



The Best New Opportunities that Benefit Planter Manufacturers



ENGINEERING YOUR SUCCESS.

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Introduction

The EU's total agricultural output, valued at an estimated 536.7 billion euros in 2022 in a study by the European Commission, rising sharply in nominal terms by +19.2 % This represented a new peak and continued the upward trend that had started in 2010¹. The biggest factor attributed to this continuous growth over the last decade 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 agricultural 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 fertilisers, 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 agricultural industry as a whole, as well as introduce new opportunities in the planter space.



Challenges

As the agricultural 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 compaction². As planters and other heavy agricultural equipment move over a field, they compact the soil below them with their tyres. 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 tyre 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 downtime, 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 standpoint, agricultural 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 agricultural equipment is a nagging obstacle. There is a long-established downward trend in the number of people working in the EU's agricultural sector; during the period between 2007 and 2022, the average rate of decline in the volume

of agricultural labour used across the EU as a whole was 2.6 % per year. The downward trend continued in 2022, albeit estimated at a slightly slower pace (-1.9 %)³. This is one of the greatest limiting factors for many farmers across Europe.

Seed planting and downforce

While all of these issues affect agricultural equipment in general, a challenge unique to planters and seeders is achieving the right amount of downforce. However, this is not 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 are not just precise, but also fast, otherwise crop yields will take a major hit.



Downtime

It is always costly to the farmer when agricultural equipment breaks down, however during planting the cost of downtime rises. 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 agricultural 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 agricultural 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 agricultural equipment by using both smaller and lighter components. Looking at the automotive industry⁴ 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.

Parker offers the perfect maintenance free solutions for either low noise, high efficiency or price level. The combination of high performing GVM motor together with Gear, Vane, Bent-Axis or Piston pumps gives outstanding performance and can downsize the system to reduce the ground force and power consumption.

Precision agriculture

Even with lighter equipment and better tyres/tracks, ground compaction is still going to occur to some extent. That is why many in the industry are looking toward precision agriculture⁴ as a solution. This is all about optimising the spacing and depth of planted seeds. Whether 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 utilising sensors as well as “smart” IoT-integrated products is a growing trend with seeders and agricultural equipment in general.

Agricultural equipment with embedded sensors and network connectivity provides significant value to farmers by constantly collecting and analysing 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 spontaneously modify their machine parameters, 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 agricultural equipment. To help make the transition, 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 agricultural 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 agricultural industry.

Reducing ground compaction

OEMs can minimise 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 System⁶ (CTIS) offers improved planter mobility while allowing the driver to optimise 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 agricultural 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 installation⁶ that also reduces labour costs for OEMs.

Corrosion-resistant coatings

Another solution available to the agricultural market is to use a protective coating on a planter's components to help prevent corrosion. An outstanding advancement for agricultural 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 agricultural 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 O-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 mechanisation 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 tonne 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 a made-to-order preformed hose is too costly, an 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" (approximately 3mm) 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 fibre-reinforced hoses can be formed, such as the TOUGHJACKET product range, 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[®], 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 is this design freedom that enables customised downforce solutions for every planter, ensuring a better precision downforce solution.



Increased planting performance

Parker offers a wide range of hydraulic pumps and motors to provide fluid flow in an efficient and reliable way. An optimized power to weight ratio and reduced energy losses improves farmers machine efficiency and contribute to a lower overall weight. With Gear Pumps & Motors, Torqmotors, Vane Pumps & Motors, Bent-Axis Pumps & Motors as well as Axial Piston Pumps Parker offers components for any solution and price level in high quality, short lead times and great service. The pneumatic Planters offers the most advanced planting method. The hydraulic fan motor delivers reliable and at a high performance speed in certain load cycles the air flow for pneumatic system. Different hydraulic motors can be used depending on the working width of the Seeders. For Seeder machines with a working width of 3 m – 4 m, primarily Parkers PGM511⁹ gear motors are used, which deliver a performance speed of 5.000 rpm. For working widths beyond 4 m, primarily Parkers F10 motors are used, with more power and speed



rates above 7000 rpm. Parker Torqmotors are ideally suited for tough jobs under tough conditions, offering high starting torque and trouble-free service. Used in Planters to transport and seed the planting goods, Torqmotors are the perfect choice for low speed rotation without the need of a drain line.

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. Parker's Hydraulic Rotary Actuators¹⁰ 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 maximising yield when planting. Unlike other cylinders within these applications, Parker's customised 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 reparability driving lower owning and operating cost.¹⁰

Enhanced Controls and interfaces

In the context of automated agriculture, HMIs play a pivotal role in enhancing efficiency and productivity. They facilitate intuitive control of agricultural machinery, encompassing essential input operations like start/stop and adjustments, and displaying real-time data empowering farmers to make informed decisions.

The IQAN-MD5 is a family of master display units, fully compliant with the IQANdesign platform system. These units serve as programmable master controllers allowing users to tailor HMI systems to diverse machine applications, offering comprehensive graphical, diagnostic, and CAN gateway functionalities. Their user-friendly interface, paired with IQAN programming tools, simplifies HMI design through predefined building blocks and guided development with templates and libraries. This user-friendly drag-and-drop interface enables rapid and efficient HMI creation.

These master displays support IP cameras, eliminating the need for separate monitors and allowing multiple cameras to be connected via an IP switch. Installation is hassle-free, with options



for flush mounting using steel clips or a standalone mount compatible with RAM™ mount components, in both landscape and portrait orientations.

Crucially, these HMI products and solutions are engineered for reliability, ensuring a long service life despite intensive and regular use. The IQAN-MD5 units feature a rugged mechanical design with no moving parts and are completely sealed, incorporating optically bonded display glass to enhance readability, prevent light refraction, and eliminate condensation risks.

Electrified systems

Understanding the opportunities that electrification can present, Parker is helping OEMs implement electrified systems into their planter designs. Parker's Global Vehicle Motor (GVM) series offers electric and hybrid electric powertrain motors, as well as electro-hydraulic actuation¹¹. 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.

The combination of high performing GVM motor together with unbeatable efficiency from F10 hydraulic bent-axis pumps gives outstanding performance and can downsize the system to reduce the ground force and power consumption.



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 customised 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.¹²

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 agricultural market's growth for years to come.

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