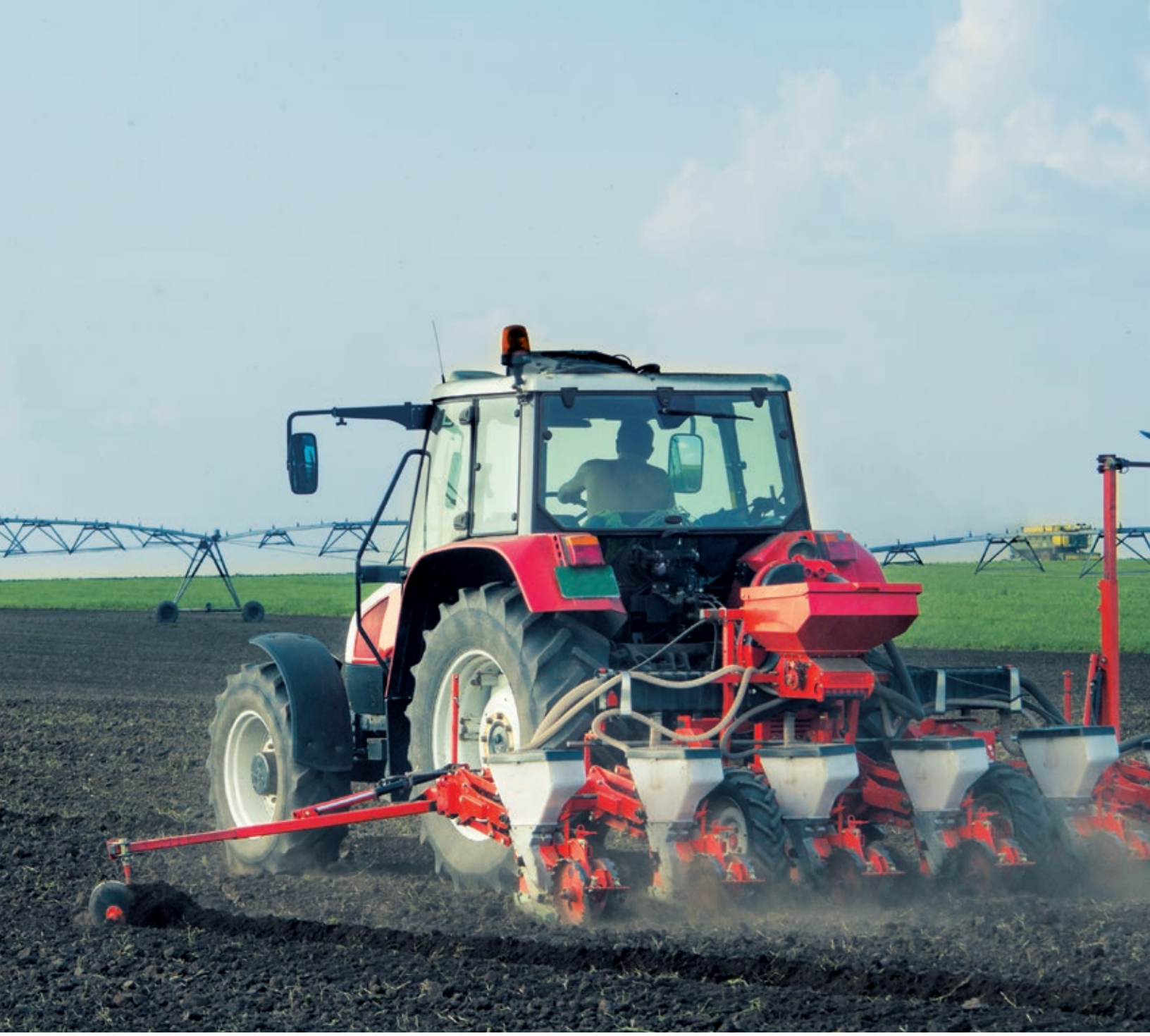

The Best New Opportunities that Benefit Planter Manufacturers

Parker

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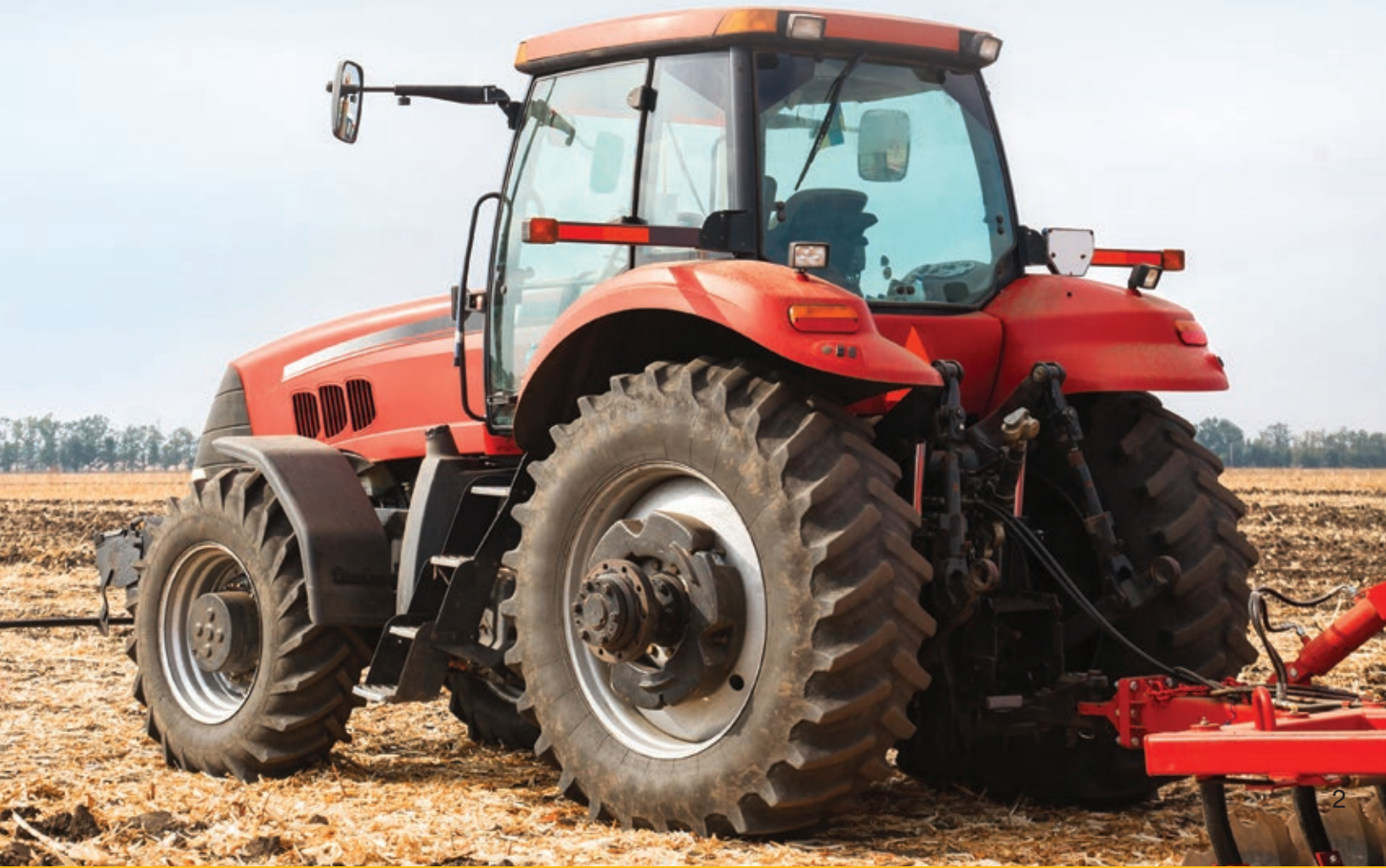
Contents

Introduction

Between 1948 and 2015, the United States' total agricultural output nearly tripled[1]. The biggest factor attributed to this growth is increased productivity, which can only be accomplished through better equipment. Through advanced technologies and better farm equipment, OEMs have the opportunity to further drive the agriculture market into a period of rapid growth.

Since they handle one of the first steps in many agricultural processes – planting seeds – planters are one of the most crucial pieces of farming equipment out there, and thus primed for growth. As planters face a demand for increased production while precisely placing seeds and fertilizer, improving upon them will lead to increased crop yields, improved system efficiencies and higher overall margins. This white paper will detail the challenges and trends impacting planter design and the agriculture industry as a whole, as well as introduce new opportunities in the planter space.



Challenges

As the agriculture industry evolves, so do the challenges within it. The following challenges threaten crop yields and lead to costly planter damage or failure.

Ground Compaction

One of the biggest challenges in the agriculture industry is ground compaction[2]. As planters and other heavy agriculture equipment move over a field, they compact the soil below them with their tires. This compaction changes the quality of the soil, negatively impacting crop yields. Soil should be a mix of about 50 percent solids (dirt, clay and other organic matter) and 50 percent pore space (the space between particles). Ground compaction compresses soil particles into a smaller volume, reducing the available pore space. This makes it harder for the soil to get adequate amounts of water, which damages crop emergence, root penetration and crop nutrient uptake. All field managers have to do is look at a yield map, and they'll be able to see where any equipment's tire tracks were.

Ground compaction worsens the more a piece of equipment weighs. Beyond causing increased ground compaction, heavier equipment also consumes more power. In fact, diesel costs are often one of the largest line items in an end user's budget, making it a lasting pain point. But this is not just a user issue. Since equipment with high fuel consumptions are increasingly harder to sell in today's market, the need for higher fuel efficiencies falls on the OEM.

Corrosion and Leakage

Corrosion is a major concern for planters due to the harsh environments in which they operate. When a planter experiences corrosion, especially on critical internal components, it can put the whole assembly at risk for an early failure. This causes unplanned and costly equipment down-time, which can drastically affect a field's crop yields since seeds aren't being planted.

Corrosion can also lead to hydraulic fluid leakage, which is a significant pain point in and of itself. From both an end user and a regulatory stand-point, agriculture equipment is expected to have zero leakage. Leakage can lead to anything from lower fuel efficiencies and mechanical issues to costly crop destruction as caustic internal fluids contaminate the soil.

Labor Shortages

Machine issues aside, getting trained people in the seats of agriculture equipment is a nagging obstacle ever since the great recession that occurred around a decade ago[3]. Even as the market recovered from that event, the displaced workforce has led to a lasting shortage of labor. This is one of the greatest limiting factors for many farmers and ranchers across the United States.

Seed Planting and Downforce

While all of these issues affect agriculture equipment in general, a challenge unique to planters and seeders is achieving the right amount of downforce[4]. However, this isn't just as simple as making sure enough downforce is used to push the seed into the soil. The depth of a seed and how it was placed – along with other conditions like soil contact and moisture availability – will affect its germination, growth rate and root development. Ground compaction comes into play here, as heavier, compressed soil will "push back" on the planter, leading to inconsistent seed placement. Being able to plant seeds faster and at the proper depth is important. OEMs and designers need to make planters that aren't just precise, but also fast, otherwise crop yields will take a major hit.

Downtime

It is always costly to the farmer when agriculture equipment breaks down, however during planting the cost of downtime rises. Losing just eight hours, or one day, of planting can cost a farmer an estimated $2,400.[5] Although actual costs of downtime will vary due to how much yield is affected by planting later in the season rather than the day that the planter was down.

Downtime for planters can be caused by a variety of factors including user errors such as improper storage or maintenance, but planter machine quality and performance can also cause downtime.

Trends

Heavily influenced by the challenges that planters face, there are a number of trends in the agriculture industry that are gaining traction. Whether it's enhancing equipment performance and reliability, keeping costs down or directly increasing crop yields, these trends all aim to improve planters and the agriculture industry as a whole.

Equipment Downsizing

Since the size and weight of the tractors and the towed planter implement affect everything from its ground compaction to its fuel efficiency, there is a large push to reduce the weight for agriculture equipment by using both smaller and lighter components. Looking at the automobile industry[6] as an example of the impact of a vehicle's weight on fuel economy, a recent study found that for every 100 kg decrease in a vehicle's weight, it resulted in a fuel consumption savings of 40 L per every 1,000 km. A similar study found that reducing a car's weight by 35 percent would lead to reduced fuel consumptions of 12 to 20 percent. With the planter and tractor being much heavier than the average car, reducing the weight not only of the tractor but the planter implement could have an even greater impact on overall efficiency. A lighter planter is also easier to transport, making the trend even more lucrative and appealing to farmers.

Precision Agriculture

Even with lighter equipment and better tires/tracks, ground compaction is still going to occur to some extent. That's why many in the industry are looking toward precision agriculture[7] as a solution. This is all about optimizing the spacing and depth of planted seeds. Whether it's from ground compaction, uneven land or natural variations in the soil, the downforce requirements of a planter will change as it moves through a field. With these shifting conditions, the standard manual downforce adjustments of the past just won't cut it.

Planter designers are aiming for that "Goldilocks effect" here: planting a seed deep enough so that it gets enough moisture, but not so far down that the deeper, more compact soil impedes the seed's root developments. Precision agriculture systems automatically adjust downforce in order to ensure consistent planting depths.

Sensors and IoT

Precision agriculture is only made possible by using advanced sensors that can detect the conditions of the soil and track how far down a seed is planted. This is one of the many reasons why utilizing sensors as well as "smart" IoT-integrated products is a growing trend with seeders and agriculture equipment in general.

Agriculture equipment with embedded sensors and network connectivity provides significant value to farmers by constantly collecting and analyzing critical data like usage, maintenance needs and downtime. Not only can sensors on a controller area network (CAN bus) enable end users and field managers to modify their machine parameters on the fly, but they can also provide remote diagnostics and automated reports that can be used to help increase yields in the long run. Combine all of this with the power of an IoT solution, and farmers have an integrated planter system that can enable superior uptime performance without needing their constant attention.

Electrification

Better sensors and IoT connectivity are also driven in part by electrification. Turnkey electrified systems help to reduce the mechanical risk of a planter, as well as help to make it more "eco-friendly." With increasing regulatory pressure for higher efficiencies and less waste, both OEMs and end users are seeking out ways to avoid using diesel engines in their agriculture equipment. To help make the jump, proper documentation is needed to allow hesitant OEMs to easily see the benefits of electrified equipment. IoT systems enable the necessary tracking and documentation that make electrifying systems a smart choice for OEMs and a sought-after capability by end users.

Electrifying hydraulic systems also allows for increased efficiency and integrated control in hydraulic applications. For instance, a draw bar which can be controlled by onboard hydraulics, can be moved with greater accuracy and precision when powered by electricity. Since precision agriculture is so important to planter operations, this is invaluable to farmers. This also reduces the capacity strain on the planter's hydraulic systems, leading to an overall better system.

Opportunities

To support the trends and goals of the agriculture industry, there are several opportunities and specific solutions for OEMs to take advantage of when it comes to planters. Each of the following will provide value to anyone designing, manufacturing or working with planters in the agriculture industry.

Reducing Ground Compaction

OEMs can minimize ground compaction by reducing the ground pressure exerted by the planter. Some OEMs opt to use tracks for reducing compaction. While this is effective, it can limit vehicle speeds for on-road travel.

That's just one of the reasons why others are increasingly looking to the intelligent management of tire pressure, or Central Tire Inflation, to reduce ground pressure. Built for off-road applications and soft soil conditions, Parker's Central Tire Inflation System[8] (CTIS) offers improved planter mobility while allowing the driver to optimize tire inflation pressure with the push of a button. Reducing the tire pressure of a heavy planter results in a bigger tire footprint, increasing traction and reducing ground compaction.

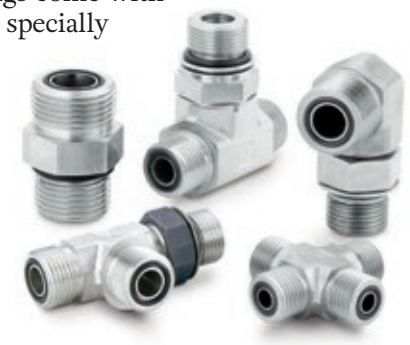
Specifying lighter weight components also reduces ground compaction for large agriculture equipment as well as improved efficiency. This can be as simple as specifying miniature ball valves that are both lightweight and compact as well as save installation time with push-to-connect installation[9] that also reduces labor costs for OEMs.

Corrosion-Resistant Coatings

Another solution available to the agriculture market is to use a protective coating on a planter's components to help prevent corrosion. An outstanding advancement for agriculture equipment that operate in highly caustic environments, Parker's XTR (Extreme-Resistance) Coating provides unprecedented corrosion resistance for the internal components of a planter. Steel fittings and adapters with the XTR Coating can withstand corrosion more than seven times longer than the SAE standard of 96 hours. In fact, Parker's proprietary formulation resists corrosion for more than 720 hours when tested in accordance with ASTM B117. Compliant with environmental regulations such as RoHS, ELV and REACH, Parker's XTR Coating assures leak-free performance in even the harshest applications.

Improved ORFS Seal Retention

Leakage issues are always a concern with agriculture equipment. ORFS fittings are commonly used for their superior leak-free connections, vibration resistance, reusability, and resistance to over torque. Leak issues can occur when the O-ring is missing from the groove or pinched during assembly. O-rings can fall out prior to assembly and go unnoticed or can get pinched during assembly if they are partially of the groove. Both assembling machinery without O-rings or having them become pinched causes leaks. Parker's Seal-Lok ORFS fittings come with Trap-Seal which is a specially shaped seal that fits snugly in the ORFS groove and prevents such leaks.



Hose Assemblies

The mechanization of agriculture has been a key growth driver in the hose and fitting market. Farmers rely on increasingly efficient equipment that equate to lower cost per crop ton or lower cost per hour of operation. Though OEMs have different growth strategies, the challenges are similar: growing competition, evolving customer demands and shifting hose and fitting geographic markets. Specific applications require specific hoses.

Globally available product or high impulse life are two examples. Bend radius is particularly important in tight spaces. Hose weight is critical due its impact on transportation costs, fuel economy and ease of installation. Parker's GlobalCore high-performance cohesive hose and fitting system meets these needs. It was designed, built and tested to the ISO 18752 specification. It simplifies specification for OEMs and end-users by providing a complete family of products for the most commonly used constant working pressure classes.

In cases, where made to order preformed hose is too costly, E-Z Form hose for coolant, water and oil suction/return lines should be considered. Designed to handle extreme bends while allowing full-flow, kink-free performance, E-Z Form hose effectively replaces pre-formed hoses - eliminating special design, tooling and fabrication costs.

Conversely, formed hoses continue to be beneficial though. They can save, space, time and eliminate misalignment issues. As little as 1/8" of misalignment to the connection can create enough issues to potentially shut down equipment. Formed hoses also eliminate the need for additional fittings/adapters, significantly reducing equipment weight. Parker's thermoplastic wire and fiber-reinforced hoses can be formed, such as our TOUGHJACKET products, for applications requiring up to 6000 psi and an O.D. of -2 to -16.

For planters, Parker's hydraulic and formed hoses offer innovative design, high performance, easy installation and extended hose life to enable farmers to meet the increased demand.

Precision Agriculture Downforce Solutions

Moving past the old ways of having to apply manual downforce to plant a seed, there are two emerging contenders when it comes to precision agriculture: pneumatic solutions and hydraulic ones. While they work differently, both types of technologies aim to achieve uniform pressure and consistent seed planting depths.

With Parker's Hydraulic Downforce Solution system[10], planters and seeders can achieve uniform seed depth by applying force efficiently and precisely with the system's controlled hydraulic downforce. With an individual unit mounted on each row or section of the planter, the Hydraulic Downforce Solution switches between either active or passive force to maintain consistent ground contact in order to plant seeds at a specific depth. Force sensors are custom built for every system or operation to ensure the planter meets the needs of the specific application. It's this design freedom that enables customized downforce solutions for every planter, ensuring a better precision downforce solution.

Advanced Actuators

Closely tied to fittings and hoses, actuators are another area of great opportunity for planters. Actuators are used both to help assist the steering components of planters, as well as to move their implements, essentially functioning as hydraulic hinges. Hydraulic Rotary Actuators[11] were designed to meet these needs. This extensive line of actuators offers a high-torque, high-bearing capacity solution to move, support and position rotary loads with zero leakages. With a high-power density, these actuators were designed to replace multiple components in a seeder, functioning as a rotating device, mounting bracket and bearing, all in a single compact device.

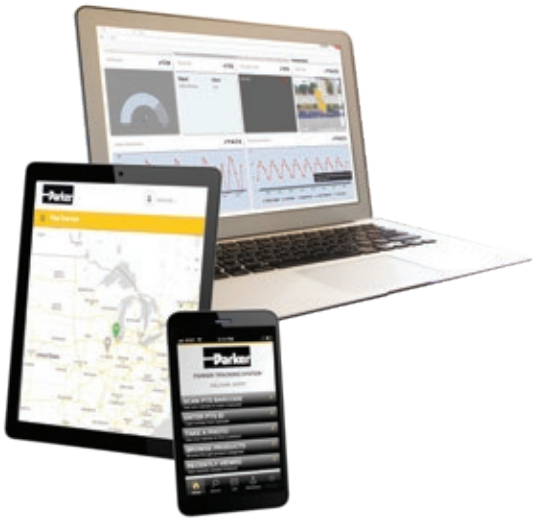
Heavy-duty, custom-welded rod cylinders offer another advancement opportunity for planters. These cylinders provide durability in a tough agricultural environment while uniquely designed to work with the planter system for help maximizing yield when planting. Unlike other cylinders within these applications, the Parker customized solution has a unique rod seal wiper design to stop any potential contaminants from entering the cylinder system. Additionally, the cylinder has a custom designed head for repairability driving lower owning and operating cost.[12]

Electrified Systems

Understanding the opportunities that electrification can present, Parker is helping OEMs implement electrified systems into their planter designs. Parker's GVM (Global Vehicle Motor) Series motors offer electric and hybrid electric powertrain motors, as well as electro-hydraulic actuation[14]. Using a patent-pending advanced cooling system that has minimal impact on the size and weight of a motor, GVMs achieve efficiencies in peak regions that are unobtainable in other designs. Scalable for any sized planter or other piece of agriculture equipment, the GVM offers the widest performance range available.

IoT-Enabled Technology

With the power of advanced sensors, hydraulic systems can benefit from IoT-enabled smart hydraulics. By embedding electronics and sensors within internal components, operators can receive critical insights regarding onboard hydraulics, enabling superior uptime performance. A customized mobile IoT solution like Parker's is digitally integrated to connect hardware, software and asset management for real time operational information which provides data and analysis capabilities to benefit both the planter owners and OEMs.[15]



Conclusion

The road ahead for planters is a very exciting one, filled with ways to increase crop yields and system efficiencies. While there are many challenges to overcome, the opportunities presented in this white paper can help OEMs and planter designers to take advantage of the advanced technologies and strategies that will fuel the agriculture market's growth for years to come.

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