United States Department of Agriculture

Precision Agriculture: Profitability and Resource Stewardship

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Outline:

1. Precision Ag: Why is it important? What is it?

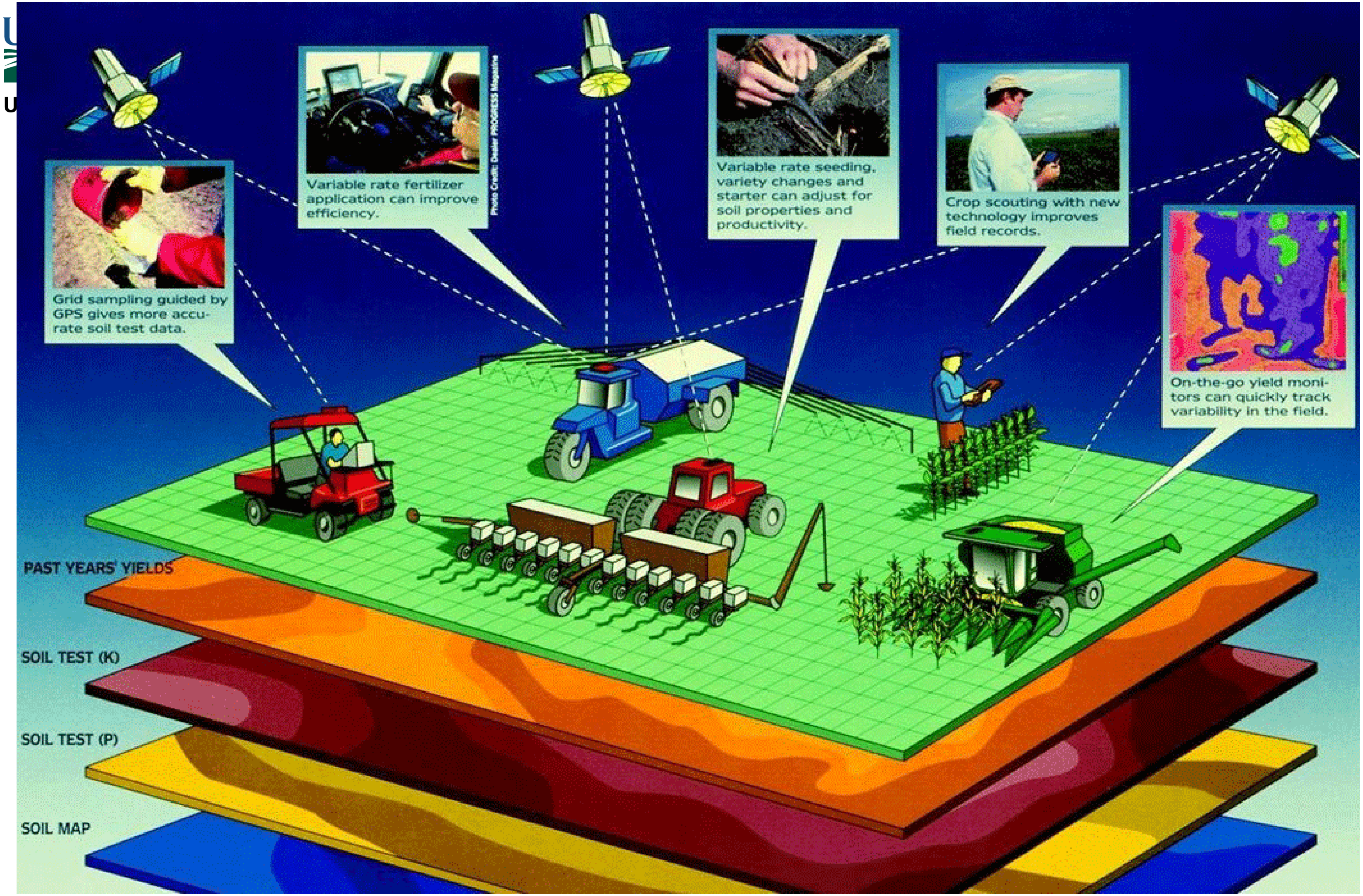
2. Can Productivity/Efficiency of Precision Ag be estimated?

3. Implementation:

   Data development using 2010 & 2016 NASS/ERS field-level corn data

   Best Practice models

4. Results, policy implications and future work



Source: GPS4US

J. Lowenberg-DeBoer and B. Erickson (2019):

“Because precision agriculture (PA) is considered an approach that meets **production and environmental goals** simultaneously, both scientists and policymakers have been investigating techniques to overcome **adoption barriers**”

Griliches (1957):

Expected profitability influences agricultural innovation **adoption**.

Adoption

- By 2016, 15-40 percent of U.S. farms used variable-rate application equipment, which adjusts input application rates depending on field conditions.

- Labor-saving auto-steering guidance systems for tractors and combines were the most popular precision agriculture technology, reaching 50-60 percent of farm planted acres growing corn, peanuts, rice, and spring wheat.

Environmental benefits and profitability

- Precision technologies increase use of soil conservation tillage, erosion reduction, and nutrient control practices.

- Field View, for instance, developed by Bayer AG, could be placed in the back of a combine to detect soil health resulting in reduction of nitrogen application by 10 pounds per acre, increasing yield by 2–3 bushels per acre, and increasing profitability by $12 per acre [Condon (2018).]

Precision Ag Farm-level Studies

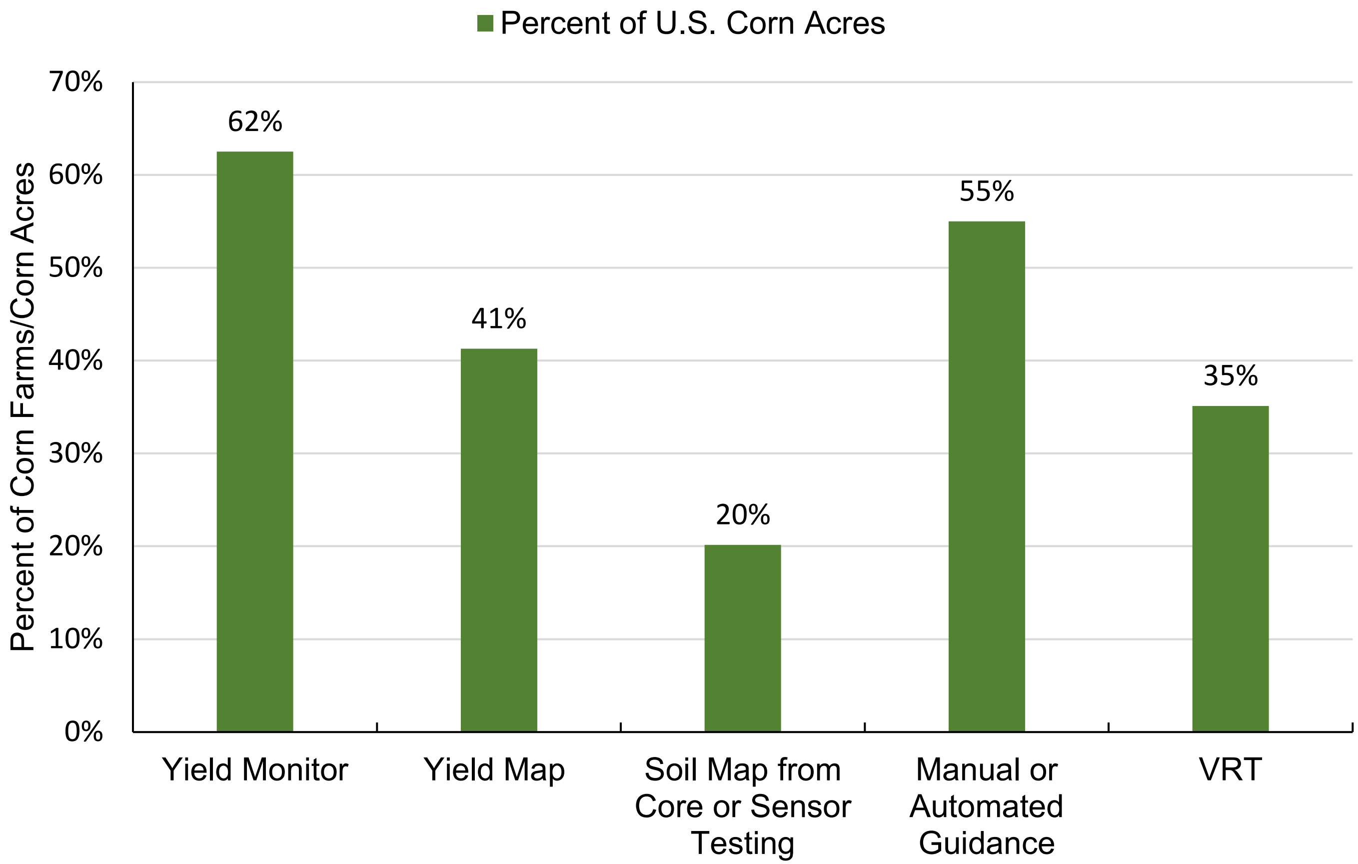
Data: Corn Agricultural Management Survey (ARMS)

- This project uses nationally representative data ARMS data.

- ARMS collects field-level data on practices and resource use for a rotating set of field crops.

- ARMS provides information on inputs like nutrients and pesticides, machinery, labor, use of precision technologies, including GPS mapping, guidance systems, and variable rate application (VRT). Precision technologies is now an integral part of the ARMS survey.

2016 Adoption of Precision Agriculture on U.S. Corn Fields Varies by Technology



Summary of Results and Conclusions

- To estimate the most appropriate technology and avoid the problem of measuring a group's performance by a production technology estimated for another group we envelop both technologies.

- We chose 258 farms of adopters and non-adopters that have the most similar condition to control influences within the production environment. Index varies from 0 to 1, 1 being the best. *0.831 Adopters 0.652 Non-Adopters*.

- We find that GPS yield maps, guidance auto-steering precision agriculture technologies, and managerial ability save input costs and increase farm production efficiency which has environmental benefits.

- Maps created from soils or aerial data and input applications using VRT did not produce useable results.

Complementary ERS Research Findings

- A related ERS study has examined efficiency of corn farms using 2010 and 2016 ARMS Phase II data with a similar model.

- We find that mapped fields are higher-yielding and more input intensive, and thus tend to be higher value.

- These fields are generally located on larger farms with operators that have 1-2 years less experience with the field than operators of unmapped fields.

- Yield maps increase technical efficiency by 1.1-7.2%, while soil maps increase efficiency by 0.4-2.3%. These are small "per-bushel" effects but nonetheless significant.