



Fertility Management

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Precision Soil Sampling and Nutrient Application - A Case Study Evaluating the Economic Benefits in Jefferson County, West Virginia

The precision farming program was started by the Greenbrier Hydrologic Unit in Lewisburg, W.Va., in 1997. With four years of research completed in the Greenbrier Valley, we are noticing some broad-spectrum indications of why or why not precision farming will work in West Virginia. HUA personnel had sampled more than 2000 acres via the precision method. Thus far, data retrieved is very appealing, especially on pastureland. Due to our smaller size crop fields in West Virginia, as compared to the Midwest, we are noticing smaller variations in fertility, as compared with 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.

Trials were conducted in Nicholas, Barbour, and Jefferson counties in 2006. Below is an overview of the case study done in Jefferson County on Meadow Green Farm in 2006.

Overview:

Meadow Green Farm is a 180-acre beef and hay farm that utilizes the following management practices:

- Rotational Grazing
- Field Size Less than 15 Acres
- Chain Harrowing
- Rolling Hay Out
- Annual Fall Soil Sampling

Methods Used in Jefferson County:

The methods and goals, impacts, and outcomes of the forthcoming information are reflective of the work completed in Jefferson County during 2006. To determine the economic differences between the conventional and precision methods, soil samples were pulled and analyzed. The initial soil samples of Meadow Green Farm were taken on May 13, 2006. Using the precision method, 26 samples, representing 35.61 acres divided among three fields were taken. Also on May 13, the same 35.61 acres that had been previously sampled using the precision method were conventionally sampled, by dividing the acreage into three exiting fields. An analysis was then conducted using data from the two sets of soil samples.

Goals:

To determine the economic validity of precision agriculture soil sampling versus the conventional method of soil sampling.

Outcomes/Impacts:

Soil results of the two sampling methods show variations across fields. Maps portray the gradient in the movement of nutrients. While soil type does play a role, distance from water, minerals, and the farmstead also play a role. These gradients were not apparent through the conventional sampling completed in this study or previous sampling accomplished by the landowner.

Comparisons of the precision method and the conventional method were focused on the recommended application of phosphorous in the form of 18-46-0, potassium in the form of 0-60-0, and lime. Table 1 below summarizes the findings and compares soil recommendations based on conventional sampling versus precision soil sampling:

Table 1

Field Number	Acres	Lime Recommendation (tons)	18-46-0 Recommendation (pounds)	0-0-60 Recommendation (pounds)
Recommendations Based on Conventional Soil Testing				
1	14.122	0	0	0
2	12.627	0	400	0
3	8.8599	0	0	0
Recommendations Based on Precision Soil Sampling				
1	14.122	13992	65	0
2	12.627	14180	922	525
3	8.8599	6612	0	0

Table 1 shows that through the sampling process, an additional 34,824 pounds (17.4 tons) of lime, 587 pounds of 18-46-0, and 525 pounds of 0-0-60 are required based on precision sampling over conventional sampling. Table 2 summarizes these differences and the cost to the farm.

The cost is over \$1,000 more to perform precision sampling

Table 2—Cost

Amendment	Cost per Ton	Precision			Conventional			Difference
		Recommendation	Cost	Percent of Total Cost	Recommendation	Cost	Percent of Total Cost	
Soil Sampling	xxxxxxx	36 acres @ \$8.00	\$288.00	21.3%	36 acres @ \$3.00	\$108.00	20.2%	\$180.00
Spreading Cost	xxxxxxx	A total of 40 acres over 3 applications @ \$10.00	\$400.00	29.7%	26 acres @ \$6.50	\$169.00	31.6%	\$231.00
Lime	\$23.83	17.4 tons	\$414.64	30.8%	8.0 tons	\$190.64	35.6%	\$224.00
18-46-0	\$337.25	0.49 tons	\$165.25	12.3%	0.2 tons	\$67.45	12.6%	\$97.80
0-0-60	\$293.00	0.27 tons	\$79.11	5.9%	0	\$0.00	0%	\$79.11
Total Cost			\$1,347.00			\$535.09		\$811.91

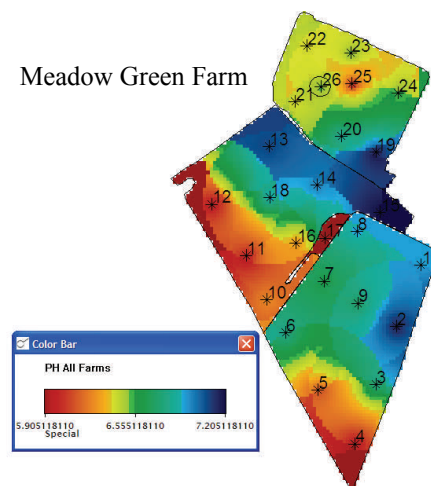


Figure 1 - pH Map

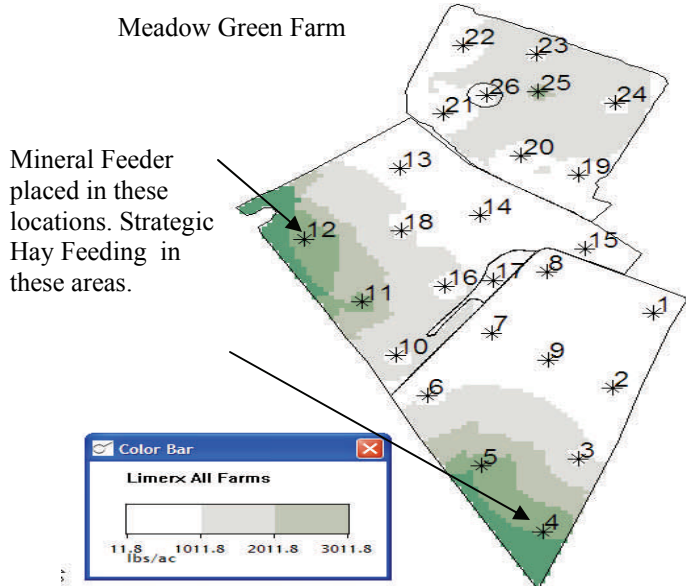
and precision application of nutrients. Table 2 shows that more nutrients were applied through precision soil analysis and interpolation than would have been applied through conventional sampling. This alone accounted for \$400.91 of the difference. Conventional sampling identified less need for nutrients, resulting in a smaller spreading cost and fewer acres being treated. Conventional application required that nutrients be applied on 26 of the 36 acres (72%). The precision application covered a total of 40 acres over the three applications (111%).

Yield Response to Proper Nutrient Placement

The soils will respond to the added nutrients differently, based on their productive capacity. This was determined by using the

maps provided by Tim Fullen, aerials from the West Virginia University GIS Technical Center, and soils from the NRCS Soil Data Mart.

Each point of a precision sample was identified with an under-



lying soil. Table 3 describes the impact on the productivity when nutrients are applied. Interpolation was used to determine the percentage of each soil in the field. The soils for the conventional A value of \$100 per ton was used for the additional

Figure 2 - Lime Application Map

forage produced in response the strategically placed nutrients.

Table 3—Yield Response and Value of Additional Yield

	Soil Type	Acres	Yield Response per Acre *	Tons Produced	Value
Precision	CdB	5.6	1	5.6	\$560.00
	HgC	8	0.7	5.6	\$560.00
	HgB	4	0.7	2.8	\$280.00
	HbC	2	1	2	\$200.00
	Ho	1.5	1.2	1.8	\$180.00
	Lo	3	1.2	3.6	\$360.00
	HbB	1	1	1	\$100.00
Total		25.1		22.4	\$2,240.00
Conventional					
	Lo	5	1.2	6	\$600.00
	HgC	6.5	0.7	4.55	\$455.00
	Ho	0.5	1.2	0.6	\$60.00
Total		12		11.15	\$1,115.00
Difference					\$1,125.00

***Jefferson County Soil Survey**

The value of the additional yield (\$1,125.00—Table 3) minus the additional cost of amendments, services of precision sampling and application (\$811.91—Table 2) returned an additional \$313.09 (\$8.70 per acre) to the farm compared

with conventional sampling and spreading of soil amendments.

Management Changes

The producer, armed with this information, moved mineral feeders to strategic locations based on the application maps. Hay was also fed based on the generated maps. Lime was applied using variable rate application. The producer also plans to have more fields sampled.

Acknowledgments

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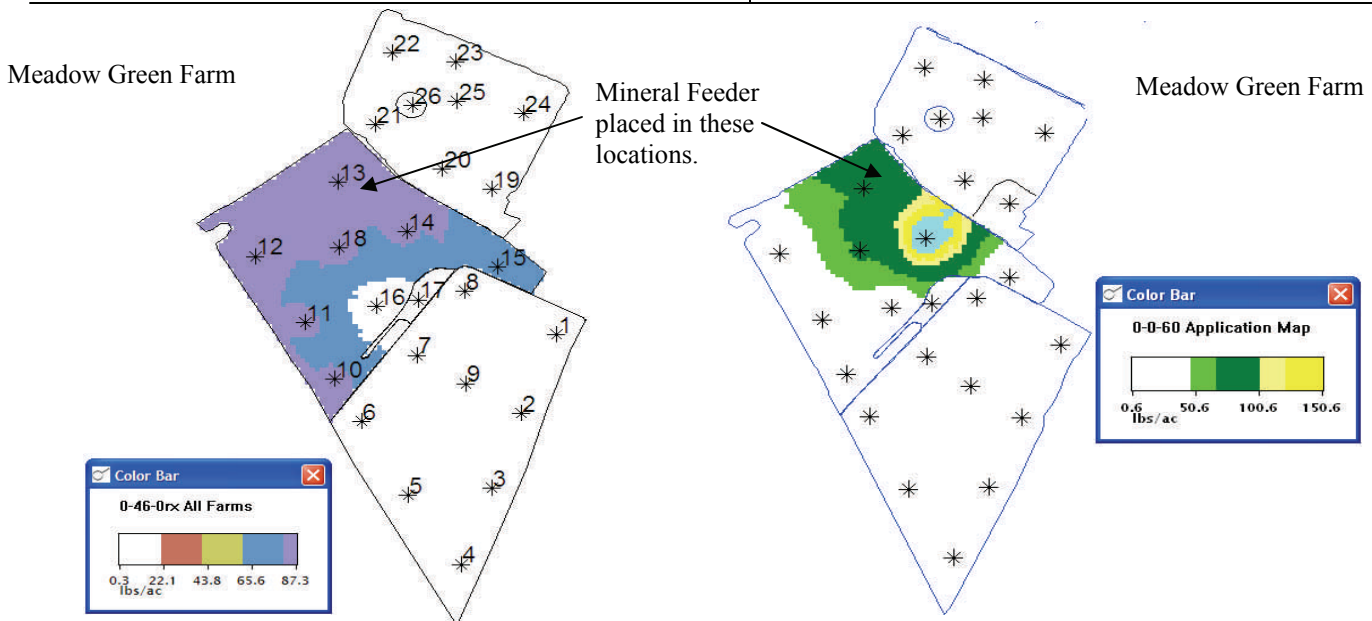


Figure 3 - Phosphorous Application Map

Figure 4 - Potash Application Map