBeans-ReduceTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | SINGLE DISK | | |
| 3/23/08 | Tillage | STRIP TILLING | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 6/15/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-StripTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/23/08* | Tillage | STRIP TILLING | | |
| *5/1/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *5/1/08* | Tillage | BEDDER (DISK) | | |

DryBeans-StripTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | STRIP TILLING | | |
| 5/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 5/20/08 | Planting | Dry beans | | |



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| | | | | |
|---|---|---|---|---|
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *6/15/08* | Nutrient | Elemental Phosphorous | 15 | no |
| *6/15/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *8/15/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 6/15/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 6/15/08 | Nutrient | Elemental Phosphorous | 15 | no |
| 6/15/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 8/15/08 | Harvest & Kill | | | |

*DryBeans-NoTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *5/1/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *5/1/08* | Nutrient | Elemental Phosphorous | 15 | yes |
| *5/1/08* | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Dry beans | | |
| *6/15/08* | Nutrient | Elemental Nitrogen | 40 | no |
| *6/15/08* | Nutrient | Elemental Phosphorous | 15 | yes |
| *8/15/08* | Harvest & Kill | | | |

DryBeans-NoTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 5/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 5/1/08 | Nutrient | Elemental Phosphorous | 15 | yes |
| 5/20/08 | Planting | Dry beans | | |
| 6/15/08 | Nutrient | Elemental Nitrogen | 40 | no |
| 6/15/08 | Nutrient | Elemental Phosphorous | 15 | yes |
| 8/15/08 | Harvest & Kill | | | |

## Division 2

## Alfalfa Scenarios

*Alfalfa-ConventionalTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *2/28/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/5/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/7/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |

*Alfalfa-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |



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| | | | | |
|---|---|---|---|---|
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |
| *Alfalfa-ReduceTill-Flood* | | | | |
| *date* | operation | par1 | par2 | par3 |
| *2/28/08* | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |
| *Alfalfa-StripTill-Flood* | | | | |
| *date* | operation | par1 | par2 | par3 |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |

| | | | | |
|---|---|---|---|---|
| 9/14/11 | Harvest & Kill | | | |
| | | | | |
| Alfalfa-ReduceTill-Sprinkler | | | | |
| date | operation | par1 | par2 | par3 |
| 2/28/08 | Tillage | SINGLE DISK | | |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |
| | | | | |
| Alfalfa-StripTill-Sprinkler | | | | |
| date | operation | par1 | par2 | par3 |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |



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|---|---|---|---|---|---|---|---|---|---|
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |
| *Alfalfa-NoTill-Flood* | | | | | Alfalfa-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |

| *Alfalfa-ConventionalTill-SplitApply-Flood* | | | | | *Alfalfa-ConventionalTill-SplitApply-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *2/28/0* | Tillage | DEEP RIPPER- SUBSOILER | | | 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/5/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/7/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/10/08* | Tillage | CULTI-PACKER PULVERIZER | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |



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| | | | | |
|---|---|---|---|---|
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

| *Alfalfa-ReduceTill-SplitApply-Flood* | | | | |
|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 |
| *2/28/08* | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

| Alfalfa-ReduceTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|
| date | operation | par1 | par2 | par3 |
| 2/28/08 | Tillage | SINGLE DISK | | |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

| *Alfalfa-StripTill-SplitApply-Flood* | | | | |
|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 |
| *3/7/08* | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |

| Alfalfa-StripTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|
| date | operation | par1 | par2 | par3 |
| 3/7/08 | Tillage | STRIP TILLING | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |
| | | *Alfalfa-NoTill-SplitApply-Flood* | | | Alfalfa-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |

## Grass Pasture Scenarios

| | | *GrassPasture-ConventionalTill-Flood* | | | *GrassPasture-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| | | *GrassPasture-ReduceTill-Flood* | | | GrassPasture-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| *GrassPasture-StripTill-Flood* | | | | | GrassPasture-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| *GrassPasture-NoTill-Flood* | | | | | GrassPasture-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| | | *GrassPasture-ConventionalTill- SplitApply-Flood* | | | GrassPasture-ConventionalTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| | | *GrassPasture-ReduceTill- SplitApply-Flood* | | | GrassPasture-ReduceTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |



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| | | *GrassPasture-StripTill- SplitApply-Flood* | | | GrassPasture-StripTill- SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |
| | | *GrassPasture-NoTill- SplitApply-Flood* | | | GrassPasture-NoTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/20/08* | Harvest | | | | 6/20/08 | Harvest | | | |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/1/08* | Harvest & Kill | | | | 9/1/08 | Harvest & Kill | | | |

## Grass Pasture (Mountains) Scenarios

| | | *GrassPasture-ConventionalTill-Flood* | | | *GrassPasture-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | | *GrassPasture-ReduceTill-Flood* | | | GrassPasture-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| *GrassPasture-StripTill-Flood* | | | | | GrassPasture-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| *GrassPasture-NoTill-Flood* | | | | | GrassPasture-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-ConventionalTill-SplitApply-Flood* | | | | GrassPasture-ConventionalTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-ReduceTill-SplitApply-Flood* | | | | GrassPasture-ReduceTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-StripTill- SplitApply-Flood* | | | | GrassPasture-StripTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |
| | *GrassPasture-NoTill-SplitApply-Flood* | | | | GrassPasture-NoTill- SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Planting | Pasture | | | 3/15/08 | Planting | Pasture | | |
| *4/15/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *6/25/08* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/08* | Harvest & Kill | | | | 8/1/08 | Harvest & Kill | | | |

## Winter Wheat Scenarios

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *WinterWheat-ConventionalTill-Flood* | | | | *WinterWheat-ConventionalTill-Sprinkler* | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | DEEP RIPPER- SUBSOILER | | | 9/15/07 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *9/16/07* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 9/16/07 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *9/17/07* | Tillage | MOLDBOARD PLOW REG GE10B | | | 9/17/07 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *9/20/07* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 9/20/07 | Tillage | CULTI-MULCH ROLLER GE18FT | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *9/25/07* | Nutrient | Elemental Nitrogen | 90 | no | 9/25/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *9/25/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/25/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/28/07 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9/28/07* | Tillage | CULTI-PACKER PULVERIZER | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| | | *WinterWheat-ReduceTill-Flood* | | | WinterWheat-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | SINGLE DISK | | | 9/15/07 | Tillage | SINGLE DISK | | |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 2/1/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *2/1/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| *WinterWheat-StripTill-Flood* | | | | | WinterWheat-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 2/1/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *2/1/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| *WinterWheat-NoTill-Flood* | | | | | WinterWheat-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/30/07* | Nutrient | Elemental Nitrogen | 90 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 90 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | yes | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | yes |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *WinterWheat-ConventionalTill-SplitApply-Flood* | | | *WinterWheat-ConventionalTill-SplitApply-Sprinkler* | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | DEEP RIPPER- SUBSOILER | | | 9/15/07 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *9/16/07* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 9/16/07 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *9/17/07* | Tillage | MOLDBOARD PLOW REG GE10B | | | 9/17/07 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *9/20/07* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 9/20/07 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *9/25/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/25/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/25/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/25/07 | Nutrient | Elemental Phosphorous | 30 | no |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/28/07 | Tillage | CULTI-PACKER PULVERIZER | | |
| *9/28/07* | Tillage | CULTI-PACKER PULVERIZER | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 2/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *2/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| | *WinterWheat-ReduceTill-SplitApply-Flood* | | | | WinterWheat-ReduceTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/15/07* | Tillage | SINGLE DISK | | | 9/15/07 | Tillage | SINGLE DISK | | |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 2/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *2/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 2/1/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *2/1/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| | *WinterWheat-StripTill-SplitApply-Flood* | | | | WinterWheat-StripTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/16/07* | Tillage | STRIP TILLING | | | 9/16/07 | Tillage | STRIP TILLING | | |
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | no | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | no |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *9/30/07* | Planting | Winter Wheat | | | 2/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *2/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 2/1/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *2/1/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |
| | *WinterWheat-NoTill-SplitApply-Flood* | | | | WinterWheat-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *9/30/07* | Nutrient | Elemental Nitrogen | 50 | no | 9/30/07 | Nutrient | Elemental Nitrogen | 50 | no |
| *9/30/07* | Nutrient | Elemental Phosphorous | 30 | yes | 9/30/07 | Nutrient | Elemental Phosphorous | 30 | yes |
| *9/25/07* | Tillage | BEDDER (DISK) | | | 9/30/07 | Planting | Winter Wheat | | |
| *2/1/08* | Planting | Winter Wheat | | | 2/1/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *2/1/08* | Nutrient | Elemental Nitrogen | 40 | no | 3/14/08 | Harvest & Kill | | | |
| *3/14/08* | Harvest & Kill | | | | | | | | |

## Corn Grain Scenarios

| *Corn-ConventionalTill-Flood* | | | | | *Corn-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *Corn-ReduceTill-Flood* | | | | | Corn-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *Corn-StripTill-Flood* | | | | | Corn-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *Corn-NoTill-Flood* | | | | | Corn-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/30/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | | *Corn-ConventionalTill-SplitApply-Flood* | | | Corn-ConventionalTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par 3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/14/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| | | *Corn-ReduceTill-SplitApply-Flood* | | | Corn-ReduceTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| | | *Corn-StripTill-SplitApply-Flood* | | | Corn-StripTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| | | *Corn-NoTill-SplitApply-Flood* | | | Corn-NoTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn | | |
| *4/30/08* | Planting | Corn | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

## Corn Silage Scenarios

| | | *CornSilageConventionalTill-Flood* | | | *CornSilageConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilageReduceTill-Flood* | | | CornSilageReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilageStripTill-Flood* | | | CornSilageStripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilageNoTill-Flood* | | | CornSilageNoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/30/08* | Nutrient | Elemental Nitrogen | 160 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 160 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilage-ConventionalTill-SplitApply-Flood* | | | CornSilage-ConventionalTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 60 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 60 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilage-ReduceTill-SplitApply-Flood* | | | CornSilage-ReduceTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilage-StripTill-SplitApply-Flood* | | | CornSilage-StripTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 30 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 30 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |
| | | *CornSilage-NoTill-SplitApply-Flood* | | | CornSilage-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no | 4/30/08 | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Nutrient | Elemental Phosphorous | 30 | yes | 4/30/08 | Nutrient | Elemental Phosphorous | 30 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/30/08 | Planting | Corn Silage | | |
| *4/30/08* | Planting | Corn Silage | | | 6/24/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 70 | no | 9/10/08 | Harvest & Kill | | | |
| *9/10/08* | Harvest & Kill | | | | | | | | |

## Sorghum Grain Scenarios

| *GrainSorghum-ConventionalTill-Flood* | | | | | *GrainSorghum-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 70 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | | *GrainSorghum-ReduceTill-Flood* | | | GrainSorghum-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 70 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | | *GrainSorghum-StripTill-Flood* | | | GrainSorghum-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 70 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| *GrainSorghum-NoTill-Flood* | | | | | GrainSorghum-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 70 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 70 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | | *GrainSorghum-ConventionalTill-SplitApply-Flood* | | | GrainSorghum-ConventionalTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | *GrainSorghum-ReduceTill-SplitApply-Flood* | | | | GrainSorghum-ReduceTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | *GrainSorghum-StripTill-SplitApply-Flood* | | | | GrainSorghum-StripTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |
| | *GrainSorghum-NoTill-SplitApply-Flood* | | | | GrainSorghum-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Grain Sorghum | | |
| *6/1/08* | Planting | Grain Sorghum | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |



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# Sorghum Forage Scenarios

*ForageSorghum-ConventionalTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 4/14/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/14/08 | Tillage | BEDDER (DISK) | | |
| 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*ForageSorghum-ConventionalTill-Sprinkler*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 4/14/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*ForageSorghum-ReduceTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | SINGLE DISK | | |
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/14/08 | Tillage | BEDDER (DISK) | | |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

ForageSorghum-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/23/08 | Tillage | SINGLE DISK | | |
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*ForageSorghum-StripTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 4/14/08 | Tillage | BEDDER (DISK) | | |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

ForageSorghum-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Tillage | STRIP TILLING | | |
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| 6/1/08 | Planting | Sorghum Hay | | |
| 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| 9/14/08 | Harvest & Kill | | | |

*ForageSorghum-NoTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| 4/14/08 | Tillage | BEDDER (DISK) | | |
| 6/1/08 | Planting | Sorghum Hay | | |
| 9/14/08 | Harvest & Kill | | | |

ForageSorghum-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/13/08 | Nutrient | Elemental Nitrogen | 120 | no |
| 4/13/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| 6/1/08 | Planting | Sorghum Hay | | |
| 9/14/08 | Harvest & Kill | | | |



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| *ForageSorghum-ConventionalTill-SplitApply-Flood* | | | | | *ForageSorghum-ConventionalTill-SplitApply-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 6/1/08 | Planting | Sorghum Hay | | |
| *6/1/08* | Planting | Sorghum Hay | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| *ForageSorghum-ReduceTill-SplitApply-Flood* | | | | | ForageSorghum-ReduceTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Sorghum Hay | | |
| *6/1/08* | Planting | Sorghum Hay | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| *ForageSorghum-StripTill-SplitApply-Flood* | | | | | ForageSorghum-StripTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Sorghum Hay | | |
| *6/1/08* | Planting | Sorghum Hay | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

| *ForageSorghum-NoTill-SplitApply-Flood* | | | | | ForageSorghum-NoTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 80 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 80 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 6/1/08 | Planting | Sorghum Hay | | |
| *6/1/08* | Planting | Sorghum Hay | | | 6/24/08 | Nutrient | Elemental Nitrogen | 40 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *6/24/08* | Nutrient | Elemental Nitrogen | 40 | no | 9/14/08 | Harvest & Kill | | | |
| *9/14/08* | Harvest & Kill | | | | | | | | |

# Small Grains Scenarios

| *SmallGrains-ConventionalTill-Flood* | | | | | *SmallGrains-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 55 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 55 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-ReduceTill-Flood* | | | SmallGrains-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 55 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 55 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-StripTill-Flood* | | | SmallGrains-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 55 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 55 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-NoTill-Flood* | | | SmallGrains-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 55 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 55 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-ConventionalTill-SplitApply-Flood* | | | SmallGrains-ConventionalTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/23/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/23/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 35 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 35 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-ReduceTill-SplitApply-Flood* | | | SmallGrains-ReduceTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 35 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 35 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-StripTill-SplitApply-Flood* | | | SmallGrains-StripTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 35 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 35 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/24/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *6/24/08* | Tillage | FURROW-OUT CULTIVATOR | | | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |
| | | *SmallGrains-NoTill-SplitApply-Flood* | | | SmallGrains-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 35 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 35 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | yse | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/1/08 | Planting | SmallGrains | | |
| *4/1/08* | Planting | SmallGrains | | | 6/24/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/24/08* | Nutrient | Elemental Nitrogen | 20 | no | 8/15/08 | Harvest & Kill | | | |
| *8/15/08* | Harvest & Kill | | | | | | | | |

# Melons Scenarios

| | | *Melons-ConventionalTill-Flood* | | | | | *Melons-ConventionalTill-Drip* | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 125 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 125 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |
| | | *Melons-ReduceTill-Flood* | | | Melons-ReduceTill-Drip | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 125 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 125 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |
| | | *Melons-StripTill-Flood* | | | Melons-StripTill-Drip | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 125 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 125 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |
| | | *Melons-NoTill-Flood* | | | Melons-NoTill-Drip | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 125 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 125 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |

| *Melons-ConventionalTill-SplitApply-Flood* | | | | | *Melons-ConventionalTill-SplitApply-Drip* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/23/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/27/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/27/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/14/08* | Nutrient | Elemental Nitrogen | 85 | no | 4/14/08 | Nutrient | Elemental Nitrogen | 85 | no |
| *4/14/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *4/14/08* | Tillage | CULTI-PACKER PULVERIZER | | | 4/14/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 45 | no | 6/24/08 | Nutrient | Elemental Nitrogen | 45 | no |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |

| *Melons-ReduceTill-SplitApply-Flood* | | | | | Melons-ReduceTill-SplitApply-Drip | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/23/08* | Tillage | SINGLE DISK | | | 3/23/08 | Tillage | SINGLE DISK | | |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 85 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 85 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 45 | no | 6/24/08 | Nutrient | Elemental Nitrogen | 45 | no |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |

| *Melons-StripTill-SplitApply-Flood* | | | | | Melons-StripTill-SplitApply-Drip | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Tillage | STRIP TILLING | | | 4/13/08 | Tillage | STRIP TILLING | | |
| *4/13/08* | Nutrient | Elemental Nitrogen | 85 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 85 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | no | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | no |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 45 | no | 6/24/08 | Nutrient | Elemental Nitrogen | 45 | no |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |

| *Melons-NoTill-SplitApply-Flood* | | | | | Melons-NoTill-SplitApply-Drip | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *4/13/08* | Nutrient | Elemental Nitrogen | 85 | no | 4/13/08 | Nutrient | Elemental Nitrogen | 85 | no |
| *4/13/08* | Nutrient | Elemental Phosphorous | 80 | yes | 4/13/08 | Nutrient | Elemental Phosphorous | 80 | yes |
| *4/14/08* | Tillage | BEDDER (DISK) | | | 4/14/08 | Tillage | BEDDER (DISK) | | |
| *5/20/08* | Planting | Melons | | | 5/20/08 | Planting | Melons | | |
| *6/24/08* | Nutrient | Elemental Nitrogen | 45 | no | 6/24/08 | Nutrient | Elemental Nitrogen | 45 | no |
| *9/14/18* | Harvest & Kill | | | | 9/14/18 | Harvest & Kill | | | |

# Division 3

## Alfalfa Scenarios

| *Alfalfa-ConventionalTill-Flood* | | | | | *Alfalfa-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *2/28/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/5/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/7/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/10/08* | Tillage | CULTI-PACKER PULVERIZER | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |

| *Alfalfa-ReduceTill-Flood* | | | | | Alfalfa-ReduceTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *2/28/08* | Tillage | SINGLE DISK | | | 2/28/08 | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | | 3/7/08 | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |



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|---|---|---|---|---|---|---|---|---|---|
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |
| | | | *Alfalfa-StripTill-Flood* | | Alfalfa-StripTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/7/08* | Tillage | STRIP TILLING | | | 3/7/08 | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |
| | | | *Alfalfa-NoTill-Flood* | | Alfalfa-NoTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |

| | | | | |
|---|---|---|---|---|
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |

*Alfalfa-ConventionalTill-SplitApply-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *2/28/08* | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/2/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *3/5/08* | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/7/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | |
| *3/10/08* | Tillage | CULTI-PACKER PULVERIZER | | |
| *3/15/08* | Planting | Alfalfa | | |
| *6/1/09* | Harvest | | | |
| *7/15/09* | Harvest | | | |
| *8/30/09* | Harvest | | | |
| *9/20/09* | Harvest | | | |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no |
| *6/1/10* | Harvest | | | |
| *7/15/10* | Harvest | | | |
| *8/30/10* | Harvest | | | |
| *9/20/10* | Harvest | | | |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no |
| *6/1/11* | Harvest | | | |
| *7/15/11* | Harvest | | | |
| *8/30/11* | Harvest | | | |
| *9/14/11* | Harvest & Kill | | | |

Alfalfa-ConventionalTill-SplitApply-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 2/28/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| 3/2/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| 3/5/08 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| 3/7/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| 3/10/08 | Tillage | CULTI-PACKER PULVERIZER | | |
| 3/15/08 | Planting | Alfalfa | | |
| 6/1/09 | Harvest | | | |
| 7/15/09 | Harvest | | | |
| 8/30/09 | Harvest | | | |
| 9/20/09 | Harvest | | | |
| 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| 6/1/10 | Harvest | | | |
| 7/15/10 | Harvest | | | |
| 8/30/10 | Harvest | | | |
| 9/20/10 | Harvest | | | |
| 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| 6/1/11 | Harvest | | | |
| 7/15/11 | Harvest | | | |
| 8/30/11 | Harvest | | | |
| 9/14/11 | Harvest & Kill | | | |



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| *Alfalfa-ReduceTill-SplitApply-Flood* | | | | | Alfalfa-ReduceTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *2/28/08* | Tillage | SINGLE DISK | | | 2/28/08 | Tillage | SINGLE DISK | | |
| *3/7/08* | Tillage | STRIP TILLING | | | 3/7/08 | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |

| *Alfalfa-StripTill-SplitApply-Flood* | | | | | Alfalfa-StripTill-SplitApply-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/7/08* | Tillage | STRIP TILLING | | | 3/7/08 | Tillage | STRIP TILLING | | |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | no | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | no |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/10/08 | Tillage | FURROW-OUT CULTIVATOR | | |
| *3/10/08* | Tillage | FURROW-OUT CULTIVATOR | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | no |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | no | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | no | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |
| | | *Alfalfa-NoTill-SplitApply-Flood* | | | Alfalfa-NoTill-SplitApply-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/10/08* | Nutrient | Elemental Phosphorous | 125 | yes | 3/10/08 | Nutrient | Elemental Phosphorous | 125 | yes |
| *3/10/08* | Nutrient | Elemental Nitrogen | 26 | no | 3/10/08 | Nutrient | Elemental Nitrogen | 26 | no |
| *3/10/08* | Tillage | BEDDER (DISK) | | | 3/15/08 | Planting | Alfalfa | | |
| *3/15/08* | Planting | Alfalfa | | | 6/1/09 | Harvest | | | |
| *6/1/09* | Harvest | | | | 7/15/09 | Harvest | | | |
| *7/15/09* | Harvest | | | | 8/30/09 | Harvest | | | |
| *8/30/09* | Harvest | | | | 9/20/09 | Harvest | | | |
| *9/20/09* | Harvest | | | | 4/15/10 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/10* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/10 | Nutrient | Elemental Phosphorous | 50 | yes |
| *4/15/10* | Nutrient | Elemental Phosphorous | 50 | yes | 6/1/10 | Harvest | | | |
| *6/1/10* | Harvest | | | | 7/15/10 | Harvest | | | |
| *7/15/10* | Harvest | | | | 8/30/10 | Harvest | | | |
| *8/30/10* | Harvest | | | | 9/20/10 | Harvest | | | |
| *9/20/10* | Harvest | | | | 4/15/11 | Nutrient | Elemental Nitrogen | 10 | no |
| *4/15/11* | Nutrient | Elemental Nitrogen | 10 | no | 4/15/11 | Nutrient | Elemental Phosphorus | 50 | yes |
| *4/15/11* | Nutrient | Elemental Phosphorus | 50 | yes | 6/1/11 | Harvest | | | |
| *6/1/11* | Harvest | | | | 7/15/11 | Harvest | | | |
| *7/15/11* | Harvest | | | | 8/30/11 | Harvest | | | |
| *8/30/11* | Harvest | | | | 9/14/11 | Harvest & Kill | | | |
| *9/14/11* | Harvest & Kill | | | | | | | | |

## Grass Pasture Scenarios

| | | *GrassPasture-ConventionalTill-Flood* | | | | | *GrassPasture-ConventionalTill-Sprinkler* | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *11/15/2007* | Planting | Pasture | | | 11/15/2007 | Planting | Pasture | | |
| *4/15/2008* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/2008* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/2008* | Harvest | | | | 5/15/2008 | Harvest | | | |
| *6/25/2008* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/2008* | Harvest | | | | 8/1/2008 | Harvest | | | |
| *9/30/2008* | Harvest | | | | 9/30/2008 | Harvest | | | |
| *11/1/2008* | Harvest & Kill | | | | 11/1/2008 | Harvest & Kill | | | |
| | | *GrassPasture-StripTill-Flood* | | | | | GrassPasture-StripTill-Sprinkler | | |

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

*GrassPasture-ReduceTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

GrassPasture-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

*GrassPasture-NoTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

GrassPasture-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | yes |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

*GrassPasture-ConventionalTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | yes |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

GrassPasture-ConventionalTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

*GrassPasture-StripTill-Flood*

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 11/15/2007 | Planting | Pasture | | |
| 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| 5/15/2008 | Harvest | | | |
| 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| 8/1/2008 | Harvest | | | |
| 9/30/2008 | Harvest | | | |
| 11/1/2008 | Harvest & Kill | | | |

GrassPasture-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
|---|---|---|---|---|---|---|---|---|---|
| *11/15/2007* | Planting | Pasture | | | 11/15/2007 | Planting | Pasture | | |
| *4/15/2008* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/2008* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/2008* | Harvest | | | | 5/15/2008 | Harvest | | | |
| *6/25/2008* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/2008* | Harvest | | | | 8/1/2008 | Harvest | | | |
| *9/30/2008* | Harvest | | | | 9/30/2008 | Harvest | | | |
| *11/1/2008* | Harvest & Kill | | | | 11/1/2008 | Harvest & Kill | | | |

| *GrassPasture-ReduceTill-Flood* | | | | | GrassPasture-ReduceTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *11/15/2007* | Planting | Pasture | | | 11/15/2007 | Planting | Pasture | | |
| *4/15/2008* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/2008* | Nutrient | Elemental Phosphorous | 40 | no | 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | no |
| *5/15/2008* | Harvest | | | | 5/15/2008 | Harvest | | | |
| *6/25/2008* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/2008* | Harvest | | | | 8/1/2008 | Harvest | | | |
| *9/30/2008* | Harvest | | | | 9/30/2008 | Harvest | | | |
| *11/1/2008* | Harvest & Kill | | | | 11/1/2008 | Harvest & Kill | | | |

| *GrassPasture-NoTill-Flood* | | | | | GrassPasture-NoTill-Sprinkler | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *11/15/2007* | Planting | Pasture | | | 11/15/2007 | Planting | Pasture | | |
| *4/15/2008* | Nutrient | Elemental Nitrogen | 50 | no | 4/15/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/15/2008* | Nutrient | Elemental Phosphorous | 40 | yes | 4/15/2008 | Nutrient | Elemental Phosphorous | 40 | yes |
| *5/15/2008* | Harvest | | | | 5/15/2008 | Harvest | | | |
| *6/25/2008* | Nutrient | Elemental Nitrogen | 50 | no | 6/25/2008 | Nutrient | Elemental Nitrogen | 50 | no |
| *8/1/2008* | Harvest | | | | 8/1/2008 | Harvest | | | |
| *9/30/2008* | Harvest | | | | 9/30/2008 | Harvest | | | |
| *11/1/2008* | Harvest & Kill | | | | 11/1/2008 | Harvest & Kill | | | |

## Potatoes Scenarios

| *Potatoes-ConventionalTill-Flood* | | | | | *Potatoes-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/08 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/15/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/15/08 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *4/14/08* | Nutrient | Elemental Phosphorous | 200 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 200 | no |
| *4/15/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | | 4/15/08 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *4/15/08* | Tillage | Bedder (Disk) | | | 4/30/08 | Nutrient | Elemental Nitrogen | 50 | no |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *4/30/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/30/08 | Planting | Potatoes | | |
| *4/30/08* | Planting | Potatoes | | | 5/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/5/08* | Tillage | Bedder (Disk) | | | 5/30/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/15/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/5/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/30/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/5/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/15/08* | Nutrient | Elemental Nitrogen | 20 | no | 7/10/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 20 | no | 7/20/08 | Nutrient | Elemental Nitrogen | 10 | no |
| *7/10/08* | Nutrient | Elemental Nitrogen | 20 | no | 8/20/08 | Kill | | | |
| *7/20/08* | Nutrient | Elemental Nitrogen | 10 | no | 9/15/08 | Dig | POTATO DIGGER | | |
| *8/20/08* | Kill | | | | 9/15/08 | Harvest | | | |
| *9/15/08* | Dig | POTATO DIGGER | | | | | | | |
| *9/15/08* | Harvest | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *Potatoes-ReduceTill-Flood* | | | Potatoes-ReduceTill-Sprinkler | | | | |
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | SINGLE DISK | | | 3/15/08 | Tillage | SINGLE DISK | | |
| *3/15/08* | Tillage | STRIP TILLING | | | 3/15/08 | Tillage | STRIP TILLING | | |
| *4/14/08* | Nutrient | Elemental Phosphorous | 200 | no | 4/14/08 | Nutrient | Elemental Phosphorous | 200 | no |
| *4/15/08* | Tillage | Bedder (Disk) | | | 4/30/08 | Nutrient | Elemental Nitrogen | 50 | no |
| *4/30/08* | Nutrient | Elemental Nitrogen | 50 | no | 4/30/08 | Planting | Potatoes | | |
| *4/30/08* | Planting | Potatoes | | | 5/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/5/08* | Tillage | Bedder (Disk) | | | 5/30/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/15/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/5/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *5/30/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/15/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/5/08* | Nutrient | Elemental Nitrogen | 20 | no | 6/25/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/15/08* | Nutrient | Elemental Nitrogen | 20 | no | 7/10/08 | Nutrient | Elemental Nitrogen | 20 | no |
| *6/25/08* | Nutrient | Elemental Nitrogen | 20 | no | 7/20/08 | Nutrient | Elemental Nitrogen | 10 | no |
| *7/10/08* | Nutrient | Elemental Nitrogen | 20 | no | 8/20/08 | Kill | | | |
| *7/20/08* | Nutrient | Elemental Nitrogen | 10 | no | 9/15/08 | Dig | POTATO DIGGER | | |
| *8/20/08* | Kill | | | | 9/15/08 | Harvest | | | |
| *9/15/08* | Dig | POTATO DIGGER | | | | | | | |
| *9/15/08* | Harvest | | | | | | | | |

## Small Grains Scenarios

| | | *SpringGrains-ConventionalTill-Flood* | | | *SpringGrains-ConventionalTill-Sprinkler* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *date* | operation | par1 | par2 | par3 | date | operation | par1 | par2 | par3 |
| *3/15/08* | Tillage | DEEP RIPPER- SUBSOILER | | | 3/15/14 | Tillage | DEEP RIPPER- SUBSOILER | | |
| *3/15/08* | Tillage | MOLDBOARD PLOW REG GE10B | | | 3/15/14 | Tillage | MOLDBOARD PLOW REG GE10B | | |
| *3/15/08* | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | | 3/15/14 | Tillage | OFFSET DIS/HEAVDUTY GE19FT | | |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | yes | 4/30/14 | Nutrient | Elemental Phosphorous | 40 | yes |



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| | | | | |
|---|---|---|---|---|
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| *5/1/08* | Planting | Small grains | | |
| *8/31/08* | Harvest | | | |
| *9/15/08* | Harvest & Kill | | | |

| | | | | |
|---|---|---|---|---|
| 4/30/14 | Nutrient | Elemental Nitrogen | 90 | no |
| 4/30/14 | Tillage | CULTI-MULCH ROLLER GE18FT | | |
| 5/1/08 | Planting | Small grains | | |
| 8/31/14 | Harvest | | | |
| 9/15/14 | Harvest & Kill | | | |

*SpringGrains-ReduceTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | SINGLE DISK | | |
| *3/15/08* | Tillage | STRIP TILLING | | |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Tillage | BEDDER (DISK) | | |
| *5/1/08* | Planting | Small grains | | |
| *8/31/08* | Harvest | | | |
| *9/15/08* | Harvest & Kill | | | |

SpringGrains-ReduceTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/14 | Tillage | SINGLE DISK | | |
| 3/15/14 | Tillage | STRIP TILLING | | |
| 4/30/14 | Nutrient | Elemental Phosphorous | 40 | yes |
| 4/30/14 | Nutrient | Elemental Nitrogen | 90 | no |
| 5/1/14 | Planting | Small grains | | |
| 8/31/14 | Harvest | | | |
| 9/15/14 | Harvest & Kill | | | |

*SpringGrains-StripTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *3/15/08* | Tillage | STRIP TILLING | | |
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Tillage | BEDDER (DISK) | | |
| *5/1/08* | Planting | Small grains | | |
| *8/31/08* | Harvest | | | |
| *9/15/08* | Harvest & Kill | | | |

SpringGrains-StripTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 3/15/14 | Tillage | STRIP TILLING | | |
| 4/30/14 | Nutrient | Elemental Phosphorous | 40 | yes |
| 4/30/14 | Nutrient | Elemental Nitrogen | 90 | no |
| 5/1/14 | Planting | Small grains | | |
| 8/31/14 | Harvest | | | |
| 9/15/14 | Harvest & Kill | | | |

*SpringGrains-NoTill-Flood*

| *date* | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| *4/30/08* | Nutrient | Elemental Phosphorous | 40 | yes |
| *4/30/08* | Nutrient | Elemental Nitrogen | 90 | no |
| *4/30/08* | Tillage | BEDDER (DISK) | | |
| *5/1/08* | Planting | Small grains | | |
| *8/31/08* | Harvest | | | |
| *9/15/08* | Harvest & Kill | | | |

SpringGrains-NoTill-Sprinkler

| date | operation | par1 | par2 | par3 |
|---|---|---|---|---|
| 4/30/14 | Nutrient | Elemental Phosphorous | 40 | yes |
| 4/30/14 | Nutrient | Elemental Nitrogen | 90 | no |
| 5/1/14 | Planting | Small grains | | |
| 8/31/14 | Harvest | | | |
| 9/15/14 | Harvest & Kill | | | |