



MACHINERY

PRECISION AG TECHNOLOGY

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EXECUTIVE SUMMARY



The Agriculture Industry Stands at a Pivotal Crossroads.

External pressures like rising input costs, environmental challenges, and ongoing labor shortages compel farms to adopt innovative technologies to stay viable. Precision Agriculture (Precision Ag) offers a transformative solution tailored for modern farming

operations. By leveraging cutting-edge technologies like GPS-guided automation, real-time data analytics, and advanced machinery, Precision Ag empowers farmers to optimize productivity, reduce costs, and achieve sustainable growth.

This white paper provides an in-depth look at how Precision Ag technology, supported by John Deere and Papé Machinery Agriculture & Turf, equips agricultural operations to navigate these challenges successfully. It highlights real-world applications, measurable benefits, and emerging innovations, making the case for companies to expand their Precision Ag adoption and unlock their full potential.





**US FARMLAND
DROUGHT**



**234.4
MILLION ACRES**

External Factors Shaping America's Agriculture

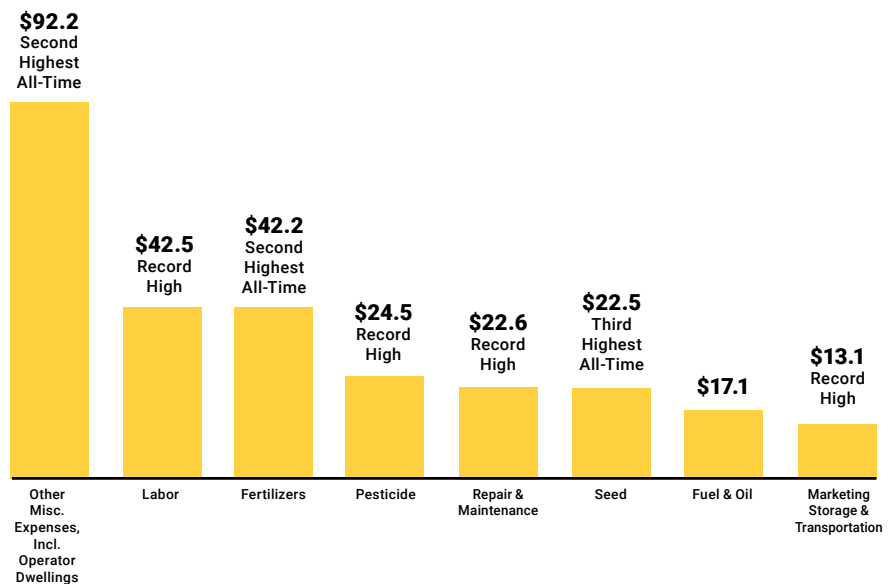
The agriculture industry in America will continue to be altered by myriad factors throughout the coming years. The rising input costs of farming are driving change in operations seeking to remain profitable through waste reduction and loss mitigation. Since 2020, input costs like fertilizer, machinery, and land, have increased by 28% according to the US Department of Agriculture⁽¹⁾. These costs, coupled with low commodity prices, are eating into already razor-thin margins that make farming a challenging venture. Small operations, which make up the majority of US-based agriculture, are facing increased pressure to stay profitable, or risk going without critical supplies. Labor shortages are also causing challenges for operations of all sizes, leading to crop loss at harvest time.

At the same time, growing environmental factors are driving farmers to adopt more sustainable practices to preserve soil health

and water resources. Regions of the country historically dominated by agriculture are facing more frequent droughts. According to the NOAA National Integrated Drought Information System, 234.4 million acres of US farmland are currently

experiencing drought⁽²⁾. Drought within these key regions impacts not only the volume of water available for growing crops but also the quality of the water available, making precision and waste mitigation all the more imperative.

Farm Production Expenses Are Record-High



These external factors, among others, are fueling new and innovative solutions for operations of all sizes. Advancements in Precision Ag technology reshape how crops are planted, nurtured, and harvested. Partners like John Deere and Papé Machinery Agriculture & Turf are supporting agricultural operations to adapt and remain resilient through machinery support and new technology solutions.

PRECISION AG: INNOVATION TO FACE AN UNCERTAIN FUTURE

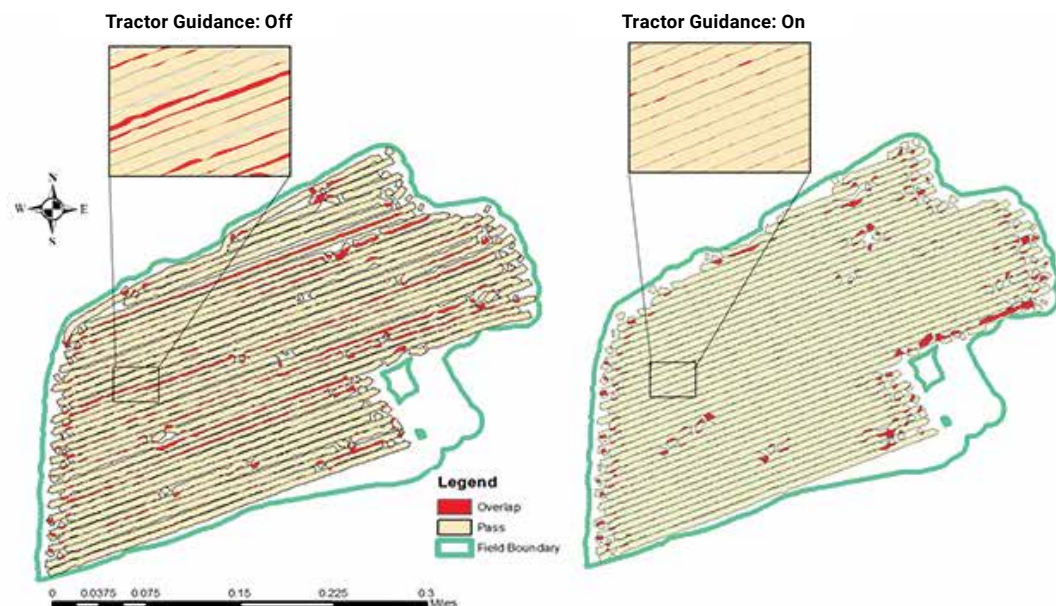
When it comes to addressing the challenges of rising costs, John Deere's Precision Ag solutions provide cutting-edge technologies to reduce input costs and increase yields. These technological solutions are compatible with existing machinery, allowing operations to upgrade and benefit from new advancements without replacing their equipment with costly new machines. Available Precision Ag upgrades include modifications for planters, seeders, combines, sprayers, and tractors. Automation and guidance systems also are available from John Deere to modernize operations and solve the unique challenges of each operation.

How Precision Ag Technology Improves Agricultural Operations

Technological advancements in precision agriculture provide ample improvements to the traditional method of commercial farming. When combined, these technologies help

farmers and operators alike to reduce costs, improve yields, mitigate over-application, and maximize efficiencies that are critical to the profitability of an operation.

With Guidance upgrades like G5 and AutoTrac Precision Guidance added to existing equipment, over-application can be significantly reduced. In a study conducted by the ARS team in Arkansas, the reduction in overlap was mapped out and shows how the use of Precision Ag Technology greatly improves traditional methods⁽³⁾.





The Human Element: Optimizing Your Labor Force

Beyond the cost-savings associated with waste reduction, Precision Ag Technologies provides benefits by automating certain portions of the planting, feeding, spraying, and harvesting processes. This automation, once implemented, can save operators from the stress and hassle of correcting issues in the field. With less stress and fatigue operators can work longer hours, maximizing your workforce without sacrificing well-being for uptime.

Ongoing labor shortages will continue to affect the agriculture industry as operations face again workforces, immigration and migrant worker regulation changes, and more. As both large- and small-scale operations are forced to maintain productivity with fewer workers, optimizing the time and effort of existing employees becomes critical to maintaining profitability year after year.

Precision Ag technology does come with a certain element of skill set requirements, which requires operators to be trained on their proper use. While most of these technologies feature user-friendly interfaces to navigate menus and settings, understanding settings and performance data takes training and education. As such, systems can be set up by qualified operators, and permissions set in place for operators to access only the tools they need to complete specific tasks.



PRECISION AG TECHNOLOGIES FROM JOHN DEERE & PAPÉ



G5 Advanced Guidance Display

John Deere's G5 Advanced Guidance Display represents the latest innovation in precision farming technology, designed to deliver unparalleled accuracy, usability, and functionality. As the next evolution of guidance displays, the G5 offers a high-definition 1080p resolution 10.1-inch touchscreen, providing a seamless user interface that makes it easier for operators to monitor and adjust operations in real-time. This advanced display supports up to four video inputs, giving operators unparalleled situational awareness in the field.

The G5 Display integrates seamlessly with John Deere's Precision Ag suite, offering enhanced compatibility with AutoTrac guidance and other advanced features. With faster processing speeds, improved data visualization, and wireless connectivity, the G5 enables streamlined operations, reduces downtime, and maximizes productivity.



Key Features of the G5 Advanced Guidance Display:

- 10.1-inch High-Definition 1080p Resolution Touchscreen
- Customizable layouts to display the most relevant information for their specific tasks.
- Real-time Wireless Data Transfer
- AutoTrac Integration
- Advanced Mapping Tools
- Video Capabilities: Up to four video inputs for enhanced field awareness and safety.
- Enhanced Cloud-based Data Management
- 3x Faster Processing Speeds than previous displays.

By incorporating the G5 Advanced Guidance Display into their operations, farmers can achieve new levels of precision and efficiency. Whether planting, spraying, or harvesting, the G5 ensures optimal resource utilization and minimizes errors. This cutting-edge technology underscores Precision Ag's ability to empower agricultural operations with tools that drive improved productivity and profitability.

[For more information on G5, Click Here.](#)





AutoTrac

AutoTrac Precision Guidance saves significant input costs by providing GPS-based guidance. In a study conducted by Auburn University, operations can save up to 10% in input costs by using AutoTrac during planting and fertilizing. By determining the best route to maximize coverage across an operation's footprint, AutoTrac takes the guesswork out of your workday and reduces inefficiencies and overfertilization. The equipment required for AutoTrac is the StarFire Receiver, which can be programmed

for both broad-acreage and compact operations. AutoTrac allows for hands-free operation of compatible machines, taking over steering control with the press of a button. Operators can override and take control at any point, giving added flexibility. This technology is also available with PivotPro, which makes it ideal for center-pivot irrigation fields. This suite of capabilities all reduce overlap, improve operator fatigue, and by reducing costs, increases productivity and profitability.

By using the StarFire Receiver, AutoTrac provides farming operations with a reliable and accurate signal with reduced interference and faster signal reacquiring than previous models. Three signal strengths allow for the level of accuracy required for both large and small jobs, with accuracy ranges of ± 9 inches down to ± 1 inch. This technology makes hilly ground or tree-lined borders a problem of the past, maximizing uptime and reducing challenges.

For more information on AutoTrac, [Click Here.](#)





ExactApply

John Deere's ExactApply sprayer upgrade introduces advanced precision in agricultural spraying by leveraging pulse-width modulation (PWM) technology. Chemical application is optimized by delivering uniform droplet sizes and consistent application rates, regardless of changes in ground speed.

PWM maintains consistent pressure and flow to ensure that variations in operator speed do not compromise spray accuracy. Independently-controlled nozzles allow precise application within sub-inch accuracy to minimize overlap, eliminate skips,

and reduce chemical drift, enhancing both efficiency and environmental compliance.

ExactApply also features Dual-Mode Operation, seamlessly switching between PWM and conventional spraying modes. PWM operates at a frequency of 15 Hz, adjusting duty cycles to match your target application rates.

The system also supports a continuous-flow option for compatibility with older systems and models, maximizing operational flexibility. Integrated sensors monitor

nozzle performance continuously for real-time diagnostics. Alerts notify operators of clogs or malfunctions, enabling rapid maintenance and minimizing operational disruptions. This enhances uptime and ensures consistent field performance. Supporting a wide range of droplet size classifications, from ultra-coarse to fine, ExactApply meets diverse agricultural needs and complies with chemical drift regulations. This allows ExactApply to be used for the application of herbicides, fungicides, and insecticides requiring different spray characteristics.

ExactApply reduces input costs through precise chemical use and minimizes the environmental impact by curbing off-target drift. On average, operations that used ExactApply save 2-5% on herbicides and pesticides thanks to the enhanced precision and reduced likelihood of over-application⁽⁴⁾. In field tests, operators have reported significant reductions in chemical waste and improvements in crop health due to targeted application.

To learn more about ExactApply, [Click Here.](#)



Variable Rate Section Control

When it comes time to plant crops, John Deere's Precision Ag technology improves yields and reduces costs. Section Control reduces operator fatigue and improves input placement by automatically switching specific sections on and off. Turning off sections prevents over-application of product, which lowers costs. It also prevents nutrient competition

in overplanted areas, which impacts harvest yields. By automating the implementation process, you can reduce operator fatigue, allowing your operation to run longer hours and maximize uptime while reducing human error in the process. Section Control reduces average seed costs by 4.3%, and can improve yield loss by 1% to 12%⁽⁵⁾.

Section Control can be further enhanced to meet the needs of your operation through performance tuning. Settings like mechanical delay timing, entry/exit skip issues, and plant-to-row functionality can be controlled to exact specifications so you can understand and improve performance. Section Control can also be programmed to disallow application outside of field or headland boundaries, ensuring that crops are planted exactly where they should be.

EAST VALLEY SEED: A CASE STUDY IN PRECISION AG

Precision Ag technology is being used by an increasing number of operations around the nation to improve their functionality and efficiency. East Valley Seed Company, a seed production farm located in the Willamette Valley of Oregon, sought the help of Papé Machinery Ag & Turf in implementing Precision Ag upgrades to their existing operations.



Having pivoted from a livestock and grain operation to a seed producer in the mid-1970s, East Valley Seed Co. offers grass seed varieties as well as crop seeds like cabbage, beets, clover, and wheat. By capitalizing on the mild climate of the Pacific Northwest, they have been able to grow a breadth of seed crop varieties that are unavailable in other regions. As their operation grew over the decades, the need for Precision Ag solutions increased. Coupled with the challenges of modern agriculture as addressed earlier, Precision Ag technologies became a necessity for East Valley Seed Co.

Papé Machinery Ag & Turf was able to collaborate with East Valley Seed Co. to identify their needs and find solutions that integrated with their existing machinery, eliminating the need to replace entire fleets of equipment, which would have been detrimentally expensive. Instead, Precision Ag solutions were implemented to address the needs of East Valley Seed Co., such as

AutoTrac and ExactApply spraying. With ExactApply integrated into their sprayers, each nozzle is controlled individually. By using GPS-Guidance systems, the system knows when they enter an area that has already been sprayed, and automatically turns off the corresponding nozzles, virtually eliminating all overspray and excess application of fertilizer or pesticides.



As a result of integrating John Deere Precision Ag technology into its operations, East Valley Seed Co. has saved money by reducing wasted pesticides and herbicides while also saving money thanks to the reduction in crop damage from overspray. The time savings have also been tangible; with less crop damage, there's less need to spend time replanting or respraying areas that may have been skipped. Because John Deere Precision Ag technology can be retrofitted onto older models and different manufacturers' equipment, East Valley Seed Co. and similar small-scale operations can improve the efficiency of their operations significantly without modernizing or switching their fleets to all John Deere machines.



"I've seen Precision Ag from the days of its infancy to where it is today," says James Emmet of East Valley Seed Co., "It is amazing the technology that is coming up." Emmet is able to oversee operations sitewide thanks to the web-based Operation Center, which can be accessed remotely on a computer, phone, or tablet. "You can see where all your equipment is, what it's doing in the field, and what you're accomplishing in an hour. It shows you on the map

where the equipment is in the field, so I can take that information and see where the other people are, whether they're having problems or it's going well, and what time they will be done. It gives you an incredible amount of information right at your fingertips." By using the Operation Center data, planning the day or week and what resources are required is informed not by guesswork, but by data-driven decisions backed by technological efficiency.



THE ROAD AHEAD FOR PRECISION AG



Very Few Agricultural Operations Have Implemented Precision Ag

By late 2024, very few agricultural operations in the United States have implemented Precision Ag at scale. Only about half of all large-scale commercial agriculture operations utilize it, and an even smaller portion of small-scale farms use Precision Ag. This technology has benefits that directly address some of the major challenges modern operations face on a day-to-day basis, and researchers with the USDA's Agricultural Research Service (ARS) are working to increase education and encourage modernization through Precision Ag technology as a

means to bolster critical agricultural operations across the nation⁽⁶⁾.

As Precision Ag continues to modernize the agriculture industry, new innovations will help to evolve the daily operations of farming on all scales. Artificial intelligence (AI) and Machine Learning (ML) are some of the innovations being introduced to the Precision Ag technology suite. Machine learning was first introduced in crop monitoring as a means to predict production and yields, but now has capabilities across a broad range of agricultural

activities. This allows Precision Ag solutions to learn an operation's agricultural activities in order to make continuous improvements in planting, harvesting, spraying, weeding, and crop monitoring. By using a dataset specific to an operation or set of operations, systems can make insightful recommendations to help farmers reduce spend and increase productivity⁽⁷⁾. Crop monitoring, when coupled with visual AI and in-field sensors, has the potential to pinpoint the precise needs of crops in a given area and inform operators of the action needed.

Certain factors, such as weather resilience, interoperability, and data-siloing continue to be challenges for these technologies. High costs also prevent them from yet being adopted on a wide scale. While these innovations are still being developed and refined, the future of agriculture can be greatly impacted by the adoption of AI and machine learning in the years to come.

CONCLUSION



The agricultural industry is undergoing a pivotal transformation, driven by rising input costs, environmental challenges, and labor shortages. Precision Ag technologies, such as those offered by John Deere and supported by Papé Machinery Agriculture & Turf, provide innovative solutions to address these issues without prohibitive costs. Precision Ag delivers measurable benefits in cost reduction, efficiency, and sustainability. From the advanced capabilities of G5 displays and AutoTrac guidance to the sub-inch accuracy of ExactApply sprayers, these tools give farming operations

the necessary innovations to adapt in this complex and ever-evolving industry.

Precision Ag technology is no longer a luxury— but a necessity— for modern agricultural operations. It addresses critical challenges like rising costs, labor shortages, and environmental sustainability while delivering measurable ROI. With solutions from John Deere and support from Papé Machinery Agriculture & Turf, your operation can harness the power of Precision Ag to thrive in an increasingly complex industry.

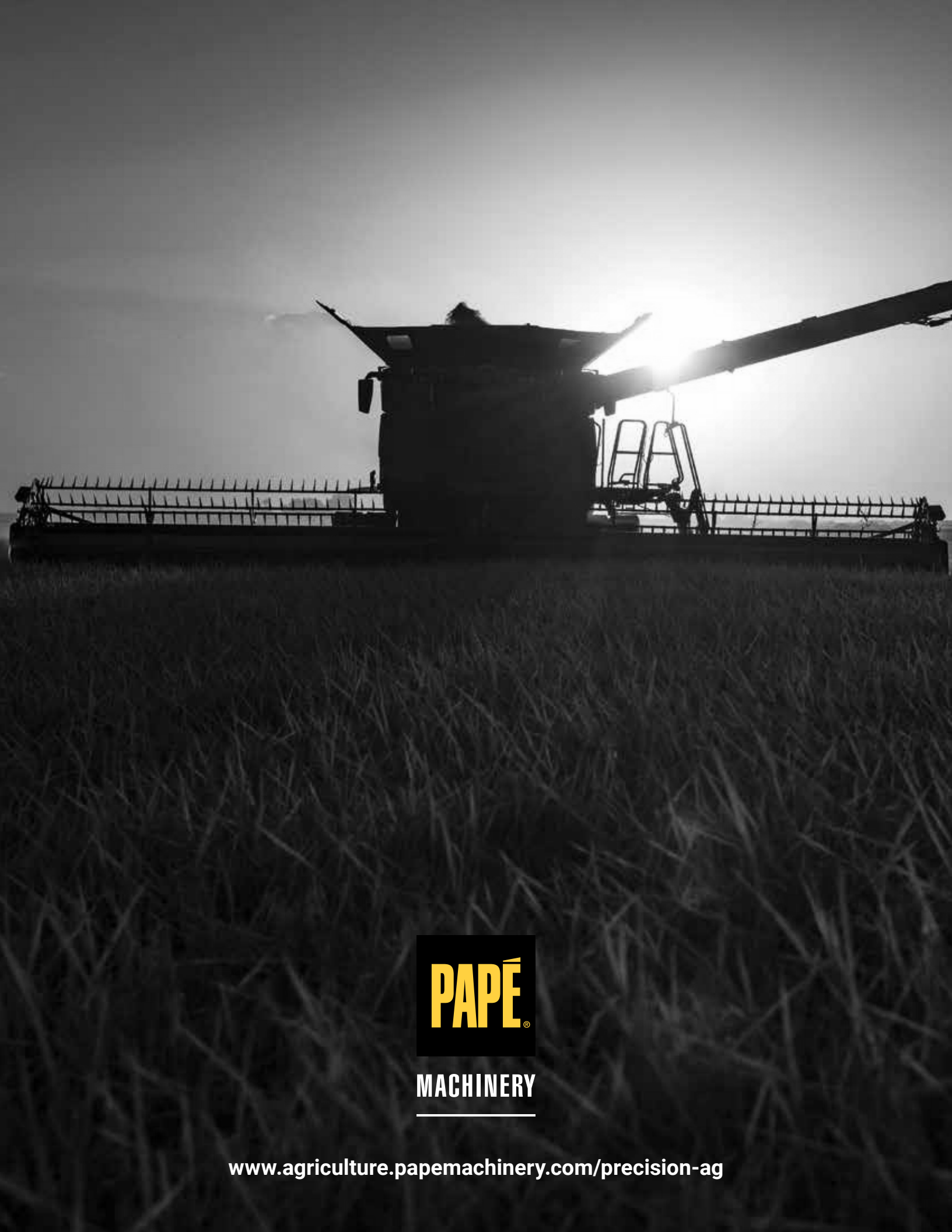
The success of East Valley Seed demonstrates the tangible benefits of adopting these innovations. Whether you aim to reduce costs, improve yields, or achieve sustainability goals, Precision Ag offers a proven pathway to success. Equip your operation for the future today and join the growing number of farms transforming agriculture through Precision Ag technology.



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