IMPROVING FERTILITY MANAGEMENT & PROFITABILITY

THROUGH PFR SOIL SAMPLING STUDIES

AUTOPROBE VS. HAND SAMPLING

In the fall of 2015, PFR Agronomist, Scott Nelson conducted a soil sampling comparison in Iowa and Missouri, between the AutoProbe™ automated soil sampling technology and traditional hand sampling. The standard method of assessing these nutrients is by soil sampling at 2.5 grids. In this research, we examined the profitability of various soil sampling schemes including use of an automated soil sampling machine developed by AutoProbe.

AutoProbe Automated Soil Sampling Technology

METHODS TESTED

Two fields were sampled according to the following soil sampling schemes.

- Hand sampled at 1.25 acre grids
- Hand sampled at 2.5 acre grids
- AutoProbe sampled at 1.25 acre grids
- AutoProbe sampled at 2.5 acre grids

One field was located near Mt. Vernon, Iowa on a farm with known yield variability. The second field was located in Marshall, Missouri. The Marshall field had a history of intense sampling and high management.

Adequate potassium, phosphorous, and pH are key foundations for optimum yield and profitability. Soil tests for organic matter, CEC, potassium, pH and phosphorous were conducted by A&L labs. Soil test points were spatially analyzed to create fertilizer prescriptions based upon the various sampling practices. Spatial analysis involved ordinary kriging to best simulate fertilizer spread maps developed by the fertilizer industry.

AUTOPROBE — AUTOMATED SOIL SAMPLING TECHNOLOGY

Traditional hand sampling simply cannot reap the quality sample that today's farmers require to get the results promised by precision agriculture technologies.

Soil sampling methods haven't changed much since collecting soil samples began. Typically four to six cores are pulled by hand at inconsistent depths and angles from the center of a grid, covering only 30 feet. Mechanical soil sampling methods pull cores more consistently but still typically only deliver six to twelve cores pulled from a small area.

According to AgRobotics, AutoProbe™ automated soil sampling technology effortlessly collects up to 40 cores per sample from the comfort of a tractor cab. The distance, angle, and depth are consistent, uniform, and accurate. Precise sampling leads to precise planting and precise nutrient management, which allows maximum yield, lower costs, and greater profit.

AUTOPROBE TECHNOLOGIES

TRADITIONAL HAND SOIL SAMPLING — 4-6 CORES

AUTOPROBE AUTOMATED SOIL SAMPLING — 40 CORES

BECK'S

PRACTICAL FARM RESEARCH

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SOIL SAMPLING FOR POTASSIUM & PHOSPHOROUS

AutoProbe spread maps for potassium and phosphorous were significantly more detailed compared to hand sampling for both fields (Figures 1-3).

FIGURE 1. Amount of potassium fertilizer to spread to bring soil tests into the optimum range. (Mt. Vernon, Iowa field)

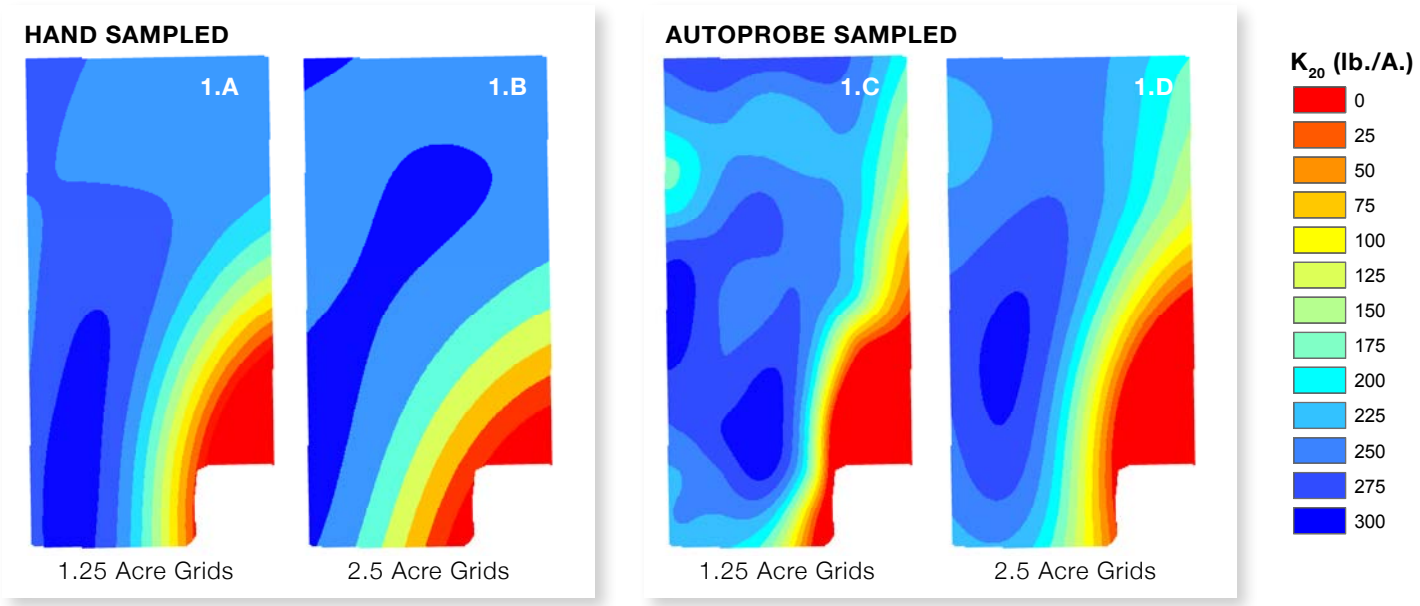


FIGURE 2. Amount of phosphorous fertilizer to spread to bring soil tests into the optimum range. (Mt. Vernon, Iowa field)

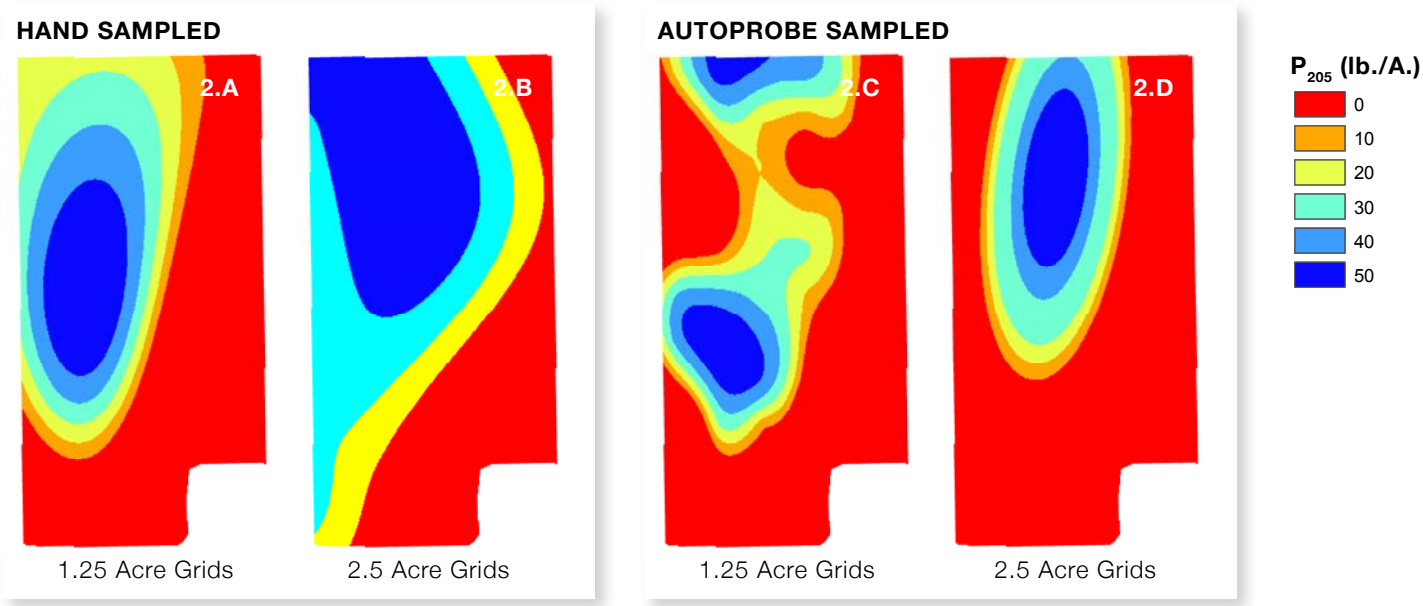
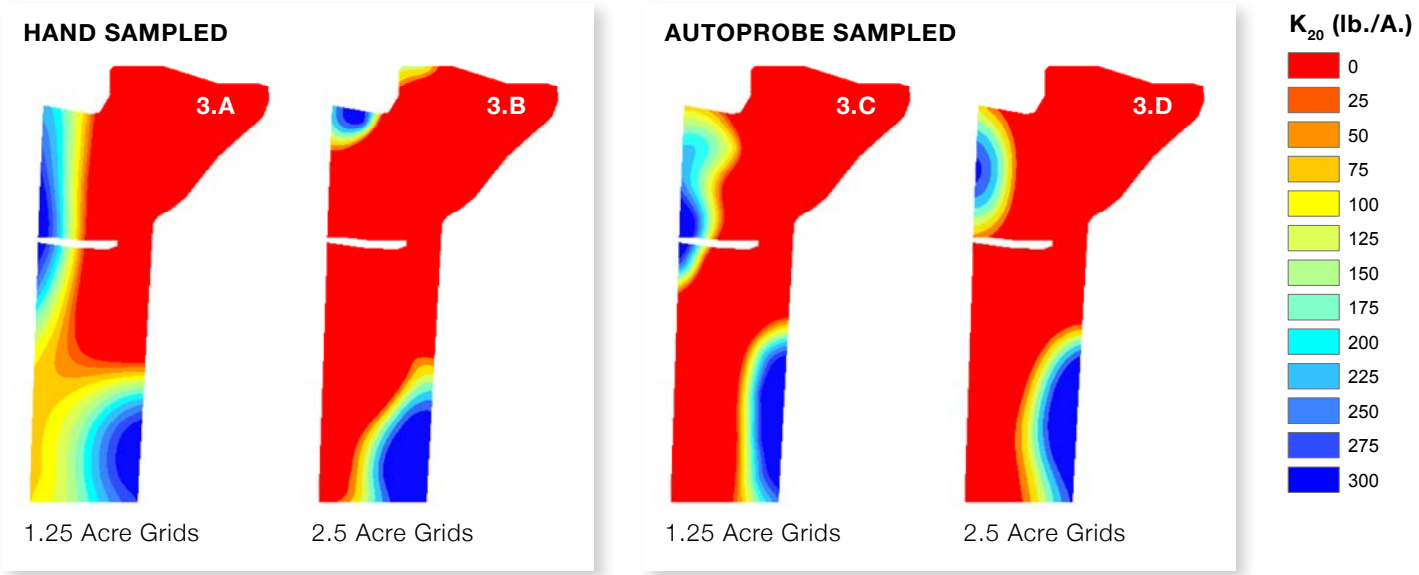
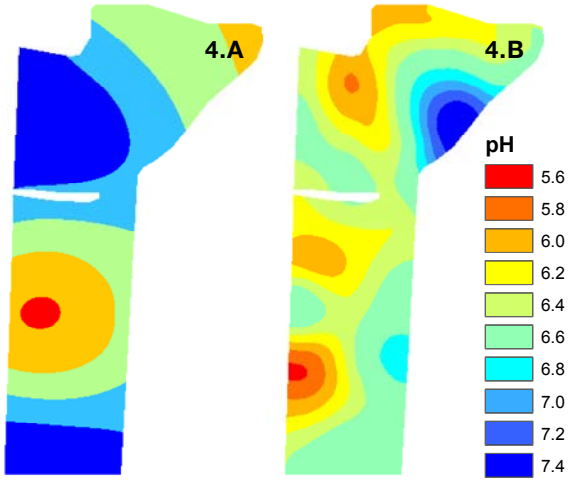


FIGURE 3. Amount of potassium fertilizer to spread to bring soil tests into the optimum range. (Marshall, Missouri field)



SOIL SAMPLING FOR pH LEVELS

FIGURE 4. Soil test pH for sampling at 1.25 acre grids. The greater map detail associated with AutoProbe was most dramatic for pH at the Marshall field where hand sampling seemed to have missed areas of both low and high pH.

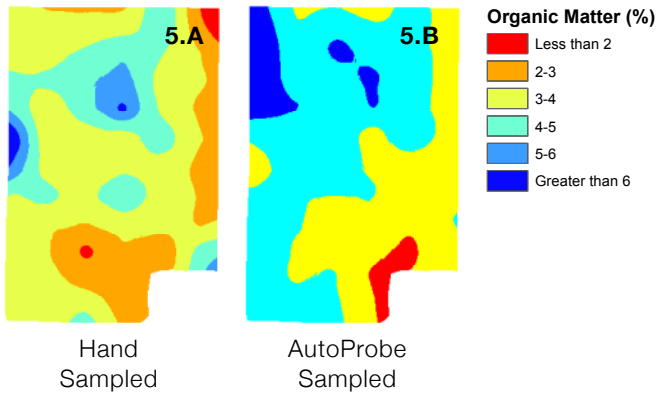


SOIL SAMPLING FOR ORANIC MATTER

Interestingly, organic matter maps were also dramatically different between AutoProbe sampling and hand sampling at the Mt. Vernon field (Figure 5). Hand sampling at 1.25 acre grids predicted an area of very high organic matter while the AutoProbe sampling did not. AutoProbe sampling also made it possible to predict a larger area of low organic matter compared to hand sampling.

The dramatically different phosphorous, potassium, organic matter, and pH maps provide significant evidence that hand sampling and AutoProbe sampling are not similar. The AutoProbe machine samples every 90 ft. and bulks the samples according to whatever grid size the farmer wants to test. This greater sampling across the landscape tends to smooth out extreme values from limited hand sample probes, while providing greater detail on the soil test across the landscape.

FIGURE 5. Soil test organic matter for sampling at 1.25 acre grids. (Mt. Vernon, Iowa field)



"AutoProbe mechanized soil sampler takes the guess work out of pulling quality soil samples. And, it speeds up the process to allow for more cores to be pulled from a wider area at the same angle and to the same depth. These may sound like little things, but they're huge when it comes to making predictions for a nutrient application in the correct amounts on the right hybrids to maximize yields. The work we've been conducting on variable rate and variable hybrid planting will become common place in the near future in more farmers fields. I predict the same thing is true for mechanized soil samples using the AutoProbe. This may become the new standard by which precision farming soil samples are measured. This could help us do a better job by analyzing quality soil sample analysis data upfront. We'll be able to apply the most optimal amounts of nutrients to produce the highest yields."

- **Jason Webster, PFR Innovation Lead**

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SOIL SAMPLING RESULTS

Table 1 shows tabulated results for potassium prescriptions based upon the various sampling practices for the two fields. In the Iowa field, hand sampling at 1.25 acre grids resulted in fertilizer savings of 1,987 lb. or $451.05 cost savings for the field based upon a potassium cost of $454/ton. For the same field, AutoProbe sampling at 2.5 acre grids resulted in fertilizer savings of 3,796 lb. or $861.70 for the entire 72 acre field. While spread maps were significantly different between AutoProbe sampling at 1.25 acre grids and 2.5 acre grids, the amount of predicted fertilizer savings was remarkably similar.

SUMMARY OF RESULTS

- In an Iowa field, sampling at 1.25 acre grids resulted in potash savings of $451.00 on a 72 acre field or $6.00/A.
- In the same field, AutoProbe sampling at 2.5 acre grids compared to hand sampling at 2.5 acre grids predicted less potash needed resulting in savings of $861.70 or $12.00/A.
- Results from a field in Missouri where potassium levels were high was less conclusive.
- Management zone maps generated from AutoProbe were more detailed and significantly different compared to hand sampling.
- These results provide evidence that denser soil sampling using automated soil sampling machines could increase profitability.
- Sampling additional fields will be necessary to derive firm conclusions on the merits of denser soil sampling.

TABLE 1. POTASSIUM FERTILIZER RECOMMENDATIONS

	MT. VERNON, IA		MARSHALL, MO	
SAMPLING PRACTICE	K_{20} (LB./FIELD)	COST FOR FIELD	K_{20} (LB./FIELD)	COST FOR FIELD
Hand Sampled @ 1.25 Acre Grids	12,868	$2,921.00	2,990	$672.75
AutoProbe Sampled @ 1.25 Acre Grids	11,079	$2,514.90	1,856	$417.60
Hand Sampled @ 2.5 Acre Grids	14,855	$3,372.10	997	$219.25
AutoProbe Sampled @ 2.5 Acre Grids	11,059	$2,510.40	1,106	$248.85