Project Name: Demonstration of Precision Agriculture on Grassland in the Greenbrier Valley, (WV)
Recipient Organization/Agency: WVU Extension Service
Recipient Organization Web Address: http://ext.wvu.edu/

1) Summary of Accomplishments
The Demonstration of Precision Agriculture on Grassland in the Greenbrier Valley project has definitely been an educational benefit for producers. A goal of forty producers participating in the program was set in 2008. When the project was completed in 2010 thirty six producers, representing 3,842.87 acres, had soil sampled via precision methods. The initial sampling goal was set at 2,900 acres, but do to the lack of monies used for spreading of nutrients and lime using precision methods, these monies were moved, and devoted to the sampling portion of the program. The goal for acreage spread for fertilizer and lime was also set at 2,900 acres for each, bringing the total spreadable acreage goal to 5,800 acres. For the fertilizer spreading portion of the project twelve producers, representing 1,265 acres, elected to have fertilizer applied using precision methods, and twenty producers, representing 1,773.9 acres, opted to have lime applied using the new technology.

2) Project Activities & Results
If your grant agreement included an approved logic framework, paste the logic framework table here.

Background, Preparation:
With the end of the cold war, satellite-based technology that was only available to the armed forces has been released for civilian use. The uses of satellites for geo-referenced data collection, computers to convert the data to soil fertility maps, and machines for the site-specific application of nutrients have resulted in the development of a new farming system called precision agriculture. The use of this technology alone does not change a farming system from a conventional to a precision system. The conventional method of nutrient and lime treatment evolved from one analysis recommendation representing a field, with the entire field receiving the same rate of nutrients or lime. Precision agriculture includes a process of data collection, conversion of data to knowledge and application of the knowledge to site-specific management within field boundaries. Thus any evaluation of precision farming must include validation of sampling data; determination of accuracy of soil maps, and documentation of economic and environmental benefits of switching from conventional to a precision based farming.

The technology used in precision farming is very fascinating. For nutrient management this technology is based on collecting soil samples on a grid and using the soil test results to produce soil fertility maps. This geo-referenced soil fertility information is then used to apply variable rates of nutrients or lime to a field. Thus, the success or failure of precision agriculture
is determined by the accuracy of the soil fertility maps, and the variance in nutrient content throughout the field. A map produced by using many sampling points is likely to be more accurate than one produced with a few data points. However, when we increase sampling intensity that also increases the cost of setting up a precision farming system. Thus, it is important to have an optimum grid soil sampling intensity.

The precision farming program was started by the Greenbrier Hydrologic Unit in Lewisburg, WV during 1997. With four years of research complete in the Greenbrier Valley, we are noticing some broad-spectrum indications of why or why not precision farming will work in West Virginia. HUA personal had sampled over 2000 acres via the precision method. Thus far data retrieved is very appealing, especially on pastureland. Due to our smaller sized crop fields in West Virginia, as compared to the mid-west, we are noticing smaller variations in fertility, as compared to a larger pasture fields having more slope, more soil types, and inconsistent terrain, ultimately leading to more variation in soil fertility. With increased variation in fertility, the reasons for using precision agriculture are enhanced.

Collaborators:
Brian Wickline, WVU Extension Agent, Monroe County
John McCutcheon, WVU Extension Agent, Greenbrier County
Greg Hammons, WVU Extension Agent, Pocahontas County
Brian Sparks, WVU Extension Agent, Nicholas & Fayette Counties
David Richmond, WVU Extension Agent, Raleigh & Summers Counties
Tom Basden, WVU Extension Water Quality Specialist
Ed Rayburn, WVU Extension Forage Specialist
Tim Fullen, Private Crop Consultant
Tara Helmick, GVCD Grassland Technician
Adam Merritt, West Virginia Conservation Agency
Dennis Burns, West Virginia Conservation Agency

Methods:
During the fall of 2007 Agent Brian Wickline along with Agent John McCutcheon and Nutrient Management Specialist Tom Basden worked to complete the application for the Conservation Innovation Grant (CIG). This particular CIG grant was written to demonstrate to agricultural producers the technology of precision agriculture through a cost share program. The grant was written for livestock producers to use towards fertility management on grasslands within the Greenbrier Valley of West Virginia. In July the agents were informed that the grant was fully funded for $75,800.00. Within the grant a time line of procedures to carry out the program was devised and is as follows:

Project action plan and timeline:
- October of 2008 – Ranking Criteria Developed
- October-December 2008-Producer Education and Program Awareness
- November-December 2008 –1st Sign up Period
- January 2009- Ranking of Applicants
- February-April 2009 Soil Sampling, Nutrient Analysis, and Fertility Maps
- February-May 2009 Lime and Nutrient Application
- June-July 2009 2nd Sign Up Period
- June-July 2009 Producer Education and Program Awareness
August 2009 2nd Ranking of Applicants
September-November 2009 Soil Sampling, Nutrient Analysis, and Fertility Maps
September-December 2009 Lime and Nutrient Application
January 2010 Development of Survey Instrument for Final Program Evaluation
March-May 2010 Survey Distribution
June 2010-Analysis for Survey Data
July-August 2010 Prepare and Completion of Final Report

Goals:
The overall objective of the project is to build awareness among forty producers concerning the use of precision agriculture technology, and to access whether there is a need for further education on precision agriculture and nutrient management. The goal will be achieved through the use of mass media, workshops/field days, and one on one conversation using previous data that had been collected during the last ten years of research. This project will demonstrate that precision nutrient placement will allow for a more uniform amount of forage production, and may reduce the amount of nutrients needed to be applied, ultimately becoming an economic benefit to producers. Of 108 studies reviewed by Lambert and Lowenberg-Debour, 69% had positive economic returns, while only 12% were negative, and 19% had mixed results using this type of technology (1). A sampling acreage goal of 2,900 acres was set, 1,450 acres per each year of the project.

Evaluation:
Two methods was be used to determine the success of the demonstration. The initial evaluation was observed through the number of applicants for the program compared with the final number of applicants funded. The goal of the project is to cooperate with forty producers over the length of the demonstration. The second evaluation of the project was completed via a survey instrument developed to determine the producer’s satisfaction with the overall program. The producer’s thoughts concerning the economic validity of the program, and the attitudes towards the environmental benefits of the demonstration will also be measured. These evaluations will be compiled to determine the overall effectiveness of the demonstration.

Outcomes/Impacts:
• $75,800.00 was obtained for the project
• 2009
  • Educational were brochures been designed and mailed
  • 21 producers representing 1,920 acres applied for cost share
  • 1,662.82 acres sampled for 17 participants during first sign-up period
  • 534 acres had 104,000 lbs. of 18-46-0 applied
  • 587.2 acres had 576,000 lbs. of lime applied
  • 17 producers received 34 hours of instruction relating to each of their farms.
• 2010
  • 19 producers representing 2,205.65 acres were sampled
  • 9 producers had lime spread on 1,187.7 acres
  • 8 producers had fertilizer spread on 628 acres
• Final Results
  • 36 producers participated in the program (Goal: 40 producers)
  • 3,842.87 acres soil sampled using PA methods (Goal: 2,900 acres)
• 12 Producers had 1,265 acres of fertilizer applied (Goal: 40 producers, 2,900 acres)
• 20 Producers had 1,773.9 acres of lime applied (Goal: 40 producers, 2,900 acres)
• The goal was not met for lime and fertilizer application due to the drastic increase in these products during 2008-2010.
• All applicants who applied for the cost share were accepted due to the excess funding available.

• Survey Results (completed summer of 2010)
• 35 surveys were sent out with 18 being returned. (51% Return Rate)
• 94.4 % felt the program benefited them
• 94.4 % felt they would use precision agriculture again
• 55.5% felt the soil fertility variation was more than expected
• 94.4% felt the format of the soil fertility maps were easily understandable
• 83.3 % felt they would make management changes via using the soil fertility maps other than spreading lime and fertilizer. Example: feeding hay
• 72.2 % felt they needed more training on Nutrient Management

3) Lessons Learned, Reflective Critique and Program Recommendations:
Ten years ago when the Greenbrier Hydrologic Unit started to promote this program, the adoption rate was low among producers and continued through 2008. Five to seven years ago the economic validity of the program could be questioned. This was simply due to the decreased cost of nutrients at the time. During the last three years the United States has seen a drastic increase in nutrient expense, which makes this program much more economically feasible, as seen from the research completed by Agent Brian Wickline and Agent Craig Yohn, in Jefferson County. This data proved that the expense of precision agriculture was very comparable to the price of conventional sampling, and did not account for the potential increase in forage production. The survey results from 2010 showed that of the producers who participated in the program, almost all of them would use this type of technology again. This explains that once producers build a level of understanding of the technology it becomes much more comfortable for them to use. This has been a program that has been promoted for ten years, and now may have the capabilities to do so.

4) Presentation and Dissemination:
A mass mailing of over 1,000 brochures was mailed to producers in the three county area in early December 2008 explaining the program. Brochures were placed in feed stores, WVU Extension offices, and U.S.D.A. county offices. During the second signup period, which ended November 15, 2009, articles were placed in newspapers in the three county region, twice during consecutive weeks. Survey results will be discussed at local grasslands and conservation district meetings. In addition, each producer received individual consultation concerning their sampling results and soil fertility maps. Soil fertility management plans were discussed to see how best to apply the results to each producers individual situation. Some produces opted to spread fertilizer via precision, and in two situations, do to the high price of fertilizer prices, producers decided to increase livestock feeding in the areas that were requiring more phosphorus and potassium.
5) **Project Documents**

**Attachments**

1) Producer Letter Notice  
2) Producer Ranking Criteria Sheet  
3) Producer Contract  
4) Producer Letter 2\textsuperscript{nd} Sign Up Notice  
5) Producer Survey Letter  
6) Producer Survey  
7) Three County Project Map  
8) Program Brochure  
9) GPS Soil Points  
10) GPS Soil Fertility pH Map  
11) Sampling Picture 1  
12) Sampling Picture 2