CHOICES

AAEA Agricultural & Applied Economics Association

Volume 38. Quarter 1

Data: What Farmers Need To Know

Cheryl Wachenheim, Bryon Parman, Abiodun Idowu, and Erik Hanson

JEL Classifications: O33, O34, Q16, P48
Keywords: Data, Precision agriculture, Privacy

Agricultural technology has rapidly evolved in recent decades. Many advancements have involved precision agriculture, which aims to boost operational efficiency and profitability through site-specific management enabled by precise locational data. Today, precision agriculture technologies enabled by Global Positioning Systems (e.g., autosteer, variable rate input application, and automatic section control) are common on U.S. farms. Autosteer adoption increased from less than 10% in 2004 to over 80% today, and adoption of several other precision agriculture technologies has increased markedly over a similar timeframe (Erickson and Lowenberg-DeBoer, 2021). Farm operators are also using emerging technologies such as unmanned aerial vehicles, sometimes referred to as drones, more frequently (Zuo, Wheeler, and Sun, 2021).

These technologies create and collect an unprecedented amount of information about farms and their operations. Data is used to inform farm-level decision making and add value for farmers and ranchers when they work with crop consultants and other experts. Other external-to-farm partners also use data collected on the farm. For example, implement dealers use data from machinery operation to rapidly diagnose and repair problems.

Benefits to farmers can come at a cost when data is available to others. And farm operators are concerned with who has access to their data and how those parties may use that data (Wiseman et al., 2019). Whether they realize it or not, many farm operators automatically share information with machinery manufacturers, technology companies, and service providers when they employ their products and services, shifting the informational balance. While concerns about the disposition of data are not unique to production agriculture, they stand out in an industry that has long been characterized by privacy, caution, and risk-aversion. Mitigating agricultural data privacy and ownership concerns will be key to realizing the full potential of digital agriculture.

Disposition of Data

Data in its raw form is not protectable under traditional intellectual property tools such as trademarks and copyrights. The primary venue for protection is therefore a contract between the farmer and the entity involved in collecting, storing, or analyzing the data or that otherwise has direct data access. Formal and informal contracts have long been used in agriculture to cover rights and responsibilities associated with the use of resources such as land, machinery and equipment, and labor (Allen and Lueck, 2005). Farmers also enter into contracts associated with production and marketing of commodities and when they provide or hire a service such as custom harvesting, herbicide application, or soil sampling.

As precision agriculture has emerged and developed, and adoption has continued to grow and be increasingly applied for prescriptive purposes, new contracts have emerged. These contracts specify rights and responsibilities associated with data generated from farm operations. Specified are management and control details covering the collection, analysis, use, sharing, and disposition of data. Farmers can enter these contracts explicitly—such as through negotiation—or implicitly. The latter may apply simply by employing a service provider to collect, store, or analyze data or provide prescriptions for farm operations based on this data or using machinery or equipment that collects or stores data from operations. In such cases, users typically encounter a clickthrough agreement where they must accept the proposed terms and conditions without an opportunity for negotiation in order to employ the provider. Especially for implicitly entered contracts, farmers and ranchers don't necessarily know the details of these often unseen and unread contracts. This lack of awareness can be explained in part by trust between the farmer and the service or product provider or cognitive dissonance, for example, if a farmer believes they know what they are agreeing to when they employ operations but does not. Even if farmers are aware of contract language, they may not be interpreting it correctly.

This is to be expected. Contracts can be long, tedious to read, and difficult to understand. For example, a John Deere Telematic Subscription Contract that informs customers where data will be stored and who has access to it and provides some general examples for how it may be used is nine single-spaced pages, 16 when specialized language is added for non-U.S. use. Common contract language includes specific uses allowed, such as to help develop new products, offer customer products or services, comply with or enforce legal or contractual requirements, help develop new usages for equipment, repair and diagnose equipment issues, or manage fleet equipment.

A customer in some instances will have the option to limit who has access to the data, but limiting access may require certain actions by the customer. Only a farmer who has read and understands the contract language and can perform the steps to limit access can do so. Given growth in both precision agriculture technology and the extent to which service and resource suppliers have retained control over data generated, farmers need to understand and, notably, not assume or misunderstand their rights to data generated from their use of precision agriculture. Contract language is an important means for data protection.

What Are We Protecting?

Three primary considerations associated with lack of data and information protection are privacy, consent, and security. Privacy is important not only to farmers but also to nonfarming citizens and organizations. And there is sometimes a disconnect between what we believe to be private and what is actually private. For example, it can be unsettling to be targeted with advertisements for a product or service that you recently investigated on the Internet or to otherwise have your personal information available to an untold number of others with a range of interests and motivations. We often do not know who has our personal information or how they intend to use it. Second is consent. Because data is not inherently protected, unless contractually protected, we do not have control over its use or disposition; that is, there is no requirement to acquire consent for data to be used. In fact, those with access to data such as that generated on a private farming operation can sell or otherwise make this data available to external parties. While there are laws that protect some data and information—such as the Health Insurance Portability and Accountability Act which sets and regulates industry-wide standards for health care information and protects how confidential health information is handled— other industries have no such protection. A third consideration is security. Is data that can result in financial or other harm or liability potentially accessible to those who may misuse it? How is our data protected from security breaches?

Agriculture is a unique business. As data comprises the inherent value of precision agriculture, there are additional considerations, namely, interoperability, mobility, retention, and access by others. Interoperability refers to the ability of systems to share data and for one system to directly use data created by another system. Mobility refers to the ability to transfer data across systems. For precision agricultural technologies, interoperability and mobility cover a wide range of operational considerations, such as the format in which data will be collected and stored and whether it can be used, shared, and transferred across systems employed on the farm operation. Beyond system-to-system considerations, farmers may value the right to retain data if they, for example, change service or storage providers. Data retention is valuable not only to the operator but also to the landowner for whom access to historical data such as crop yields and input use may affect the value of their land for sale or lease in the future. Finally, access considerations may extend beyond those of concern when personal data is available to others. Farmers may be concerned about public and government access to data on their farm and farming practices. For example, even when employing generally accepted operating procedures, the court of public opinion has become increasingly strong and farm data can be manipulated and reported out of context (e.g., levels of chemical use in cropping operations)

What Farmers Think

North Dakota farmers and ranchers were surveyed to gain their perceptions about these and other issues related to data generated from the use of precision agriculture on their operations. Many North Dakota farm operators have adopted precision agriculture technologies, in part due to the state's large farm sizes and crop mix (Hanson, Cossette, and Roberts, 2022). Farmers were asked about their level of comfort with their farm data being shared with others. Approximately three-fourths of farmers reported being (very) comfortable sharing their data with their crop insurance agent or banker or with a service provider such as a crop consultant. Farmers reported being much less comfortable providing data to government entities such as the Farm Services Agency, a unit of the U.S, Department of Agriculture charged with implementing farm policy, administering loan programs, and managing farm programs. Farmers are generally not comfortable when their data is shared with third parties, particularly when they are not provided with an incentive when data is shared. This aligns with findings by Idowu et al. (2023), who reported that farmers were less likely to enroll in contracts that allowed the service provider to use their farm data for profit but who did not provide incentives to farmers for doing so.

Table 1. Level of Comfort Sharing Data from Precision Agricultural Operations

	Uncomfortable	Neutral	Comfortable
Crop insurance agent or banker	18.3	6.7	75.0
Service provider (such as crop consultant)	3.3	23.3	73.3
Government representative (such as NRCS, FSA)	43.3	23.3	33.3
Third-party firm that may use your data to make a profit and provides you incentives	48.3	35.0	16.7
Third-party firm that may use your data to make a profit without providing you incentives	81.7	11.7	6.7

Farmers were also asked the extent to which various factors affect or would affect their decision of whether to adopt precision agriculture technologies. The most important consideration was data security, with nearly half of responding farmers indicating that this had a strong level of influence (Table 2). Moderately important were if data was transferable, such as if a farmer changed service providers, and if others could use their data for profit. Reported least influential was potential data access by others.

What Farmers Need to Know

First, customers who are considering purchasing a subscription for data management, or already have one, should carefully read the contract details regarding data collection, storage, and usage. Contracts from dealers and software providers should detail their data management policies as well as the options the customer has regarding access and storage. Additionally, the contract will often state what happens when a subscription is terminated. Recognizing that few have the time or inclination to read and fully understand detailed contracts, a nonprofit organization, Ag Data Transparent (AgDataTransparent.com), has developed a data transparency evaluator useful to judge service and product suppliers with access to their data on how that data will be used. Certifications are offered to firms that follow core principles. It is also recommended that a licensed attorney review contracts.

Second, the customer should consider what happens when using other systems. Compatibility may be an issue and cause problems if a customer doesn't verify that a piece of equipment or software are compatible with existing systems in terms of data transfer and use. It may require contacting a system manufacturer directly as some dealers or other middlemen may not be aware of software or hardware glitches or other issues.

Third, customers should have a data access plan. This requires a user to have goals associated with having a subscription. For example, if a customer wants to use data to make production decisions—such as plant populations, fertilization, and chemical application—and wants the data available to a third party, then the customer will need to make sure they are clear on third party usage from the software provider as well as what data is available to that third party. If the customer is mostly concerned with system diagnostics, maintenance, and fleet management, then the customer might make different decisions about who has access and how their data is to be used. Essentially, a data access plan requires customers to know, first, what they want to gain from having the subscription and, second, who needs access to facilitate that.

Fourth, landlords and tenants should discuss how data developed on rented land is treated. This issue is often overlooked, though. While the customer and often equipment owner may be aware of and comfortable with

Table 2. Level of Influence on Adopting Precision Agriculture Technologies

	Level of Influence					
	None	Slight	Some	Moderate	Strong	Average*
Level of security on data to protect from malicious activities (such as identity theft).	5.0	3.3	10.0	33.3	48.3	4.2
If data can be transferred if change service providers.	5.0	8.3	28.3	33.3	25.0	3.7
That data may be used for profit by service providers or others	6.7	13.3	28.3	26.7	25.0	3.5
Potential for data access by others	16.7	16.7	36.7	23.3	6.7	2.9

Note: Five-point Likert scale used to indicate level of influence with 1= none and 5 = strong.

the policies regarding data collection, storage, usage, and security, a landlord may not. For example, a landlord may find out after the fact that years of data regarding their land are being stored by companies, even though they were unaware of this and did not authorize its collection, storage, or use. It is recommended that if a tenant is utilizing such a subscription that they make the landlord aware and perhaps offer to share the information with them.

In summary, customers need to take to time to understand clearly what any subscription contract states about how their data is collected, stored, and used, including external-to-farm use. Discussing the intended uses with the service provider will also help prevent a violation of specific contract terms regarding third parties and access. This discussion should take place before a subscription is purchased. Knowing the customers' options in terms of management of data, security, and access should also help ensure that users can avoid unintended or unwanted third-party access.

For More Information

Allen, D.W., and D. Lueck. 2005. “Agricultural Contracts.” In C. Menard and M.M. Shirley, eds, Handbook of New Institutional Economics. Boston, MA: Springer, pp. 465–490.

Erickson, B., and J. Lowenberg-DeBoer. 2021. Precision Agriculture Dealership Survey. Sponsored by Croplife Magazine and Purdue University. Available online: https://ag.purdue.edu/digitalag/_media/croplife-report-2021.pdf

Hanson, E.D., M.K. Cossette, and D.C. Roberts. 2022. “The Adoption and Usage of Precision Agriculture Technologies in North Dakota.” Technology in Society 71: 102087.

Idowu, A., C. Wachenheim, E. Hanson, and A. Sickler. 2023. “Farmers’ Preferences for Precision Agriculture Data Management.” Technology in Society: submitted.

John Deere. 2012. Telematic Subscription Contract. Available online: https://www.deere.com/assets/pdfs/common/privacy-and-data/docs/agreement_pdfs/english/2012_02_04_john_deere_telematic_subscription_contract.pdf

Wiseman, L., J. Sanderson, A. Zhang, and E. Jakku. 2019. “Farmers and Their Data: An Examination of Farmers’ Reluctance to Share Their Data through the Lens of the Laws Impacting Smart Farming.” NJAS: Wageningen Journal of Life Sciences 90–91: 100301.

Zuo, A., S.A. Wheeler, and H. Sun. 2021. “Flying over the Farm: Understanding Drone Adoption by Australian Irrigators.” Precision Agriculture 22: 1973–1991.

Author Information: Corresponding Author: Cheryl J. Wachenheim (cheryl.wachenheim@ndsu.edu) is Professor, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, ND. Bryon Parman (bryon.parman@ndsu.edu) is Assistant Professor, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, ND. Erik Hanson (erik.drevlow.hanson@ndsu.edu) is Assistant Professor, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, ND. Abiodun Idowu (abiodun.idowu@ndsu.edu) is Ph.D. Student, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, ND.

Acknowledgments: This work is/was supported by the USDA National Institute of Food and Agriculture, Hatch projects number ND01332 and ND01333. Senior authorship is shared among all authors.